



**CEPII**

**CENTRE  
D'ÉTUDES PROSPECTIVES  
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INTERNATIONALES**

No 2012 – 10  
May

DOCUMENT DE TRAVAIL

MAcMap-HS6 2007, an exhaustive and consistent  
measure of applied protection in 2007

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**MACMAP-HS6 2007,****AN EXHAUSTIVE AND CONSISTENT MEASURE OF APPLIED PROTECTION IN 2007**

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**NON-TECHNICAL SUMMARY**

The third version of the MACMap-HS6 database, built as a result of a joint effort of CEPII (Centre d'Etudes Prospectives et d'Informations Internationales, Paris) and ITC (International Trade Centre, Geneva), is based on ITC's MACMap raw data. It proposes an exhaustive and consistent measure of the tariff protection applied in 2007 by 164 importing countries (190 when the EU27 is disaggregated) to 238 exporters, at the 6-digit product level of the Harmonized System of nomenclature. The methodology, similar to the one used for previous versions, relies on reference groups of countries to limit the endogeneity bias faced when computing ad valorem equivalents of tariff protection, and when computing averages at aggregate levels. Tariff-rate quotas and non-ad valorem duties are included in this database, contingent protection is not.

The average level of applied protection worldwide in 2007 is estimated to be an ad valorem duty of 4.4%. Agriculture (15.9%) is more protected than textiles and clothing (9.2%), itself more protected than other manufacturing sectors (3.4%). Developed countries (2.7%) remain more open than developing countries (8%), themselves less protective than the least developed countries (10.1%). These cross-country differences are mainly linked to manufacturing sectors. In agricultural markets, rich countries' average protection (14.6%) is intermediate between the level observed for least developed (12.6%) and for other developing countries (18.3%), and it relies more heavily on non-ad valorem tariffs and on tariff-rate quotas. The cross-product dispersion of protection levels is found to be higher for developed countries, especially in agriculture.

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Compared to 2004, world average protection declined by nearly 0.7 percentage point. This is actually less than the combined effects of unilateral liberalizations and of new preferential trade agreements (-0.8 point), and of the decline in the ad valorem equivalent of specific tariffs, linked to the surge in world prices of agricultural products (-0.2 point). The explanation is the increasing share of developing countries, where protection is higher: this trend increased the world average by 0.3 point, between 2004 and 2007.

Comparisons across methodologies are carried out to check the robustness of our results. We find that the method routinely used by ITC at the tariff line level leads to a slightly higher world average in 2007 (5.1%). Closer examination shows that differences are mainly due to weighting schemes, the sensitivity of which is confirmed by comparisons with either trade-weighted or simple averages. There is no perfect approach in this respect, but these comparisons are consistent with our expectations (our assessment is higher than the trade-weighted average and lower than the simple average) and allow the consequences of different methodological choices to be illustrated and understood.

#### **ABSTRACT**

The third version of the MAcMap-HS6 database, built as a result of a joint effort of CEPII (Centre d'Études Prospectives et d'Informations Internationales, Paris) and ITC (International Trade Centre, Geneva), based on ITC's MAcMap raw data, proposes an exhaustive and consistent measure of applied, preferential tariff protection in 2007. The methodology, similar to the one used for previous versions, relies on reference groups of countries to limit the endogeneity bias faced when computing ad valorem equivalents of tariff protection, and when computing averages at aggregate levels. The world average applied protection level in 2007 is estimated to be 4.4%. Compared to 2004, this is a decline by nearly 0.7 percentage point, mainly due to unilateral liberalizations and to new preferential trade agreements. The decline in the ad valorem equivalent of specific tariffs of some agricultural products, linked to the surge in world prices, lowers the average protection. In the opposite way, the increasing share of developing countries, where protection is higher, tend to raise the world average.

*JEL Classification:* F02, F13, F15, F18.

*Key Words:* Protectionism, tariffs, trade policies, databases.

**MACMAP-HS6 2007,****UNE MESURE COHÉRENTE ET EXHAUSTIVE DE LA PROTECTION APPLIQUÉE DANS LE MONDE  
EN 2007**

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**RÉSUMÉ NON TECHNIQUE**

La base de données MACMap-HS6, résulte d'un travail mené conjointement par le CEPII (Centre d'Études Prospectives et d'Informations Internationales, Paris) et le CCI (Centre de Commerce International, Genève) sur les données source de MACMap du CCI. Elle propose une mesure exhaustive et cohérente de la protection tarifaire appliquée en 2007 par 164 pays importateurs (190 lorsque l'Union européenne est désagrégée) vis-à-vis de 238 exportateurs, au niveau détaillé des produits (système harmonisé de nomenclature à 6 chiffres). La méthodologie, proche de celles utilisées dans les versions précédentes, s'appuie sur des groupes de pays de référence pour limiter le biais d'endogénéité, tant lors du calcul de l'équivalent ad-valorem des droits de douane que lors de son agrégation sectorielle et/ou géographique. La base inclut les contingents tarifaires et les droits non ad valorem, mais ne prend pas en compte la protection contingente (droits anti-dumping, mesures compensatoires).

En 2007, le droit de douane moyen appliqué dans le monde est selon nos calculs de 4,4%. L'agriculture (15,9 %) est plus protégée que le textile-habillement (9,2 %), elle-même moins ouverte que le reste de l'industrie manufacturière (3,4 %). Les pays développés (2,7 %) restent moins protégés que les pays en développement (8 %) et a fortiori que les pays les moins avancés (10,1%). Ces différences internationales sont principalement liées aux produits manufacturés. Sur les marchés agricoles, la protection moyenne dans les pays riches (14,6 %) est intermédiaire entre celle des pays les moins avancés (12,6 %) et celle des autres pays en développement (18,3 %). Elle s'appuie plus largement sur des droits de douane non ad valorem et sur des contingents tarifaires. La dispersion des niveaux de protection entre produits est plus élevée dans les pays riches, surtout dans l'agriculture.

Par rapport à 2004, la protection moyenne dans le monde a baissé de 0,7 point de pourcentage. Les libéralisations unilatérales et l'entrée en vigueur de nouveaux accords commerciaux (régionaux ou bilatéraux) sont la principale raison de cette diminution (-0,8 point) ; s'y ajoute, du fait de la hausse des prix mondiaux, l'effet de la baisse des équivalents ad-valorem des droits de douane spécifiques sur certains produits agricoles (-0,2 point). A l'inverse, la part croissante des pays en développement – dont la protection aux frontières est plus élevée que celle des pays développés – augmente le niveau de protection mondiale.

Des comparaisons méthodologiques permettent d'évaluer la robustesse de nos résultats. Nous montrons que la méthode utilisée par ailleurs par le CCI donne une évaluation légèrement plus élevée du niveau moyen de protection dans le monde en 2007 (5,1 %). Un examen approfondi montre que les différences sont principalement liées aux systèmes de pondération utilisés, dont l'influence est confirmée par une comparaison avec une moyenne pondérée par les importations ou avec une moyenne simple. Aucune approche n'est entièrement satisfaisante à cet égard, mais ces comparaisons confirment nos a priori (notre évaluation est supérieure à la moyenne pondérée par les importations et inférieure à la moyenne simple) et permettent de mieux comprendre les conséquences des différentes options méthodologiques.

## RÉSUMÉ COURT

La base de données MAcMap-HS6 résulte d'un travail mené conjointement par le CEPII (Centre d'Études Prospectives et d'Informations Internationales, Paris) et le CCI (Centre de Commerce International, Genève) sur les données source de MAcMap du CCI. Elle propose une mesure exhaustive et cohérente de la protection tarifaire appliquée en 2007. La méthodologie, proche de celles utilisées dans les versions précédentes, s'appuie sur des groupes de pays de référence pour limiter le biais d'endogénéité, tant lors du calcul de l'équivalent ad-valorem des droits de douane que lors de leur agrégation sectorielle et/ou géographique. En 2007, le droit de douane moyen appliqué par l'ensemble des pays du monde est estimé à 4,4%, en baisse de 0,7 point de pourcentage par rapport à 2004. Les libéralisations unilatérales et l'entrée en vigueur de nouveaux accords commerciaux préférentiels sont à l'origine de ce mouvement d'ouverture. S'y ajoute la baisse des équivalents ad-valorem des droits de douanes spécifiques sur certains produits agricoles, consécutive à la hausse des prix mondiaux. A l'inverse, la part croissante des pays en développement – dont la protection aux frontières est plus élevée que celle des pays développés – augmente le niveau de protection mondiale.

*JEL Classification* : F02 ; F13 ; F15 ; F18.

*Mots Clé* : Protectionnisme, droits de douane, politiques commerciales, bases de données.

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**1. INTRODUCTION**

When analyzing trade policies at a global level, the first challenge met is merely to put together consistent and reliable information about border protection. Non-tariff barriers are widely recognized as important and a large body of literature has been devoted to their assessment. Our focus here is on tariff duties which, although directly quantifiable, are not easily assessed at the world level. The source information is public, and notification commitments even provide World Trade Organization (WTO) members a formal institutional framework to collect it, at least for protection applied on a Most Favored Nation (MFN) basis. However, with an ever increasing number of preferential trade agreements (PTAs), MFN protection is only a tiny part of the whole information needed, even too little to be called “the emerged part of the iceberg”. This increasing variability of each country’s protection across trading partners multiplies the complexity of protection patterns: in addition to being defined country by country at tariff line level (i.e., for thousands of products), protection may also vary across partners. Another difficulty is the variety of instruments: even though ad valorem duties are by far the main border measure, several other types of duties are used, besides tariff rate quotas (TRQs). A consistent and comparable measure across products and countries can only be obtained as a result of ad valorem equivalent (AVE) calculations.

Since 2000, CEPII and ITC have engaged a joint effort to treat this information, so as to build an exhaustive and consistent database measuring ad valorem equivalent protection at the six-digit product level, applied by each country to each trading partner. Based on ITC’s data collected country by country about tariff-line level protection, a robust and consistent methodology is applied to build a database of AVEs suitable for analytical purposes, MAcMap-HS6. The first two versions of this database, describing applied protection in 2001 (Bouët et al., 2001, 2008) and 2004 (Boumellassa-Guimbard et al., 2009), have been used in a number of studies and served as the source of protection data in GTAP, the database now used by most global computable general equilibrium (CGE) models (Dimaranan, 2006; Narayanan and Walmsley, 2008).

As a result of the continuation of this joint effort of CEPII and ITC, this working paper presents the third version of MAcMap-HS6 (hereafter referred to as MAcMap-HS6 2007), measuring AVE protection worldwide at the six-digit product level for 2007. Contingent protection is not considered. To the extent possible, this new version follows the methodology already used in the previous ones, so as to make comparisons across time as easy and

meaningful as possible. As before, reference groups of countries are used to minimize endogeneity while computing unit values and aggregating protection. A three-year span centered on the year studied (i.e., year 2006 to 2008, in the present case) is still the reference for trade figures, and more generally the methodology still gives priority to consistency and robustness. Marginal changes were introduced where they undoubtedly brought significant improvement, for instance in the treatment of TRQs.

This paper documents and illustrates this MAcMap-HS6 2007 database. Beyond summary figures describing border protection in 2007, the changes between 2004 and 2007 are closely monitored. Methodological issues are also briefly discussed.

## 2. METHODOLOGICAL ISSUES

Many different steps and assumptions are needed to reach a consistent assessment of AVE protection. The whole methodology, presented in Bouët et al. (2008), is not fully detailed here, but the main steps are recalled, pointing out the differences with respect to previous versions, which as already mentioned have been reduced to a minimum.

### 2.1. Preliminary treatments

The starting point is ITC's source MAcMap data on applied duties, at the tariff-line level, collected directly from customs administration or trade institutes. A number of tariffs are not expressed in ad valorem terms. The most common alternative is specific tariffs, in which case a unit value must be used to compute an AVE. Compound tariffs, combining an ad valorem and a specific term, are also common, but they do not raise any additional difficulty. In contrast, mixed tariffs involve a choice between alternative specifications of tariffs (for instance, a specific tariff capped by an ad valorem one, but more complex cases are common); in this case, priority is given to the ad valorem alternative when there is one, otherwise the AVE of each alternative is computed (see below), before applying the logical rule defining the tariff. As a result, each tariff is expressed as the sum of an ad valorem and a specific component. Various tests are performed to detect potential errors or inconsistencies in data sources. The raw data used here are an aggregation at the six-digit level (hereafter, HS6 level) of the Harmonized System (HS) of this tariff-line level data, using simple averages separately for the ad valorem and the specific component.

This information is put together for 164 importing countries (190 reporters when the EU27 is disaggregated) vis-à-vis 238 exporting countries (partners). It concerns applied preferential duties in 2007, generally measured as their value on January, 1.<sup>5</sup> Anti-dumping duties and countervailing measures are not considered.

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<sup>5</sup> When information is available about seasonal variations, it is taken into account on a *pro-rata temporis* basis.

While 67 countries report protection using Harmonized System's (HS) revision 3,<sup>6</sup> officially in use since 2007, 79 countries still report in revision 2, 13 countries use revision 1, and 5 continue to use revision 0. For the sake of consistency, the information is converted in revision 2 for all countries.<sup>7</sup>

## 2.2. Computing the ad valorem equivalent of non-ad valorem tariffs

Building a database suited to analytical purposes requires computing AVEs of non-ad valorem tariffs and making it possible to aggregate the information up from the product level. Trade data are needed in both cases: unit values are requested to convert specific tariffs into AVE terms, and trade flows must be accounted if the aggregation procedure is not a simple average. A well-known problem in this context is that protection itself influences imports' values and unit values, giving rise to an endogeneity bias: since specific tariffs involve a higher proportional protection on low-unit value products, they may tend to increase unit values for the lines concerned, so that using observed unit values might lead understated AVE protection for specific tariffs; since high protection limits imports, a trade-weighted average understate protection. As discussed in Bouët et al. (2008), MAcMap-HS6 methodology intends to limit the extent of these biases. To do so, the trade data needed to calculate AVEs and weighting schemes are not computed country by country, but instead by reference groups of countries. These reference groups, built as a result of a clustering procedure based on GDP per capita and trade openness, are designed as large groups of countries sharing similar trade-relevant characteristics. Their composition is given in Appendix. Using reference groups' import values and unit values allows the direct influence of protection to be limited, since protection patterns differ across countries in each group; meanwhile, it is informative as to trade (or potential trade) patterns, like the relative importance of products, or their relative unit values.

Practically, specific tariffs are thus converted in ad valorem terms based on the exporter's reference-group unit value (ERGUV), computed as the cross-country median of unit values within the group. Using medians instead of averages limits the sensitivity to outliers.

Trade data used for this calculation and for aggregation purposes are sourced from CEPII's Tariff Lines dataset,<sup>8</sup> built from Comtrade's source files at the tariff line level (Berthou and Emlinger, 2011). The importer's statistics on cost-insurance-freight (CIF) inclusive import values are used when available; otherwise, the exporter's statistics are used instead, combined with the estimated margin between CIF and Franco-On-Board (FOB) values, based on

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<sup>6</sup> The HS6 classification has four different revisions: revision 0 (1992, 5,020 products), revision 1 (1996, 5,113 products), revision 2 (2002, 5,224 products), revision 3 (2007, 5,052 products).

<sup>7</sup> Previous versions of MAcMap-HS6 use revision 1.

<sup>8</sup> For trade and unit values, previous versions of MAcMap-HS6 used the BACI database, developed at CEPII based on UN's Comtrade (Gaulier et al., 2008). The methodological changes introduced in Comtrade in 2005 regarding unit values make it impossible to follow up with the same source.

Gaulier et al. (2008). As in previous versions, three-year averages of trade data are used to limit volatility, here over the 2006-2008 period.

Aggregation across products relies on averages weighted by imports of the importer's reference group. When aggregation is carried out across importers, these weights are scaled up to account for the importer's weight in the reference group's total imports. Aggregation across exporters relies on averages weighted by exports toward the importer's reference group. These aggregation procedures can be summarized by the following weighting scheme:

$$(1) \quad W_{i,r,s} = M_{i,r,R(s)} \times M_{\dots,s} / (M_{\dots,R(s)} - M_{\dots,s,R(s)})$$

Where  $W_{i,r,s}$  is the weight affected in the aggregation process to product  $i$  sales from exporter  $r$  to importer  $s$ .  $M$  refers to imports,  $R(s)$  to the importer's reference group, and subscript “.” refers to the total over the category concerned.<sup>9</sup>

While MAcMap-HS6 is a dataset on preferential applied duties, the applied MFN rate can be retrieved when necessary assuming that it is the highest applied rate across WTO partners, once possible outliers are excluded.<sup>10</sup>

### 2.3. Tariffs rate quotas

For TRQs, MAcMap-HS6 methodology aims at assessing both the marginal level of protection and the value of involved rents (Bouët et al., 2008). A TRQ includes an inside- and an outside-quota tariff rate (IQTR and OQTR, respectively). The marginal level of protection (also referred to as the shadow tariff rate) is equal to the IQTR if the quota is not binding, to the OQTR if the quota is binding and the OQTR is not prohibitive, and to a value in between these two rates if the quota is binding and the OQTR is prohibitive. As in previous versions of the dataset, we use the fill rate, computed as the ratio of imports over quota, to assess whether the quota is binding or not. However, an improvement of this version is the availability of information about quotas' mode of administration. Accordingly, when a quota is managed based on “Applied tariff”, meaning that only the IQTR is applied without quantity limitation, the quota is assumed not to be binding. In all other cases, the shadow rate is thus equal to:<sup>11</sup>

<sup>9</sup> The denominator of the last ratio, slightly altered compared to previous versions, only matters while aggregating across importers. Setting  $W_{i,s,s} \equiv 0$ , the formula used here is such that, for each importer, the sum of weights equals the sum of imports:  $W_{\dots,s} = M_{\dots,s}$ .

<sup>10</sup> To make sure an exceptional regime is not considered to be the MFN, only rates observed at least for three different partners for the same reporter-product pair are considered.

<sup>11</sup> In Abbott and Paarlberg (1998) taxonomy, case (i) corresponds to regime 1, “pure tariff”; case (ii) to regime 2, “quota”; and case (iii) to regime 3, “true TRQ”.

(i) the IQTR if the fill rate is below 90%; (ii) the OQTR if the fill rate is higher than 98%; (iii) the simple average between the IQTR and the OQTR if the fill rate is between 90 and 98%<sup>12</sup>.

Rents are calculated assuming they are captured by the exporter. In such a case, unit values incorporate the rent so that, for each quota,  $UV = P(1 + t^M)$ , where  $P$  is the importer net-of-rent price,  $UV$  is observed imports unit value and  $t^M$  is the AVE of the marginal (or shadow) rate of protection. The rent itself can be computed as:

$$(2) \quad R = Q \times P (t^M - t^I) = Q \times UV \frac{t^M - t^I}{1 + t^M}$$

Where  $R$  is the rent,  $t^I$  is the AVE IQTR, and  $Q$  is the quota (expressed in quantity units).

In contrast to previous versions, raw information on TRQs is provided by ITC. The original set documents the quota size and IQTR of bilateral and multilateral TRQs for 27 reporting countries<sup>13</sup> at the tariff-line level. Further treatment follows the same methodology as for applied duties, and physical quantities are all converted in tons. If the quota involves a specified bilateral allocation, the fill rate is computed separately for each (group of) partner(s). When several quotas are overlapping, importers are assumed to be allowed to use all of them.<sup>14</sup>

### 3. ASSESSED APPLIED PROTECTION ACROSS THE WORLD IN 2007

MAcMap-HS6's consistent and exhaustive assessment of applied protection makes it possible to give a meaningful snapshot of tariff protection worldwide in 2007. This is briefly done in this section, focusing first on average AVE applied duties, then on selected indicators of the structure of protection.

#### 3.1. Averages

A unique feature of MAcMap-HS6 is to allow a meaningful average level of applied protection worldwide to be computed. In 2007, this average was assessed to be 4.4% (Table 1). Averages by country or group of countries can also be computed. This is usually done by importer, since it is a way to summarize a country's trade protection. This approach confirms that developed countries are less protected on average (2.7% AVE applied tariff) than developing countries (8.0%), themselves less protected than LDCs (10.1%). While assessed

<sup>12</sup> Due to administrative or technical obstacles, imports may be slightly lower than the quota, even when the quota is actually binding. A fill rate higher than 90% is thus assumed to reflect a situation where the quota is binding.

<sup>13</sup> Albania, Algeria, Argentina, Australia, Bosnia and Herzegovina, Brazil, Canada, Chile, Colombia, Costa Rica, Croatia, El Salvador, European Union, Iceland, Japan, Taiwan, Montenegro, Morocco, Nicaragua, Norway, Pakistan, Panama, Philippines, South Africa, Switzerland, Turkey, USA.

<sup>14</sup> Thus, when applicable, imports under a preferential TRQ are not taken into account when computing the fill rate of an overlapping multilateral TRQ.

average protection is particularly low in the US (1.7%), little variability is found among developed countries, with average protection not far from 3% in most cases. Variability is more pronounced among developing countries, from 4.3% in Turkey (which trade policy is constrained by its custom union for industrial products with the EU) to 17.9% in India

**Table 1: Average applied and faced protection by group of countries and for selected countries (2007, AVE in %)**

Country	Importer				Exporter			
	All	Agric.	Textile	Indus.	All	Agric.	Textile	Indus.
<b>Developed</b>	<b>2.7</b>	<b>14.6</b>	<b>7.8</b>	<b>1.7</b>	<b>4.5</b>	<b>16.0</b>	<b>9.3</b>	<b>3.7</b>
Australia	3.5	1.5	12.3	3.2	6.3	23.0	9.6	3.4
Canada	3.3	18.1	12.4	1.8	3.4	14.2	7.0	2.5
EU27	2.6	14.6	7.0	1.7	4.7	16.2	8.8	3.6
EFTA	3.4	47.5	5.8	0.2	2.1	13.2	5.1	1.8
Japan	2.5	23.8	7.0	0.7	5.8	14.0	9.8	5.7
United States	1.7	5.5	9.8	1.1	4.7	13.6	9.4	3.8
<b>Developing</b>	<b>8.0</b>	<b>18.3</b>	<b>13.3</b>	<b>7.0</b>	<b>4.4</b>	<b>15.8</b>	<b>9.4</b>	<b>3.0</b>
ASEAN	5.3	11.8	8.2	4.7	4.6	17.8	9.1	3.2
China	6.3	9.2	9.2	5.9	4.5	16.1	10.7	3.4
India	17.9	60.5	15.1	14.3	5.1	14.8	9.5	3.1
Korea, Rep. Of	7.6	50.8	10.3	4.5	5.3	15.4	10.7	5.1
Maghreb	10.4	24.4	19.0	9.0	1.9	13.3	4.5	1.4
Mercosur	9.5	10.4	17.0	9.2	8.6	16.8	10.0	4.5
Mexico	6.6	15.5	15.7	5.4	2.1	10.7	1.8	1.6
Other SSA	11.0	19.3	18.2	9.4	2.9	11.0	6.2	2.3
Pakistan	11.5	14.9	17.8	10.9	11.2	29.2	9.1	5.7
SACU	5.3	13.7	22.5	4.0	5.4	26.9	3.7	3.1
Turkey	4.3	41.1	4.4	1.5	4.9	10.7	6.3	3.9
<b>LDCs</b>	<b>10.1</b>	<b>12.6</b>	<b>17.7</b>	<b>9.3</b>	<b>3.5</b>	<b>13.0</b>	<b>5.0</b>	<b>2.3</b>
Bangladesh	10.2	11.2	21.2	9.6	4.6	17.4	4.5	4.0
Sub-Saharan LDCs	9.2	11.3	17.9	8.4	3.1	12.2	9.2	2.0
<b>World</b>	<b>4.4</b>	<b>15.9</b>	<b>9.2</b>	<b>3.4</b>	<b>4.4</b>	<b>15.9</b>	<b>9.2</b>	<b>3.4</b>

Source: MAcMap-HS6 2007, author's calculations.

Note: Intra-EU trade is excluded from calculations. "Importer" columns refer to average tariffs applied by the row country. "Exporter" columns refer to average across export markets of tariffs faced by the row country's exporters. Only selected countries are shown individually within each group. Countries are classified as developed or developing according to their status at the WTO. "Agriculture" refers to products classified as agricultural by the WTO. "Textile" refers to the textiles, man-made fibres and wearing apparel (sectors "27-tex" and "28-wap" in GTAP classification; codes 17, 18 and 243 in ISIC rev. 3 classification). "Indus." refers to other products.

Given the bilateral dimension of applied protection, aggregation by exporter also makes sense: it corresponds to the average across export markets of tariff protection faced by a

country's exporters. Such average depends upon the preferential schemes the exporters benefits from; it also varies with the cross-product and cross-market weighting scheme, which are set here based on the country's exports to the various reference groups (see equation (1)). The hierarchy across country groups is reversed in this case, with LDCs facing the lowest average protection rate (3.5%), while developed countries faced the highest one (4.5%). However, these figures show that differences remain limited: the specialization of poor countries in agriculture and textiles-clothing largely offsets the benefits reaped from non-reciprocal trade preferences.

Differences across sectors illustrate the specificity of agricultural products, for which average protection reaches 15.9%, with extremely high assessed levels in India (61%), Korea (51%), EFTA (48%) and Turkey (41%). Only 7 countries (out of 164 in the database) apply average rates lower for agriculture than for industry.<sup>15</sup> The singularity of agriculture is especially pronounced in rich countries and in some intermediate ones. In other intermediate countries (Mercosur, Pakistan and South Africa are examples) and in LDCs, textiles-clothing exhibit higher protection than agriculture. Outside textiles-clothing, protection in non-agricultural products remains low on average in most countries singled out. The average exceeds 10% in this sector only in Pakistan and India.

### 3.2. Protection patterns

Beyond averages, the dispersion of protection across products is an important characteristic of countries protection patterns. This is summarized in Table 2 using the cross-product coefficient of variation in the power of the average applied duty (computed as one plus the average applied duty for the product), which reflects the cross-product variability of the impact of tariffs upon import prices. While the world average coefficient of variation is close to 0.6, developed countries' agricultural sector stands out, with an average beyond 2 and levels exceeding 3 in the EU, the EFTA, Japan and Korea (even though this country is classified as developing at the WTO). China's industrial sector (outside textiles and wearing apparel) also stands out, with a very large coefficient of variation (2.3), reflecting still significant protection level for some specific products, while average protection is already fairly low (5.9%). In contrast, protection exhibits little variability across products in relative terms in LDCs, with an average coefficient of variation only slightly above 0.1. Given the non-linearity of protection's impacts, these differences potentially have important consequences.

Specific tariffs also deserve attention. In contrast to ad valorem tariffs, their impact on trade flows may vary across ranges of elaboration or of product quality (see e.g. Feenstra and Boorstein, 1991), and it may change over time when prices vary significantly. Counting the EU27 once, 74 countries were using specific tariffs in 2007. Focusing on agricultural products, for which they are more widely used, AVE protection is higher for products covered by specific tariffs (excluding products covered by a TRQ): 17.5%, compared to 15.9% for all

<sup>15</sup> Australia, Bahamas, Mayotte, Djibouti, Kuwait, Maldives and New Zealand.

agricultural products and 12.0% for products only covered by ad valorem duties. This confirms that specific tariffs tend to be used for sensitive products, where protection is higher.

**Table 2 : Selected features of applied protection patterns in 2007**

Country	Coefficient of variation of the power of the tariff (1+t)				Non-TRQ agric. prod. covered by specific tariffs		Agricultural prod. covered by a TRQ	
	All	Agric.	Textile	Indus.	AVE	Coverage	AVE	Coverage
	(a)	(b)	(d)	(c)	(e)	(f)	(g)	(h)
<b>Developed</b>	<b>0.90</b>	<b>2.01</b>	<b>0.22</b>	<b>0.37</b>	<b>13.9</b>	<b>20.6</b>	<b>44.7</b>	<b>15.2</b>
Australia	0.31	0.09	0.15	0.34	9.6	1.8	1.8	0.8
Canada	1.23	2.75	0.23	0.32	6.2	8.2	63.9	21.9
EU27	1.68	3.44	0.30	0.75	18.1	20.6	38.4	24.9
EFTA	1.86	3.08	1.04	0.27	42.1	42.6	111.3	26.3
Japan	1.86	3.96	0.28	0.35	28.4	17.5	123.7	10.5
United States	0.83	1.41	0.49	0.52	4.1	39.7	19.7	16.4
<b>Developing</b>	<b>0.52</b>	<b>0.90</b>	<b>0.19</b>	<b>0.41</b>	<b>39.3</b>	<b>5.6</b>	<b>36.0</b>	<b>0.9</b>
ASEAN	1.04	2.08	0.25	0.75	54.7	8.9	42.6	0.2
China	1.98	0.77	0.23	2.32	8.9	1.4		
India	1.21	1.30	0.07	0.86	23.9	0.6		
Korea, Rep. Of	2.27	4.09	0.10	0.32				
Maghreb	0.43	0.58	0.16	0.36			24.8	3.3
Mercosur	0.48	0.22	0.07	0.55			0.3	0.2
Mexico	0.61	0.94	0.30	0.48	45.0	10.3		
Other SSA	0.35	0.46	0.11	0.32	187.8	0.2		
Pakistan	0.29	0.25	0.09	0.32	21.1	19.6	27.1	0.1
SACU	0.10	0.16	0.04	0.08	12.4	13.6	23.8	0.0
Turkey	1.03	1.66	0.05	0.30	17.1	0.4	56.0	5.5
<b>LDCs</b>	<b>0.11</b>	<b>0.15</b>	<b>0.05</b>	<b>0.11</b>	<b>38.7</b>	<b>0.5</b>		
Bangladesh	0.16	0.14	0.06	0.17	14.8	4.1		
Sub-Saharan LDCs	0.20	0.19	0.10	0.19				
<b>World</b>	<b>0.60</b>	<b>1.16</b>	<b>0.19</b>	<b>0.39</b>	<b>17.5</b>	<b>14.7</b>	<b>44.4</b>	<b>9.7</b>

Source: MAcMap-HS6 2007, author's calculations.

To assess the importance of specific tariffs, their coverage must also be taken into account. Relying on each country imports would provide a biased picture, though, since the relatively high protection for these products tends to restrict imports, thus understating their potential importance. To limit this bias, specific tariffs' coverage is assessed based on imports of the reference group of each importer (column f). This indicator clearly shows that the substantial coverage of specific tariffs among agricultural products at the world level (14.7%) is actually mainly due to their widespread use by a few large developed countries: coverage reaches 20.6% in the EU, 39.7% in the US and 42.6% in the EFTA. Beyond these specific cases, specific tariffs are of limited importance, covering most often less than 10% of agricultural product potential imports.

Using the same indicators to assess the importance of TRQs shows, not surprisingly, that the AVE of protection (44% on average at the world level) is even higher than for specific tariffs. TRQs have been built to deal with highly sensitive products, and high levels of protection persisted for the products concerned in 2007. The coverage of TRQs is not negligible: almost 10% of reference groups' imports at the world level, more than 15% on average for developed countries, 25% for the EU and a bit more for the EFTA. In contrast, TRQs only cover 0.9% of reference group's agricultural imports in developing countries (see Appendix Table for more details on TRQs).

#### 4. DECOMPOSING CHANGES IN APPLIED PROTECTION BETWEEN 2004 AND 2007

The comparison of this new version of MACMap-HS6 with the previous one allows changes in applied protection between 2004 and 2007 to be decomposed. In doing so, four sources of changes are disentangled: changes in trade policies *per se*, linked to countries' decisions as to their trade protection, either on an MFN basis or due to the enforcement or phasing-in of new preferential trade agreements; changes in the AVE of TRQs, which may be linked either to changes in tariffs applied in TRQs, or the changes in their fill rate and administration regime; changes in weighting schemes, linked to changes in import values; and changes in unit values, which influence the AVE computation of non-ad valorem tariffs. TRQs are considered as a separate source of changes, because the database does not allow changes in policies to be disentangled from changes in fill rates or administration regime in this particular case.<sup>16</sup>

The world average level of AVE applied protection declined by 0.66 percentage points between 2004 and 2007. The decomposition shows that this is slightly less than the decline explained by changes in trade policies *per se*. Tariff liberalizations have been substantial in several countries or regions, in particular other sub-Saharan countries (-9.2 points),

<sup>16</sup> Practically, the decomposition is carried out starting from the 2004 database. Unit values of the 2007 dataset are then used, instead of those of the 2004 dataset, to compute alternative AVEs. The difference is referred to as stemming from changes in unit values (columns "UV" in Table 3). From the dataset obtained, new averages are then computed using the 2007 weighting scheme. The differences are reported in columns "WS". Columns "TRQ" then report differences due to changes in marginal AVE protection for TRQ products. Finally, columns "TP" report differences linked to changes in trade policies *per se*. The final point is thus MACMap-HS6 2007, and the sum of the four steps is exactly equal to the difference in AVE applied protection between 2004 and 2007.

Bangladesh (-7.7 points), Maghreb (-6.9 points) or Pakistan (-3.7 points), as a result of both unilateral cuts in MFN applied duties and phasing-in of new preferential trade agreements, which have been numerous over the period. These cuts are common to all sectors, but they are deeper in textiles and clothing, where the average fell by almost one percentage point.

**Table 3 : Decomposition of changes in applied protection between 2004 and 2007  
(percentage points)**

Country	All					Agriculture				
	Total	TP	TRQ	WS	UV	Total	TP	TRQ	WS	UV
<b>Developed</b>	<b>-0.69</b>	<b>-0.25</b>	<b>-0.04</b>	<b>-0.13</b>	<b>-0.26</b>	<b>-3.44</b>	<b>-0.58</b>	<b>0.78</b>	<b>0.06</b>	<b>-3.71</b>
Australia	-0.28	0.02	-0.01	-0.27	-0.02	-0.30	-0.08	-0.10	-0.03	-0.08
Canada	-0.10	0.06	0.15	-0.29	-0.02	2.18	1.04	2.44	-1.05	-0.25
EU27	-0.66	0.00	-0.02	-0.31	-0.33	-6.97	-0.18	-0.31	-0.41	-6.07
EFTA	-1.46	-0.01	0.25	-0.56	-1.13	-12.64	0.01	4.07	0.64	-17.36
Japan	-0.80	-0.39	0.40	-0.31	-0.51	-4.51	-5.29	6.32	0.43	-5.96
United States	-0.73	-0.33	-0.06	-0.19	-0.15	-3.43	-0.10	-1.05	-0.56	-1.72
<b>Developing</b>	<b>-1.90</b>	<b>-1.82</b>	<b>0.00</b>	<b>-0.10</b>	<b>0.03</b>	<b>-3.00</b>	<b>-2.31</b>	<b>-0.05</b>	<b>-0.08</b>	<b>-0.56</b>
ASEAN	-1.86	-2.18	-0.03	0.48	-0.12	-5.27	-4.67	-0.48	1.14	-1.26
China	-1.63	-1.47	0.00	-0.53	0.37	-1.69	-1.88	0.00	0.24	-0.06
India	-1.09	-0.02	0.00	-1.07	-0.01	2.34	-0.24	0.00	2.65	-0.07
Korea, Rep. Of	-0.28	-0.87	0.83	-0.31	0.08	14.01	-0.12	13.42	0.70	0.00
Maghreb	-6.68	-7.09	-0.03	0.44	0.00	-4.59	-5.13	-0.37	0.91	0.00
Mercosur	-1.59	-1.00	0.02	-0.61	0.00	-1.17	-1.32	0.27	-0.12	0.00
Mexico	-1.56	-2.80	0.00	1.24	0.00	-7.03	-6.71	0.06	-0.37	0.00
Other SSA	-9.52	-9.21	0.00	-0.30	-0.01	-13.69	-12.49	0.00	-1.20	-0.01
Pakistan	-4.38	-3.66	0.00	-0.32	-0.41	-7.98	-4.87	-0.01	0.02	-3.12
SACU	-0.57	-0.07	0.00	-0.42	-0.08	-2.74	-2.74	0.00	0.60	-0.60
Turkey	-0.52	0.01	0.03	-0.56	0.00	6.01	6.70	0.42	-1.00	-0.11
<b>LDCs</b>	<b>-2.05</b>	<b>-2.20</b>	<b>0.00</b>	<b>0.17</b>	<b>-0.01</b>	<b>-1.48</b>	<b>-1.38</b>	<b>0.00</b>	<b>-0.06</b>	<b>-0.03</b>
Bangladesh	-6.84	-7.71	0.00	0.87	0.00	-8.30	-7.39	0.00	-0.91	0.00
Sub-Saharan LDCs	-0.17	-0.09	0.00	-0.08	0.00	-0.20	0.32	0.00	-0.52	0.00
<b>World</b>	<b>-0.66</b>	<b>-0.75</b>	<b>-0.03</b>	<b>0.31</b>	<b>-0.19</b>	<b>-3.04</b>	<b>-1.22</b>	<b>0.47</b>	<b>0.42</b>	<b>-2.71</b>

Source: MAcMap-HS6 2004 and 2007, author's calculations.

Note: "UV" refers to unit values; "WS" to weighting schemes; "TRQ" to tariff rate quotas; "TP" to trade policies. Each column reports changes in AVE applied protection (in percentage points) linked to changes in the variable referred to in the column header. For instance, -0.26 in the first row, first column, means that changes in unit values originated a decline by 0.26 percentage points in average AVE protection applied by developed country for all products. Detailed changes for textiles-clothing and for industrial products are shown in Table 6 in Appendix.

Changes in protection for TRQ products, while playing a minor role at the aggregate level,<sup>17</sup> were not negligible when agricultural products are considered separately (+0.47 points). Changes in weighting schemes originated an increase in the world average, by 0.31 points. More than anything else, this reflects the increasing importance of developing countries in world trade: since their average protection is higher than developed countries' one, this structural change mechanically raises the world average.

Finally, the role played by unit values is noteworthy. World prices of agricultural products strongly increased between 2004 and 2007. The calculations show that this trend significantly decreased AVE in developed countries (-3.7 points), with a spectacular decline observed in the EFTA (-17.4 points), and substantial negative influence on protection in the EU (-6.1 points) and in Japan (-6 points). The well-known property of countercyclical restrictiveness of specific tariffs thus played a significant role over the period for agricultural products.

## 5. COMPARISON ACROSS METHODOLOGIES

The methodology used to measure and aggregate protection in MAcMap-HS6 2007 is consistent and differs little from the ones used in previous versions of this database. There is not one single way to compute the AVE of protection and to aggregate it across products and countries, though. Different methodologies can be applied, for both theoretical and practical reasons (see e.g. Anderson, 2011, for a recent survey of theoretical issues). While a detailed discussion of the relative merits of each methodology is beyond the scope of this paper, this section compares the results obtained under alternative methodologies, with a focus on the methodology used by ITC to compute aggregate AVEs of protection in MAcMap.<sup>18</sup>

### 5.1. Comparable protection figures using ITC's methodology

Methodological choices when measuring and aggregating protection are often guided by the final purpose planned for the dataset being built. As already mentioned, MAcMap-HS6 has been thought of from the beginning as a dataset for analytical purposes, and in particular for use in CGE models. It is not surprising in this context that, based on the same raw data, the choices made by ITC when building a general-purpose dataset are different. This methodology mainly differs from the one used here in the following respects: (i) following ITC-WTO-UNCTAD methodology, AVEs are computed at the tariff line level based on tariff-line unit values;<sup>19</sup> (ii) while aggregation is also based on reference groups, with the same

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<sup>17</sup> A few TRQs are found outside agriculture, in particular in electrical machinery.

<sup>18</sup> See <http://www.macmap.org/Reference.Methodology.aspx> for a description.

<sup>19</sup> Unit values are computed on a bilateral basis where possible, based on Trade Map (ITC), and Comtrade (UN). When unit values at the tariff line level are not available, reference group unit values or world unit values are used instead.

general principles as the ones described above, their definition is different in ITC's methodology, where 11 groups are considered.<sup>20</sup>

For the sake of comparison, Table 4 shows the same indicators as the ones presented in Table 1, assessed here using ITC's methodology instead of MAcMap-HS6 methodology. Average protection worldwide is estimated to be 5.1% with ITC's methodology, approximately 15% more than the 4.4% average obtained in MAcMap-HS6. While the difference is limited in most cases, it is significant in several important instances. Beyond the stronger average for developing countries obtained using ITC's methodology (11.8%, compared to 8.0% in MAcMap-HS6), an almost twice higher level of protection is obtained for China (12.4%, compared to 6.3%) and Mexico (11.3% compared to 6.6%). In contrast, assessed average protection in developed countries' textile and clothing industry is 4.8%, compared to 7.8% using MAcMap-HS6 methodology.

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<sup>20</sup> This larger number of reference groups, also obtained as a result of a clustering procedure, reflects a different trade-off between the willingness to reflect as accurately as possible "natural" trade patterns (which would prevail under free-trade) and the need to limit the endogeneity bias. The weighting scheme is also slightly different: the term  $M_{.,s,R(s)}$  is not subtracted from the denominator of equation (1) (as explained in footnote 9); in addition, the weight is set to zero when a product is not exported at all neither by the exporter considered nor by its reference group.

**Table 4: Average applied and faced protection by group of countries and for selected countries, as assessed using ITC's methodology (2007, AVE in %)**

Country	Importer				Exporter			
	All	Agric.	Textile	Indus.	All	Agric.	Textile	Indus.
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
<b>Developed</b>	<b>2.2</b>	<b>14.5</b>	<b>4.8</b>	<b>1.1</b>	<b>6.2</b>	<b>19.7</b>	<b>12.0</b>	<b>4.9</b>
Australia	3.5	1.2	7.9	3.5	5.5	19.6	11.2	4.1
Canada	2.9	25.1	9.5	1.0	5.2	18.7	10.1	3.9
EU27	1.1	9.6	2.4	0.4	6.0	19.8	11.6	4.7
EFTA	3.4	50.3	2.4	0.2	4.2	18.5	6.9	3.0
Japan	2.1	19.3	5.7	0.7	5.7	19.4	11.5	4.4
United States	1.5	5.2	9.1	0.8	5.5	20.0	10.7	4.1
<b>Developing</b>	<b>11.8</b>	<b>22.4</b>	<b>20.6</b>	<b>10.5</b>	<b>4.8</b>	<b>17.6</b>	<b>9.0</b>	<b>3.6</b>
ASEAN	4.4	15.4	10.8	3.6	4.4	16.0	8.9	3.3
China	12.4	22.1	20.9	11.3	5.0	19.0	10.9	3.6
India	20.3	51.3	22.8	17.9	4.4	17.5	10.0	3.2
Korea, Rep. Of	8.2	65.6	10.5	4.1	5.4	18.1	11.1	4.1
Maghreb	10.6	18.7	17.8	9.1	4.3	16.5	7.8	3.2
Mercosur	11.5	10.9	18.4	11.3	4.5	18.5	10.3	3.2
Mexico	11.3	23.0	19.6	10.1	3.9	17.0	5.5	2.8
Other SSA	13.6	22.9	21.6	11.6	4.9	18.1	8.7	3.8
Pakistan	17.3	15.7	20.1	17.3	4.7	18.6	10.0	3.4
SACU	6.3	10.4	23.0	5.3	4.2	15.5	6.8	3.2
Turkey	4.7	62.8	4.1	1.0	4.3	17.0	7.6	3.2
<b>LDCs</b>	<b>10.8</b>	<b>13.1</b>	<b>17.2</b>	<b>10.2</b>	<b>4.1</b>	<b>11.4</b>	<b>7.0</b>	<b>3.4</b>
Bangladesh	12.9	13.3	22.6	12.3	3.5	10.3	6.0	2.9
Sub-Saharan LDCs	9.4	11.5	13.8	9.0	3.7	10.7	6.2	3.1
<b>World</b>	<b>5.1</b>	<b>16.9</b>	<b>9.4</b>	<b>3.9</b>	<b>5.1</b>	<b>16.9</b>	<b>9.4</b>	<b>3.9</b>

Source: MAcMap (ITC), author's calculations.

Note: All definitions as in Table 1. Intra-EU trade is excluded from calculations. "Importer" columns refer to average tariffs applied by the row country. "Exporter" columns refer to average across export markets of tariffs faced by the row country's exporters. Only selected countries are shown individually within each group. Countries are classified as developed or developing according to their status at the WTO. "Agriculture" refers to products classified as agricultural by the WTO. "Textile" refers to the textiles, man-made fibres and wearing apparel (sectors "27-tex" and "28-wap" in GTAP classification; codes 17, 18 and 243 in ISIC rev. 3 classification). "Indus." refers to other products.

AVE calculations differ across methodologies, with significant consequences for the assessed level of protection for many sensitive products. However, given the limited coverage of non-ad valorem duties (which concern less than 2.6% of tariff lines worldwide), these differences have limited bearing on aggregate figures, for which most of the differences are explained by different weighting schemes, as illustrated below.

## 5.2. Weighting schemes

Summarizing protection over a large number of products (let alone countries) in a single figure is a challenging task. As Anderson and Neary (2005) show, an ideal aggregator can only be defined with respect to a particular purpose, in a given economic environment. Thus, for databases serving different purposes, ideal aggregation is out of reach. When in addition aggregation has to be carried out at the product level for a large set of countries, theory-based indexes such as Anderson and Neary's Trade Restrictiveness Index cannot be applied, since their calculation must rely upon a general equilibrium analysis. Weighted means are appealing, for evident practical reasons. However, the choice of the weighting scheme is very important in practice. Import-weighted averages, used for instance in the GTAP database for aggregation of MAcMap-HS6 data, are ideal with respect to tariff receipts, but they bias downward the assessment of trade restrictiveness, as already outlined. Simple averages are another simple alternative, but they do not account for the different importance of products. And when the weighting scheme is based upon reference groups, different choices in the design of reference groups can significantly influence the results.

To illustrate these differences in the present case, MAcMap-HS6 assessed aggregate protection levels are compared in Table 5 to aggregate levels obtained from the same HS6-level AVEs, using alternative weighting schemes (results by large sector are reported in Appendix, Table 9). In addition to import-weighted and simple averages, the comparison is extended to ITC's methodology. The results confirm the sensitiveness of assessed average protection to the weighting scheme used in the aggregation process. Even at the world level, where differences tend to be strongly diluted, the resulting average, based on the same product-level data, varies from an import-weighted average of 3.6% to a simple average of 7.7%, compared to 4.4% using MAcMap methodology and 5.0% based on ITC's methodology.

In most cases, included at the sector level, the import-weighted average is lower than MAcMap-HS6 average,<sup>21</sup> often by 15 to 40% in relative terms. This is consistent with the prior that import-weighted averages are biased downward. In contrast, the simple average is larger than MAcMap-HS6 average for most (group of) countries, substantially so in several

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<sup>21</sup> A noteworthy exception is Korea's agriculture, where the trade-weighted average is far higher (102%). This is due to the presence of large, binding TRQs, for which imports are important and marginal protection is very large.

cases (including EFTA, ASEAN, China, Korea and Mexico), presumably reflecting the fact that classifications tend to be more disaggregated in sensitive sectors.<sup>22</sup>

Using ITC's methodology tends to result in slightly lower assessed average protection level in developed countries, significantly larger levels in developing countries, and slightly higher levels in LDCs. The most remarkable differences concern Mexico and China, as already mentioned. Inspection of the composition of reference groups explains this difference: Mexico's reference group includes intermediate, resource-intensive countries in MAcMap-HS6, while it is mainly composed of Latin American countries in ITC's methodology; China's reference group includes most emerging countries in MAcMap-HS6, while its three members in addition to China are the EU, India and the US in ITC's methodology. The latter also explains the difference for the EU, which is grouped with most other developed countries in MAcMap-HS6. The same holds for Canada, which is grouped with Japan, Korea and a number of intermediate countries in ITC's methodology.

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<sup>22</sup> Note that this pattern is less clear at the sector level (Appendix, Table 9), where the simple average is often lower than MAcMap-HS6 average. The differences between aggregate and sector-level comparisons reflect the fact that the number of lines by large sector may differ substantially in relative terms from their weights according to MAcMap-HS6 methodology.

**Table 5: Average applied protection by group of countries and for selected countries, assessed using alternative weighting schemes, all sectors (2007, AVE in %)**

Country	MMHS6 method. (5 RGs)	ITC's method. (11 RGs)	Import- weighted	Simple average
<b>Developed</b>	<b>2.7</b>	<b>2.2</b>	<b>2.1</b>	<b>3.3</b>
Australia	3.5	2.9	3.4	2.3
Canada	3.3	2.0	1.7	2.4
EU27	2.6	1.5	2.0	1.6
EFTA	3.4	3.2	1.5	7.3
Japan	2.5	1.9	2.4	3.6
United States	1.7	1.5	1.2	2.4
<b>Developing</b>	<b>8.0</b>	<b>11.8</b>	<b>6.4</b>	<b>11.2</b>
ASEAN	5.3	4.4	3.3	8.4
China	6.3	12.6	4.9	11.0
India	17.9	20.0	14.1	18.1
Korea, Rep. Of	7.6	8.2	7.6	11.9
Maghreb	10.4	10.7	8.5	15.0
Mercosur	9.5	11.4	7.6	10.8
Mexico	6.6	11.3	2.6	12.5
Other SSA	11.0	13.6	9.9	13.3
Pakistan	11.5	17.2	12.1	13.9
SACU	5.3	6.1	5.7	7.5
Turkey	4.3	4.7	2.1	7.1
<b>LDCs</b>	<b>10.1</b>	<b>10.7</b>	<b>9.5</b>	<b>10.4</b>
Bangladesh	10.2	12.9	10.6	14.5
Sub-Saharan LDCs	9.2	9.4	9.2	12.2
<b>World</b>	<b>4.4</b>	<b>5.0</b>	<b>3.6</b>	<b>7.7</b>

Source: MAcMap-HS6 2007, author's calculations.

Note: Intra-EU trade is excluded from calculations. Only selected countries are shown individually within each group. Countries are classified as developed or developing according to their status at the WTO. "Agriculture" refers to products classified as agricultural by the WTO. "Textile" refers to the textiles, man-made fibres and wearing apparel (sectors "27-tex" and "28-wap" in GTAP classification; codes 17, 18 and 243 in ISIC rev. 3 classification). "Indus." refers to other products. "Simple average" refers to the unweighted average across HS6 products; cross-country aggregation, when needed, is computed as the average weighted by each country's total imports.

By the way, comparing the results obtained here with those in Table 4 confirms that aggregate-level differences between ITC's and MAcMap-HS6 methodologies mainly come from weighting schemes.

## 6. CONCLUSION

MAcMap-HS6 2007 provides a consistent and exhaustive picture of protection applied across the world. Intended to be used for analytical purposes, *inter alia* as an input of worldwide CGE models, it follows up on the first two versions of MAcMap-HS6, with methodological changes kept to a minimum, so as to maximize cross-version consistency. Together with the dataset for 2004, it will be the source of protection data in version 8 of the GTAP database.

The world average AVE protection level applied in 2007 is estimated to be 4.4%, that is 0.7 percentage points less than in 2004. Unilateral liberalizations and new preferential trade agreements are the main explanations for this decline. The increasing share of developing countries, where protection is higher on average, tended to raise the world average, but this was counterbalanced by the decline in the ad valorem equivalent of specific tariffs, linked to the surge in world prices of agricultural products.

Comparisons across methodologies illustrate the importance of weighting schemes. While import-weighted averages lead to a lower assessed level of average applied protection (3.6%), the different methodology used in ITC's methodology to build reference groups results in a higher average figure (5.0%). Summarizing protection structures in aggregate figures is complex tasks, which cannot be carried out perfectly in multi-purpose databases. Even though consistent, large-scale assessments such as the one proposed here are useful, these figures emphasize once again the need to take into account the detailed structure of protection, in a way compatible with each study's purpose.

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## APPENDIX

## Additional results

**Table 6: Decomposition of changes in applied protection between 2004 and 2007, textiles-clothing and other industrial products (percentage points)**

Country	Textile				Rest of Industry			
	Total	TP	WS	UV	Total	TP	WS	UV
	(a)	(d)	(c)	(b)	(e)	(h)	(g)	(f)
<b>Developed</b>	<b>0.10</b>	<b>-0.31</b>	<b>0.33</b>	<b>0.07</b>	<b>-0.33</b>	<b>-0.33</b>	<b>0.03</b>	<b>-0.03</b>
Australia	-5.83	-6.12	0.28	0.00	0.19	0.34	-0.13	-0.02
Canada	-0.11	-0.65	0.54	0.00	0.04	0.03	0.01	0.00
EU27	0.59	0.10	0.50	0.00	-0.18	0.00	-0.17	0.00
EFTA	2.30	0.72	-0.90	2.47	-0.22	-0.04	-0.11	-0.07
Japan	-0.65	-0.54	-0.09	-0.02	-0.13	-0.03	-0.03	-0.07
United States	0.14	-0.18	0.31	0.01	-0.40	-0.35	-0.02	-0.03
<b>Developing</b>	<b>-2.87</b>	<b>-3.36</b>	<b>0.48</b>	<b>0.01</b>	<b>-1.43</b>	<b>-1.73</b>	<b>0.21</b>	<b>0.09</b>
ASEAN	-3.14	-3.00	-0.14	0.00	-1.30	-1.95	0.67	-0.02
China	-4.66	-4.65	-0.01	0.00	-1.32	-1.34	-0.41	0.43
India	-0.10	-0.02	-0.08	0.00	-0.13	0.00	-0.13	0.00
Korea, Rep. Of	-0.98	-0.96	-0.02	0.00	-0.82	-0.91	0.01	0.09
Maghreb	-7.27	-8.20	0.93	0.00	-6.37	-7.20	0.84	0.00
Mercosur	-0.58	-0.73	0.14	0.00	-1.47	-0.98	-0.49	0.00
Mexico	2.53	-1.22	3.75	0.00	-0.91	-2.47	1.56	0.00
Other SSA	-21.33	-25.13	3.80	0.00	-7.51	-7.80	0.30	-0.02
Pakistan	-3.91	-3.89	-0.02	0.00	-3.67	-3.53	-0.05	-0.09
SACU	2.46	1.53	0.92	0.00	0.01	0.10	-0.06	-0.03
Turkey	-0.75	-1.33	0.57	0.00	-0.55	-0.45	-0.11	0.01
<b>LDCs</b>	<b>-1.62</b>	<b>-2.06</b>	<b>0.44</b>	<b>0.00</b>	<b>-1.93</b>	<b>-2.31</b>	<b>0.40</b>	<b>-0.01</b>
Bangladesh	-6.39	-6.46	0.08	0.00	-6.34	-7.80	1.46	0.00
Sub-Saharan LDCs	-0.72	-1.09	0.37	0.00	0.12	-0.09	0.21	0.00
<b>World</b>	<b>-0.48</b>	<b>-1.00</b>	<b>0.46</b>	<b>0.06</b>	<b>-0.26</b>	<b>-0.77</b>	<b>0.51</b>	<b>0.00</b>

Source: MAcMap-HS6 2004 and 2007, author's calculations.

Note: "UV" refers to unit values; "WS" to weighting schemes; "TRQ" to tariff rate quotas; "TP" to trade policies. Each column reports changes in AVE applied protection (in percentage points) linked to changes in the variable referred to in the column header.

**Table 7: Coverage and ad valorem equivalent of non-tariff-rate-quota specific tariffs in 2007, by large sector**

Country	Coverage of non-TRQ specific tariffs: share in nb of products (%)				Coverage of non-TRQ specific tariffs: share in imports (%)				AVE of non-TRQ specific tariffs (%)			
	All	Agric.	Textile	Indus.	All	Agric.	Textile	Indus.	All	Agric.	Textile	Indus.
	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)	(k)	(l)
<b>Developed</b>	<b>2.3</b>	<b>6.7</b>	<b>2.8</b>	<b>1.4</b>	<b>2.3</b>	<b>15.4</b>	<b>2.8</b>	<b>1.6</b>	<b>9.3</b>	<b>13.9</b>	<b>14.4</b>	<b>5.2</b>
Australia	0.1	0.1		0.2	7.3	1.1		7.9	19.8	9.6		20.0
Canada	0.2	1.9	0.0		0.4	6.5	0.0		6.2	6.2	4.4	
EU27	1.9	14.9		0.0	0.9	16.1		0.0	17.9	18.1		3.5
EFTA	15.2	33.7	20.1	10.7	8.2	41.3	10.4	6.2	11.8	42.1	14.4	2.0
Japan	1.1	7.9	0.0	0.1	4.8	20.9	0.0	3.7	7.0	28.4	265.6	0.7
United States	4.4	20.8	5.9	1.1	3.8	23.0	8.0	2.7	4.8	4.1	13.9	4.0
<b>Developing</b>	<b>0.5</b>	<b>2.4</b>	<b>0.6</b>	<b>0.1</b>	<b>1.9</b>	<b>4.9</b>	<b>0.1</b>	<b>1.7</b>	<b>22.5</b>	<b>39.3</b>	<b>42.0</b>	<b>16.5</b>
ASEAN	0.3	1.9		0.1	0.6	4.6		0.3	28.6	54.7		10.9
China	0.5	0.4		0.6	0.4	2.3		0.3	108.8	8.9		167.0
India	0.0	0.3			0.1	2.4			23.9	23.9		
Korea, Rep. Of	0.0			0.0	0.0			0.0	0.0			0.0
Maghreb												
Mercosur												
Mexico	0.8	5.3		0.1	0.2	2.3		0.1	42.4	45.0		20.6
Other SSA	1.2	1.0	5.2	0.3	0.3	0.2	1.3	0.3	18.7	187.8	36.7	12.6
Pakistan	0.8	5.1		0.2	16.0	21.1		15.6	12.1	21.1		10.8
SACU	1.4	8.0		0.5	7.8	14.9		7.8	3.9	12.4		2.1
Turkey	0.1	0.5		0.0	0.0	0.5		0.0	54.4	17.1		136.7
<b>LDCs</b>	<b>0.1</b>	<b>0.6</b>		<b>0.0</b>	<b>1.8</b>	<b>1.8</b>		<b>2.0</b>	<b>15.3</b>	<b>38.7</b>		<b>12.5</b>
Bangladesh	0.2	0.6		0.1	10.0	8.1		12.6	8.6	14.8		7.6
Sub-Saharan LDCs												
<b>World</b>	<b>0.7</b>	<b>2.7</b>	<b>0.8</b>	<b>0.3</b>	<b>2.2</b>	<b>10.8</b>	<b>2.1</b>	<b>1.6</b>	<b>12.0</b>	<b>17.5</b>	<b>14.5</b>	<b>8.2</b>

Source: MAcMap-HS6, authors' computations.

Note: Blank means zero.

**Table 8: Coverage and ad valorem equivalent of tariff rate quotas in 2007**

Country	Coverage of TRQs in agriculture: share in nb of prod. (%)	Coverage of TRQs in agriculture: share in imports (%)	AVE of inside rate (IQTR, %)	AVE of marginal rate (%)	AVE of outside rate (OQTR, %)	Rents (M 2007 USD)
	(a)	(b)	(c)	(d)	(e)	(f)
<b>Developed</b>	<b>2.9</b>	<b>10.6</b>	<b>11.0</b>	<b>44.7</b>	<b>58.1</b>	<b>1,679</b>
Australia	0.4	0.3	1.8	1.8	21.7	
Canada	11.7	14.6	2.6	63.9	101.5	179
EU27	9.4	18.2	10.0	38.4	43.8	828
EFTA	10.3	22.0	33.5	111.3	183.5	134
Japan	7.6	7.2	18.7	123.7	141.1	231
United States	6.8	9.7	7.4	19.7	21.1	306
<b>Developing</b>	<b>0.2</b>	<b>1.9</b>	<b>10.0</b>	<b>36.0</b>	<b>41.5</b>	<b>232</b>
ASEAN	0.2	0.1	41.0	42.6	54.2	0
Maghreb	0.0	14.1	12.4	24.8	28.9	67
Mercosur	0.0	0.4	0.0	0.3	8.4	
Pakistan	0.0	0.2	23.1	27.1	34.0	0
SACU	0.0	0.0	23.8	23.8	58.3	
Turkey	0.2	7.7	5.4	56.0	62.8	72
<b>LDCs</b>						
<b>World</b>	<b>0.6</b>	<b>6.8</b>	<b>10.9</b>	<b>44.4</b>	<b>57.5</b>	<b>1,911</b>

Source: MAcMap-HS6, authors' computations.

Note: Among the countries singled out in other tables, only those applying TRQs are shown here. Blank means zero.

**Table 9: Average applied protection by group of countries and for selected countries, assessed using alternative weighting schemes, by large sector (2007, AVE in %)**

Country	MMHS6 method. (5 RGs)			ITC's method. (11 RGs)			Import-weighted			Simple average		
	Agric.	Textile	Indus.	Agric.	Textile	Indus.	Agric.	Textile	Indus.	Agric.	Textile	Indus.
	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)	(a)	(b)	(c)
<b>Developed</b>	<b>14.6</b>	<b>7.8</b>	<b>1.7</b>	<b>14.0</b>	<b>5.2</b>	<b>1.2</b>	<b>13.6</b>	<b>6.4</b>	<b>1.2</b>	<b>12.2</b>	<b>4.6</b>	<b>1.4</b>
Australia	1.5	12.3	3.2	1.1	8.1	2.9	1.5	11.7	3.2	0.8	6.2	1.7
Canada	18.1	12.4	1.8	10.0	9.7	1.1	12.5	9.3	0.7	6.2	6.4	0.8
EU27	14.6	7.0	1.7	10.4	3.4	0.7	9.2	6.0	1.3	8.1	1.8	0.4
EFTA	47.5	5.8	0.2	44.2	4.0	0.3	26.4	1.7	0.1	41.4	8.7	0.8
Japan	23.8	7.0	0.7	20.0	5.8	0.5	21.4	7.8	0.5	20.2	3.9	0.6
United States	5.5	9.8	1.1	5.3	9.1	0.8	2.9	8.4	0.7	3.7	7.8	0.9
<b>Developing</b>	<b>18.3</b>	<b>13.3</b>	<b>7.0</b>	<b>22.1</b>	<b>20.2</b>	<b>10.6</b>	<b>12.7</b>	<b>10.9</b>	<b>5.7</b>	<b>17.6</b>	<b>16.8</b>	<b>8.8</b>
ASEAN	11.8	8.2	4.7	15.2	10.9	3.6	9.5	11.7	2.6	14.0	12.3	6.5
China	9.2	9.2	5.9	22.2	20.9	11.5	5.7	8.3	4.8	14.0	11.3	10.4
India	60.5	15.1	14.3	51.7	14.9	17.9	57.2	15.6	12.6	37.7	15.0	15.2
Korea, Rep. of	50.8	10.3	4.5	65.3	10.6	4.2	102.4	9.0	3.3	51.1	9.4	5.4
Maghreb	24.4	19.0	9.0	18.8	17.9	9.2	17.5	11.7	6.7	26.5	19.2	12.0
Mercosur	10.4	17.0	9.2	11.0	17.3	11.2	9.1	16.5	7.4	9.9	17.1	9.6
Mexico	15.5	15.7	5.4	23.3	19.7	10.1	3.7	8.2	2.4	16.3	19.2	10.4
Other SSA	19.3	18.2	9.4	22.9	20.5	11.5	14.7	13.9	9.1	19.1	19.9	10.8
Pakistan	14.9	17.8	10.9	14.7	20.1	17.3	11.8	14.3	12.0	15.7	18.5	12.5
SACU	13.7	22.5	4.0	10.7	23.3	4.9	6.8	22.0	4.3	9.9	21.8	3.8
Turkey	41.1	4.4	1.5	58.2	4.4	1.1	23.0	3.1	0.9	41.6	3.5	1.6
<b>LDCs</b>	<b>12.6</b>	<b>17.7</b>	<b>9.3</b>	<b>13.0</b>	<b>17.2</b>	<b>10.2</b>	<b>9.8</b>	<b>16.6</b>	<b>8.8</b>	<b>14.6</b>	<b>13.6</b>	<b>9.0</b>
Bangladesh	11.2	21.2	9.6	13.2	22.6	12.3	6.8	19.9	10.2	16.9	20.8	12.6
Sub-Saharan	11.3	17.9	8.4	11.5	13.7	9.0	11.1	18.8	8.1	14.0	17.8	10.6
<b>World</b>	<b>15.9</b>	<b>9.2</b>	<b>3.4</b>	<b>16.4</b>	<b>9.4</b>	<b>3.9</b>	<b>13.1</b>	<b>7.7</b>	<b>2.7</b>	<b>14.8</b>	<b>11.0</b>	<b>5.6</b>

Source: MAcMap-HS6, authors' computations.

## MAcMap-HS6 reference groups

**Group 1:** Albania, Algeria, Angola, Azerbaijan, Armenia, Bosnia and Herzegovina, Brazil, Belize, Bulgaria, Myanmar, Cape Verde, Sri Lanka, China, Colombia, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Equatorial Guinea, Fiji, Gabon, Georgia, Palestinian Territory, Guatemala, Guyana, Indonesia, Iran, Jamaica, Kazakhstan, Jordan, Kyrgyzstan, Lebanon, Libyan Arab Jamahiriya, Maldives, Montenegro, Morocco, Namibia, Nauru, Vanuatu, Panama, Paraguay, Peru, Philippines, East Timor, Romania, Saint Lucia, Saint Vincent and the Grenadines, Serbia, Swaziland, Syrian Arab Republic, Thailand, Tonga, Tunisia, Turkey, Turkmenistan, Ukraine, Macedonia, Egypt, Venezuela, Samoa, Serbia and Montenegro, Kosovo.

**Group 2:** Andorra, Australia, Bahamas, Bahrain, Barbados, Bermuda, Virgin Islands (British), Canada, Cayman Islands, Mayotte, Cook Islands, Faroe Islands, Falkland Islands, French Guiana, French Polynesia, Gibraltar, Greenland, Guam, Hong Kong, Iceland, Israel, Japan, Korea, Kuwait, Liechtenstein, Macau, Taiwan, Oman, Aruba, New Caledonia, New Zealand, Norway, Northern Mariana Islands, Micronesia, Fed St, Marshall Islands, Palau, Puerto Rico, Qatar, Anguilla, St Pierre and Miquelon, San Marino, Singapore, Switzerland, United Arab Emirates, Turks and Caicos Islands, United States Of America, Virgin Islands (US), Wallis and Futuna Island, EU25.

**Group 3:** Afghanistan, Bangladesh, Bolivia, Solomon Islands, Cambodia, Cameroon, Central African Republic, Comoros, Djibouti, Gambia, Ghana, Kiribati, Guinea, Haiti, Honduras, Iraq, Côte d'Ivoire, Korea, Lao People's Democratic, Lesotho, Mauritania, Mongolia, Moldova, Nepal, Nicaragua, Pakistan, Papua New Guinea, Rwanda, Sao Tome and Principe, Senegal, India, Viet Nam, Zimbabwe, Western Sahara, Suriname, Togo, Uganda, Uzbekistan.

**Group 4:** Bhutan, Burundi, Chad, Congo, Congo (Democratic Rep), Benin, Ethiopia, Eritrea, Kenya, Liberia, Madagascar, Malawi, Mali, Mozambique, Niger, Nigeria, Guinea-Bissau, Sierra Leone, Somalia, Sudan, Tajikistan, Tanzania, Burkina Faso, Yemen, Zambia.

**Group 5:** Antigua and Barbuda, Argentina, Botswana, Brunei Darussalam, Belarus, Chile, Costa Rica, Croatia, Grenada, Malaysia, Mauritius, Mexico, Netherland Antilles, Russian Federation, Saint Kitts and Nevis, Saudi Arabia, Seychelles, South Africa, Trinidad and Tobago, Tuvalu, Uruguay.

## Reference groups in ITC's methodology

**Group 1:** Afghanistan, Benin, Burkina Faso, Cape Verde, Cote d'Ivoire, Gambia, Ghana, Guinea, Guinea-Bissau, Haiti, Mali, Mauritania, Niger, Nigeria, Senegal, Sierra Leone, Togo, Yemen.

**Group 2:** Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Canada, Chile, Dominican republic, Georgia, Hong Kong, Iceland, Israel, Japan, Kazakhstan, Korea, republic of, Kyrgyzstan, Macau, Macedonia, the former Yugoslav republic of, Mauritius, Moldova, republic of, Mongolia, Norway, Panama, Russian federation, Serbia, Switzerland, Chinese Taipei, Tajikistan, Turkey, Turkmenistan, Ukraine.

**Group 3:** Algeria, Bahamas, Bahrain, Bangladesh, Bhutan, Comoros, Djibouti, Egypt, Iran (Islamic republic of), Jordan, Kuwait, Lebanon, Libyan Arab Jamahiriya, Maldives, Morocco, Nepal, Oman, Pakistan, Qatar, Saudi Arabia, Sri Lanka, Sudan, Syrian Arab republic, Tunisia, United Arab emirates, Uzbekistan.

**Group 4:** Angola, Botswana, Burundi, Congo (democratic republic), Eritrea, Ethiopia, Kenya, Lesotho, Madagascar, Malawi, Mozambique, Namibia, Rwanda, Seychelles, South Africa, Swaziland, Tanzania, united republic of, Uganda, Zambia, Zimbabwe.

**Group 5:** Antigua and Barbuda, Barbados, Belize, Dominica, Grenada, Guyana, Jamaica, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago.

**Group 6:** Argentina, Australia, Bolivia, Brazil, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, New Zealand, Nicaragua, Paraguay, Peru, Uruguay, Venezuela.

**Group 7:** Fiji, Kiribati, Micronesia, federated states of, Palau, Papua new guinea, Solomon islands, Tonga, Vanuatu.

**Group 8:** Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Vietnam.

**Group 9:** Cameroon, Central African republic, Chad, Congo, Equatorial guinea, Gabon.

**Group 10:** China, EU27, India, United States.

**Group 11:** American Samoa, Andorra, Anguilla, Aruba, Bermuda, Bouvet Island, British Indian Ocean Territory, Cayman Islands, Christmas Island, Cocos (Keeling) Islands, Cook Islands, Falkland Islands (Malvinas), Faroe Islands, French Guiana, French Polynesia, French Southern Territories, Gaza Strip, Gibraltar, Greenland, Guam, Heard and Mc Donald Islands, Iraq, Korea, Democratic People's Republic Of, Kosovo, Liberia, Liechtenstein, Marshall Islands, Mayotte, Midway Islands, Montenegro, Montserrat, Nauru, Netherlands Antilles, New Caledonia, Niue, Norfolk Island, Northern Mariana Islands, Pacific Islands, Pitcairn, Puerto Rico, Samoa, San Marino, Sao Tome and Principe, Somalia, South Georgia and The South Sandwich Islands, St Helena, St Pierre and Miquelon, Svalbard and Jan Mayen Islands, Timor Leste, Tokelau, Turks and Caicos Islands, Tuvalu, United States Minor Outlying Islands, Virgin Islands (British), Virgin Islands (Us), Wallis and Futuna Islands, Western Sahara.

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