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A Consistent Picture of Applied Protection Across the World

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Working Paper 05/05

TRADEAG is a Specific Targeted Research Project financed by the European Commission within its VI Research Framework. Information about the Project, the partners involved and its outputs can be found at http://tradeag.vitamib.com

A consistent picture of applied protection across the world[#]

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Revised version – September 2005

Abstract

In order to provide with a consistent assessment of protection across the world in 2001, the MAcMap-HS6 database includes ad valorem equivalent measure of tariff duties and tariff rate quotas for 163 countries and 208 partners, at the six-digit level of the Harmonized System (5,111 products), and accounting for all preferential agreements. We first describe the methodology used to compute and aggregate ad valorem-equivalent applied tariff duties, well suited for analytical purposes. Special emphasis is put in minimizing the endogeneity bias in the aggregation procedure, and in acknowledging structural differences in export specialization. We then overview applied protection across the world, in terms of average as well as distribution. Protection appears strongly uneven across countries and products. Least developed countries are in average the most protected. While developed countries exhibit the lowest average tariff level, their protection appears extremely uneven across both partners and products.

[#] The authors acknowledge financial support by the "Agricultural Trade Agreements (TRADEAG)" project, funded by the European Commission (Specific Targeted Research Project, Contract no. 513666). The authors are solely responsible for the contents of this paper. This article is part of the effort jointly devoted by ITC (UNCTAD-WTO) and CEPII (Paris) to build the MAcMap database. The authors are grateful to Mondher Mimouni and Xavier Pichot for contributing to MAcMap at the ITC, as well as to Friedrich von Kirchbach, for his fruitful collaboration. They like to thank Paul Gibson for providing them with the AMAD database on tariff rate quotas. They also benefited from valuable comments and suggestions of three anonymous referees, and of many researchers, in particular in the context of the GTAP consortium. The usual disclaimer applies. Correspondence: macmap @ cepii.fr.

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1 Introduction

At the time of "globalization", it is utterly difficult to precisely assess the magnitude of border protection and thus to give an accurate estimate of the economic impact of any trade liberalization. The Marrakech agreement admittedly brought some simplifications, in particular by abolishing quantitative trade restrictions. But it let specific tariffs still widespread in some sectors (agriculture) and some countries (Switzerland, Japan, Malaysia, Cyprus, European Union…). Worse, it gave birth to new protection instruments, known as tariff rate quotas (TRQs), through which a given amount of imports (allocated according to various possible modes of administration, and frequently on a bilateral basis) can benefit from a lowered tariff rate.[2] Besides, far from reducing the dispersion of tariff rate, dirty tariffication led to a very strong disparity of tariff levels, and to widespread tariff peaks. The number of preferential trade arrangements (PTAs) dramatically increased during the 90s,[3] while non-reciprocal trade preferences were granted by rich countries to developing ones, often for a limited period of time only.[4]

As a result, simple questions such as the systematic comparison of the level of protection across countries and industries are hardly answered. The growing complexity of trade policies has left negotiators, but also economists, without well-suited information about the current state of trade policies. Based on a joint effort devoted by the International Trade Centre –ITC– (United Nations Conference on Trade And Development –UNCTAD– & World Trade Organization –WTO–, Geneva) and the Centre d’Etudes Prospectives et d’Informations Internationales –CEPII–, Paris) to systematically collect detailed and exhaustive information on applied tariffs, this article proposes and uses a method to compute an exhaustive and consistent ad-valorem equivalent (AVE) measure of applied protection across the world. The purpose is not only to provide with a measure of border protection, but also to pave the way for well-suited economic analysis of the consequences of trade liberalization.

The source information on border protection emanates from national customs. It is defined at the tariff line level. The definition of tariff lines varies widely across countries, but it is always based on the six-digit level of the Harmonized System classification (hereafter, HS-6 level). This non-harmonized

[2] This lower tariff rate is called the Inside Quota Tariff Rate (IQTR). Imports are then taxed at the regular tariff, also called the Outside Quota Tariff Rate (OQTR), when the quota is filled.
[3] 208 enforced agreements had been notified to the WTO by May 2004.

information is hardly a well-suited basis for a wide-ranging analysis of border protection across the world. In trying to gather the relevant information, UNCTAD's TRade Analysis and INformation System (TRAINS) has played a leading role: it provides with data at the tariff line level about applied tariffs (ad valorem and specific) and TRQs, as well as import flows by origin for more than 140 countries. However, at least until recently, TRAINS suffered from an incomplete coverage of preferential agreements, and did not propose ad valorem equivalent (AVE) calculations.5 WTO's Integrated Database (IDB) is now an alternative source, although it only concerns applied MFN tariffs, and does not reach a comparable coverage. Other attempts to gather wide-ranging, harmonized data on border protection, are presented in Table 1. Some databases have a more limited coverage in terms of products and/or countries (Agricultural Market Access Database - AMAD or the Hemispheric Database.) The Integrated Tariff Analysis System (ITAS - see Fry et al., 2004) allows for a very complete analysis of applied and bound tariffs and of the outcome of cutting bound protection, but only for 17 countries and for industrial products. Databases also differ from a methodological point of view (aggregation procedure, estimation of AVEs).

Thus, although a lot of information existed, no well-suited, comprehensive assessment of AVE applied protection across the world was available. Gathering such information in a consistent and tractable way has been the first motivation for putting together the MAcMap database. Beyond, the development of this database also aimed at dealing with the main methodological hurdles faced when trying to produce tariff data well-suited for large-scale analysis.

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[4] Another difficulty is the stringency of rules attached to the latter agreements in order to be eligible to these preferences.

[5] Note, however, that such calculations have been proposed recently within TRAINS, although they are not documented in detail.

Table 1 Databases on market access

	AMAD	Hemispheric database	IDB	ITAS	MAcMap	OECD	Trains
Source	Agr. and AgriFood Canada, EU Commission, FAO, OECD, The World Bank, UNCTAD, USDA - ERS	Inter American Development Bank	World Trade Organization	Australian Government Productivity Commission	Centre d'Etudes Prospectives et d'Informations Internationales	OECD & UNCTAD	United Nations Conference on Trade And Development
Time coverage	From 1995 to 2001	From 1997 to 2001	From 2000 to 2004	1999	2001	1988, 1993 and 1996	From 1994 to 2001
Country coverage	50 countries	American hemisphere countries (33)	122 reporting countries	17 reporting countries	163 reporting countries/208 partners	14 OECD countries	163 reporting countries in 2001
Product coverage	Agricultural products (tariff lines level)	Tariff line or HS10, HS8 (HS6 for Canada)	Tariff line level	Industrial products	5,111 products (HS6)	5,111 products (HS6)	5,111 products (HS6)
Ad-valorem duties	Yes	Yes	Yes	Yes	Yes	yes	yes
Specific duties	Yes	Yes	Yes	Only 10% of specific duties included	Yes	yes	yes
Tariff quotas	Yes	No	Yes	No	Yes	Only for three countries (Canada, Iceland, USA)	yes
Anti-dumping	No	Yes	No	No	Yes	No	No
Bound vs. applied MFN rates	Bound and applied MFN duties	Bound and applied MFN duties	Bound and applied MFN duties	Bound and applied MFN duties	Applied duties	Bound and applied MFN duties	Applied duties
Tariff regimes	Multilateral (MFN)	MFN + all regional agreements + all preferences	Multilateral (MFN) partial inform. on trade preferences	MFN + all regional agreements + all preferences	MFN + all regional agreements + all preferences	Multilateral (MFN)	MFN + some regional agreements + some preferences
Method of aggregation	No average calculated	No average calculated	No average calculated	Simple average, trade-weighted average	Imports of the reporter's reference group from the partner	Simple mean	No average calculated
Ad-Valorem Equivalent (AVE) of specific duties	No AVE calculated, but world prices and exchange rates included in the database	When provided by countries	When provided by WTO members	Use of IDB's AVE when available (10% of cases)	Specific duties divided by median unit value of trade flow originating from exporter's Reference Group	By price differentials, for some products only	No AVE calculated
AVE of tariff quotas	No AVE calculated	-	When provided by WTO members	-	OQTR, IQTR or weighted mean of IQTR and OQTR according to imports level	OQTR	No AVE calculated
Possible simulation of tariff-cutting formula	No	No	Yes (under WITS application)	Yes	No	No	Yes (under WITS application)

MAcMap is originally a set of files at the tariff line level that can be mobilized for several purposes, noticeably single client studies and interactive on-line databases for the business community realized at

ITC. This article deals with one specific application of MAcMap, namely the construction of a database at the HS-6 level, intended to provide a set of consistent and exhaustive AVEs of applied border protection across the world in 2001. This specific database, referred to as MAcMap-HS6 (version 1), is in particular the source for protection data in the 6th release of the Global Trade Analysis Project (GTAP) database. At the level of disaggregation of GTAP6, MAcMap is freely available on the CEPII's web-site.[6] At the HS-6 level, the forthcoming version (2004) will be made freely available to the research community.

Section 2 proposes a detailed presentation of the methodology utilized in MAcMap-HS6 version 1.[7] Illustrative results about the worldwide structure of protection are provided in Section 3.

2 Methodological choices in MAcMap-HS6

Protection data in MAcMap originates from country notifications to the WTO, from AMAD, and from national custom information (reported directly to ITC or to UNCTAD-TRAINS). For each importing country, information on the various instruments of protection at the border (ad valorem tariffs, special tariffs, quotas, etc.) is maintained in the MAcMap database at the most disaggregated level possible: the tariff line level. In order to stick to the bilateral option, unilateral preferences and regional agreements are exhaustively documented.[8]

Tariffs at the tariff line level are aggregated up to the HS-6 level, using a simple average as trade data are not systematically available at the tariff-line level. This combined information characterizes the trade policy applied by 165 countries to 208 exporting partners. It concerns tariffs (ad valorem, specific, mixed, compound and antidumping duties), and tariff quotas. Trade data are sourced from BACI, also at the HS-6 level.[9] These data are used to calculate AVEs and to aggregate tariffs.

2.1 Calculating AVEs

The source information concerns various instruments, which cannot be directly compared or summed, and

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[6] See http://www.cepii.fr/francgraph/bdd/macmap.htm.

[7] Only the main features of the database are here presented. For more details see Bouët, et al. 2005. For the sake of simplicity, we will refer in the following to MAcMap instead of MAcMapHS6v1.

[8] Preferential tariffs include preferential ad valorem and specific tariffs.

[9] BACI is the French acronym for *Base de données pour l'Analyse du Commerce International*. This database is based on Comtrade, and includes an effort of reconciliation, harmonization, and quality check. For further details, see: http://www.cepii.fr/anglaisgraph/bdd/baci/baci.pdf

which are not all readily usable in large-scale modeling exercises. The natural solution to overcome these problems and to make the database fully operative for analytical purposes is to compute AVEs of each instrument. We describe now the methodology adopted in the case of specific tariffs and TRQs.

2.1.1 Specific tariffs

Specific tariffs were converted in AVEs by dividing the duty by a unit value (UV).[10] Choosing this UV raises important issues, both from a statistical and from a theoretical point of view.

Theoretically, specific tariffs have a more restrictive impact on unprocessed or low quality goods. Using *bilateral* UVs might seem appealing because it is fully consistent with the amount of tariff receipts collected, and because it allows the quality range of the corresponding trade flow to be taken into account. However, it is flawed with lack of robustness, thus introducing significant variance across AVE protection faced by different partners in the same market, often to a surprising extent.[11] Measurement errors, or even reporting errors (e.g. errors in the physical units reported) explain such outcome.

Computing AVEs based on a *worldwide* import average, as for instance Gibson et al. (2001), is appealing in terms of robustness, but it completely disregards the question of quality differences.

An intermediate approach was chosen for MAcMap; AVE calculations are based on the median unit value of world-wide exports originating from the reference group of similar countries the exporter belongs to (named ERGUV, for Exporter's Reference Group Unit Value, in what follows). Reference groups are not only mobilized for the calculation of AVE of specific tariffs, but also for the purpose of aggregating tariffs (see section 2.3). These groups are defined on the basis of a hierarchical clustering analysis based on GDP per capita (in PPP terms) and trade openness.[12] The five groups obtained can be loosely labeled as follows: (1) richest countries; (2) highly opened, middle income countries; (3) less opened, middle income countries; (4) highly opened, low income countries; (5) less opened, low income countries.[13]

[10] Alternative methods include an estimation based on price wedges, that is hardly tractable at the level of detail and coverage of this database. The "revenue" method, consisting in dividing tariff revenues by the value of imports, in addition to being difficult to implement, is clearly unfitted in the presence of preferential agreements.

[11] This method was used in previous releases of MAcMap, and its use for analytical purposes proved to suffer from insufficient robustness.

[12] It is a major change from the first release of MAcMap, in which reference groups were based on an arbitrary classification (GDP PPP per capita).

[13] The full set of countries and reference groups is provided on the CEPII's website.

Using this ERGUV offers three advantages:

(i) the differences in unit values across countries, associated in particular to differences in products quality, is accounted for;

(ii) the endogeneity bias (there is an incentive to alter product quality in response to a specific tariff) is lessened compared to a bilateral unit value;

(iii) more importantly, ERGUVs are more robust to measurement errors than bilateral UVs: due to the use of median, outliers do not influence strongly the result, in contrast to a calculation based on the average.

2.1.2 Tariff rate quotas

When trying to summarize and harmonize the information about border protection, TRQs originate a number of problems. Due to their intrinsic nature, they cannot be perfectly summarized through an AVE, hence the question of how to handle them in a multi-country, multi-product framework (see e.g. IATRC, 2001; Liapis & Blitz, 2001). Since TRQs are defined at very different levels (from HS-4 to tariff line), their treatment must include a consistent aggregation procedure. Keeping the basic information about IQTR, OQTR and quota as such, for instance, is not consistent with aggregation: the average IQTR and OQTR, combined with the sum of quotas, do not describe consistently the aggregate impact of various TRQs. Finally, another requirement is to combine this information with the tariff data, both for descriptive and statistical matters, as well as for incorporation in economic analyses.

Our calculations are intended to reflect the marginal level of protection, as well as the rent associated, on a bilateral basis.

A fill rate is first computed for each TRQ, as the ratio of imports to the size of the quota itself.[14] As soon as a quota involves a specified bilateral allocation, this fill rate is computed separately for each (group of) partner(s) which is allocated a separate quota. The shadow tariff is then defined as the *ad valorem* tariff that would lead to the same level of imports as is observed under the tariff rate quota. It is well known that administration problems frequently hinder from reaping full benefit from TRQs (see e.g. de Gorter and Kliauga, 2005). However, it is difficult to account systematically for such issues. We therefore only

[14] This fill rate is thus *not* restricted to being inferior or equal to one.

make use of the fill rate in defining the three market regimes considered:

0 – If the fill rate is less than 90% (quota not binding), the inside quota tariff rate is chosen as the shadow rate.

1 – In the (90-99%) range (quota assumed to be binding,[15] OQTR prohibitive), a simple arithmetic average is used (except in a few cases where external information allows a better guess to be made).

2 – If it is higher than 99% (quota binding, OQTR not prohibitive), the shadow rate is equal to the outside quota tariff rate (OQTR).

As for the quota rent, either the quota is filled and the rent is equal to the difference between the OQTR and the IQTR, multiplied by the quota, or it is not filled. In the latter case if the fill rate is less than 90% then the rent is supposed to be 0. If it is greater than 90% then the rent is equal to the difference between the shadow tariff and the IQTR, multiplied by imports.

2.2 Aggregation methodology

The most widespread methodology to aggregate tariffs is the import-weighted average. This method suffers from well-known flaws, in particular because, everything being equal, the higher the tariff, the lower the import flow (in a proportion depending on the price-elasticity of import demand.) As emphasized for instance by Anderson & Neary (2003), the import-weighted average is not even monotonic in individual tariffs, which makes it an especially ill-suited aggregate measure of protection. Using instead world imports as a weighting scheme, as proposed by Leamer (1974), avoids this endogeneity bias, but this measure fails to account for each economy's specificity. Simple averages are attractive in terms of ease of computation, but do not rest on any convincing foundation. Other weighting schemes, like production or consumption shares, in addition to be questionable in theoretical terms, are not applicable at a detailed level, due to lack of data.

From a theoretical point of view, Anderson & Neary (1996, 2003) have shown how the aggregate level of protection should be defined, depending on the criterion chosen. The Trade Restrictiveness Index (TRI) is a general-equilibrium "welfare-equivalent" aggregate measure of protection, while the Mercantilist TRI is

[15] The quota is assumed to be binding as soon as the fill rate exceeds 90%, since administration methods or other reasons might well prevent a small share of the quota from being used, even though the quota is actually binding.

a general equilibrium “import-equivalent” aggregate measure. In practice, these index numbers can be computed using a general equilibrium model of the economy concerned (see e.g. the illustrations proposed by Anderson & Neary, 1996 for the TRI, and 2001 for the MTRI). However, such models cannot be implemented at a level of detail allowing the precise structure of tariffs to be reflected. Simplified versions have also been developed. Bach & Martin (2001) show how assuming output and revenue unchanged makes it possible to compute the TRI using only detailed import and tariff data. Bureau & Salvatici makes similar assumptions and compute TRIs (2004a and b) and MTRIs (2001, 2004a and b) using CES sub-utility functions. In all these cases, however, the index number is only implicitly defined, and calculated using a numerical optimization device. While such calculations can be carried out for specific cases, they are hardly usable as an aggregation device for a large-scale database. Assuming in addition that import demand functions are linear (and ignoring cross-price effects), Feenstra (1995) gives an explicit analytical expression of the TRI, readily computable although requiring the use of Hicksian elasticities of imports, evaluated at free-trade prices. To our knowledge, no equivalent closed form expression has been proposed for the MTRI.

To sum up, existing aggregation methods include on the one hand a-theoretical measures, largely recognized as significantly flawed and potentially misleading. On the other hand, available theoretically based measures cannot be applied to a large-scale database such as MAcMap. Feenstra's approximation (1995) is an exception but, in addition to relying on a strongly simplified theoretical framework, it is contingent on estimated Hicksian elasticities, which raises question as to the robustness of the aggregate measure computed. Besides, Feenstra's approximation concerns the TRI, a welfare-equivalent measure, while Anderson and Neary (2003) convincingly argue that an import-equivalent measure fits more closely the concerns of trade policy makers.

Against this background, our approach in choosing the aggregation methodology to be used as a tool for a systematic and large-scale analysis of protection is pragmatic. The methodology must avoid the main flaws of a-theoretical measures; it should avoid or minimize the endogeneity bias, while taking into account each economy's specificity. It should also be consistent theoretically. Since we take the "Mercantilist preoccupation with the volume of trade" (Anderson and Neary, 2003) as decisive in policy formation and as consistent with the GATT-WTO framework,[16] this means that our measure should be consistent with MTRI measure of aggregate protection. For the sake of robustness, we would also like to avoid using estimated parameters in the aggregation. Finally, the methodology should be applicable on a large scale basis.

Based on these prerequisites, the premise of our methodology is that an average weighted by free-trade imports is a suitable proxy for the MTRI. Although not perfect from a theoretical point of view, this weighting scheme is appealing in that it does not suffer from any endogeneity bias, while acknowledging the economy's specificity, by reflecting the respective potential importance of products.

Formally, ignoring general equilibrium effects (that is, assuming constant production and revenue), the MTRI is exactly equal to the free-trade import-weighted average, as soon as import demand functions are linear, with zero cross-price elasticities. In this case, imports of good i can be written as $M_i = M^0_i (1-\gamma_i t_i)$, where M refers to imports, superscript 0 refers to free-trade, and t is the tariff. The MTRI τ is then defined as:

(1) $$\tau : \sum_i M_i^0 (1-\gamma_i t_i) = \sum_i M_i^0 (1-\gamma_i \tau)$$

Hence:

(2) $$\tau = \frac{\sum_i M_i^0 \gamma_i t_i}{\sum_i M_i^0 \gamma_i}$$

As soon as $\gamma_i \equiv \gamma$, this expression collapses to the average weighted by free-trade imports.

Our second important assumption is that the sector structure of imports of a group of “similar” countries is an appropriate proxy for the free-trade sector structure of imports of a given country. As soon as protection patterns are not systematically related across countries, there ought not to be any systematic bias in the sector structure of imports for a large group of countries. Still, free-trade imports might differ due to differences in demand patterns. This is why the proxy for free-trade imports shall not be computed on a worldwide basis, but only for similar countries: hence the approach based on reference groups,

[16] As emphasized by Anderson and Neary (2001), this approach is consistent with the WTO definition of retaliation

previously defined by a statistical clustering based on GDP per capita and trade openness.[17]

Admittedly, these assumptions are questionable. Similar political economy motivations have often given raise to correlation across countries in protection patterns; in addition, since each country is present in its own reference group, its own imports introduce some endogeneity. Even across comparable countries in terms of GDP and openness, idiosyncrasies remain significant in shaping import demand. Still, we argue that these assumptions provide a good rule of thumb to proxy the structure of free-trade imports. As such, given the above arguments, they allow a partial-equilibrium import-volume equivalent uniform tariff to be defined as a weighted average, easily computable even in a large-scale database like ours.

Practically, for each product–partner–reporter triplet, the following weight is used:[18]

$$Weight_{i,\,partner,\,reporter} = M_{i,\,partner,\,RefGrp(reporter)} \frac{M_{.,.,reporter}}{M_{.,.,RefGrp(reporter)}}$$

Where $M_{i,\ partner,\ reporter}$ refers to the value of product i (defined at the HS6 level) imported by country "reporter" from country "partner", "RefGroup(reporter)" refers to the reference group the country "reporter" belongs to, and "." refers to the total, so that $M_{.,.,reporter}$ refers to the total value of "reporter"'s imports.

The last term, $\frac{M_{.,.,reporter}}{M_{.,.,RefGrp(reporter)}}$, only matters as long as data are aggregated among reporters. This normalization factor accounts for the fact that reporters as well as reference groups may differ in sizes. It means that, when aggregating across reporters (*i.e.*, importers) for a given partner (*i.e.*, exporter) and a given product, weights are normalized by the share of total imports from this reporter in total imports of its reference group, so that the size of the reference groups do not have any influence on the weights affected to the reporters, and thus properly proxy what would be free-trade imports.

It is noteworthy that, in using this weighting scheme to aggregate not only across products, but also across partners, we assume each partner to export a specific good basket, different from the ones exported

measures, which is based on the equivalence of the volume of trade displaced.

[17] We are using five reference groups. A higher number of groups would allow countries specificities to be better taken into account. But a small number of large groups allows the protection pattern of each country being diluted in a large set of countries, thus limiting the extent of the endogeneity of weights to the tariffs of each individual country.

by other partners. And we assume zero cross-price elasticities across these products.

In order to check the consistency of our methodology, we will compare our results with the aggregate protection level obtained as a result of the calculation of a MTRI based on the standard assumption of constant price-elasticity demand functions. Neglecting general equilibrium effects and ignoring cross-product substitution, imports are then $M_i = M^0_i (1+t_i)^{-\sigma}$, where σ denotes the price elasticity of import demand, assumed to be equal across products. In this case, the MTRI τ^{CES} across a given set of products can be written as:

(3) $$\tau^{CES} = \left(\frac{\sum_i M_i^0 (1+t_i)^{\sigma}}{\sum_i M_i^0} \right)^{1/\sigma} - 1$$

This calculation overlooks product differences in terms of price-elasticity of import demand, but this is necessary in order to keep large-scale calculations tractable. The value of σ to be used in calculations is debatable. For the sake of illustration, we display the results of calculations for $\sigma=3$ and $\sigma=6$ in the agricultural sector (see the two last columns of Table 2, which for comparison, also expresses the MacMap-HS6 average, called MM.) It clearly highlights a great lack of robustness as it is highly sensitive to the value of the σ parameter (see the cases of Japan, Norway, European Union and Canada.)

Table 2: Comparisons between MacMap-HS6 aggregating method and a MTRI based on CES demand functions – Agriculture – 2001

[18] The aggregation SAS program is given on the CEPII website. The present methodology is a slight evolution of the methodology presented in Bouët, Fontagné, Mimouni and Pichot (2001), and in Bouët, Fontagné, Mimouni and Von Kirchbach (2002), and used in previous releases of MAcMap.

Reporter	Applied tariffs		
	Agric MM	Agric. σ= 3	Agric σ= 6
Argentina	12.0%	7.1%	7.9%
Australia	2.7%	3.2%	3.5%
Bangladesh	20.8%	15.8%	18.0%
Brazil	10.9%	5.5%	6.4%
Canada	14.8%	17.4%	37.9%
China	24.9%	53.2%	71.9%
European Union	17.8%	19.6%	49.3%
India	59.0%	63.4%	76.5%
Japan	35.1%	106.9%	321.6%
Korea	53.5%	234.9%	397.3%
Madagascar	5.5%	5.5%	5.9%
Mexico	28.1%	14.8%	23.9%
Morocco	39.9%	36.3%	71.5%
Mozambique	13.4%	14.6%	15.9%
Norway	71.9%	56.1%	124.1%
South africa	19.1%	12.5%	23.3%
Switzerland	43.1%	52.1%	124.6%
Thailand	27.8%	21.2%	28.0%
Tunisia	52.9%	59.4%	79.6%
Turkey	37.7%	19.1%	32.9%
United states of america	5.0%	3.1%	4.0%
Vietnam	25.5%	43.1%	57.2%

Source: MAcMap

3 An overview of protection patterns across the world

The above-described database makes it possible to measure border protection across the world in consistent terms, accounting for *ad valorem* and specific tariffs, as well as TRQs, and taking exhaustively into account PTAs. This section aims at brushing a broad picture of applied protection. General features of worldwide applied protection are first described. Differences between applied and MFN tariffs, and the importance of each type of instrument are then detailed. Finally, the cumulative distribution of tariffs is considered.

3.1 General features of worldwide applied protection

The first column of Table 3 reports the aggregate level of protection across all products, as calculated with the MAcMap methodology, for selected importers.[19] Among these selected countries, protection ranges from 2.3% (USA) to 33.5% (India), while the worldwide average level of protection is 5.6%. On

[19] They have been selected in order to have a representative and diversified set of situations. The corresponding information is available for all countries included in MAcMap on: http://www.cepii.fr/anglaisgraph/bdd/detailed_tables.xls

average, protection is low in the richest countries, and does not exceed 4% in Quad countries.

The high level of protection in agriculture is highlighted in the second column of Table 3. Average agricultural protection ranges from 2.7% in Australia to 59.6% in India in the sample displayed. The world average is 19.1%. On the contrary, manufacturing products outside textile and apparel are the least protected sector (world average is 4.2%). The contrast with agricultural products is especially striking in rich countries (in particular Canada, the EU, Japan, Korea and Switzerland). Trade in textile and clothing goods remains significantly restricted in most importing regions, even in countries known for their comparative advantage in this activity (Bangladesh, China, India, Morocco, Tunisia). Protection in textile and apparel also remains large in Northern America, as compared to the EU.

Table 3: Protection applied by country (2001)

		By sector			By exporter		
	Total	Agric.	Manuf.	Tex-Wea	LdC	Dvping Co.	Dvped Co.
World	**5.6%**	**19.1%**	**4.2%**	**10.5%**	**4.9%**	**5.3%**	**5.7%**
Argentina	12.6%	12.0%	12.4%	18.3%	7.7%	10.8%	13.1%
Australia	5.1%	2.7%	4.9%	14.2%	7.9%	5.6%	4.9%
Bangladesh	16.9%	20.9%	15.2%	29.7%	16.7%	20.2%	14.8%
Brazil	11.8%	11.0%	11.4%	18.1%	2.4%	9.4%	12.8%
Canada	3.4%	14.9%	2.1%	10.8%	5.8%	3.1%	3.5%
China	14.1%	25.0%	12.7%	20.4%	3.6%	12.9%	14.7%
European Union (15)	3.1%	17.9%	2.0%	5.7%	0.8%	2.7%	3.5%
India	33.5%	59.6%	29.9%	29.5%	28.3%	35.4%	32.5%
Japan	3.9%	35.3%	0.9%	6.8%	1.6%	3.9%	3.9%
Korea	9.2%	53.8%	5.5%	10.3%	10.1%	9.9%	8.9%
Madagascar	4.4%	5.5%	4.1%	4.7%	2.2%	4.6%	4.4%
Mexico	11.0%	28.2%	8.9%	14.5%	15.9%	17.9%	8.9%
Morocco	20.9%	40.1%	17.9%	33.9%	17.4%	25.0%	19.3%
Mozambique	9.9%	13.4%	8.3%	21.6%	10.0%	11.4%	9.1%
South Africa	8.4%	19.2%	6.5%	22.5%	5.8%	10.7%	7.7%
Switzerland	4.3%	43.3%	1.3%	4.0%	0.6%	4.0%	4.5%
Thailand	12.6%	28.0%	10.7%	18.1%	4.4%	12.8%	12.6%
Tunisia	20.3%	53.3%	16.5%	26.0%	9.4%	24.2%	18.9%
Turkey	6.0%	38.0%	2.6%	8.9%	3.3%	9.1%	4.9%
United States of America	2.3%	5.0%	1.7%	9.4%	5.1%	2.4%	2.3%
Vietnam	14.4%	26.0%	11.1%	31.1%	15.0%	16.6%	13.0%

Source: MAcMap

Columns 5 to 7 of Table 3 point out aggregate levels of each region's protection, by exporters' group (developed countries, middle income countries called here developing countries, Least Developed Countries – LDCs). Several countries have conceded preferential regimes to LDCs, which is reflected in better market access for LDCs in the EU, Japan and Switzerland. On the contrary, LDCs face higher average duties than other exporters in the USA,[20] in Canada and in Australia, despite the specific preferential schemes they offer to LDCs. This is due to the product composition of their exports,[21] and/or to higher AVEs of specific tariffs (since LDCs generally exhibit low export UVs).

The database also sheds light on the average protection faced by a country's exports, as the result of the specialization of exporters and of the preferential regimes they are eligible to, if any. This is illustrated in Table 4 for the same sample of countries. Argentina (13.5%) and Brazil (11.0%), due to their specialization on agricultural products, do face the highest level of protection among our sample. This situation contrasts with Mexico (2.3%), benefiting from preferential access to the USA and to Canada (only 1.9% faced on developed economies' markets).

Table 4: Protection faced by exporting country (2001)

		By sector			By importer		
	Total	Agric.	Manuf.	Tex-Wea	LdC	Dvping Co.	Dvped Co.
World	**5.6%**	**19.1%**	**4.2%**	**10.5%**	**12.8%**	**11.5%**	**3.4%**
Argentina	13.5%	18.6%	9.7%	11.4%	11.8%	17.1%	7.2%
Australia	8.9%	24.6%	4.0%	8.3%	8.7%	13.4%	7.0%
Bangladesh	5.3%	9.5%	5.2%	6.0%	13.0%	11.1%	4.8%
Brazil	11.0%	23.5%	6.0%	12.3%	13.8%	18.7%	6.4%
Canada	4.2%	16.4%	3.3%	6.0%	9.6%	9.9%	3.6%
China	5.8%	18.4%	4.2%	11.2%	16.1%	15.8%	4.2%
European Union (15)	6.1%	18.6%	4.6%	10.1%	12.4%	11.9%	4.0%
India	7.5%	19.7%	5.0%	10.3%	13.8%	13.6%	4.9%
Japan	6.1%	13.9%	5.9%	13.4%	12.4%	12.2%	3.5%
Korea	6.9%	16.0%	6.1%	14.0%	12.0%	12.9%	3.3%
Madagascar	4.3%	4.8%	3.5%	5.4%	15.1%	10.5%	3.6%
Mexico	2.6%	11.8%	2.1%	4.4%	16.2%	11.2%	1.9%
Morocco	5.4%	11.5%	4.5%	6.9%	12.9%	12.6%	4.0%
Mozambique	5.5%	25.1%	2.4%	7.4%	13.0%	16.9%	2.0%
South Africa	6.7%	19.6%	5.1%	10.3%	13.0%	16.1%	2.1%
Switzerland	3.2%	16.8%	2.7%	5.2%	8.2%	10.4%	1.4%
Thailand	8.2%	33.4%	4.7%	11.3%	14.4%	14.6%	6.1%
Tunisia	5.8%	23.4%	4.6%	6.0%	12.6%	14.2%	4.3%
Turkey	7.3%	12.7%	6.3%	7.3%	16.7%	17.5%	4.1%
United States of America	5.8%	19.3%	4.3%	11.7%	11.4%	9.0%	3.6%
Vietnam	7.3%	12.6%	4.9%	9.8%	9.7%	11.4%	6.2%

Source: MAcMap

Comparison of Tables 3 and 4 highlights a very specific pattern of world protection: LDCs impose an average 12.8% tariff on their imports, but do face an average 4.9% on their exports. Developing economies impose 11.5% and face 5.3%, and developed economies respectively 3.4% and 5.7%. Accordingly, on a worldwide basis, trade preferences are conceded to the most protected countries.

[20] In 2001, AGOA was only conceded to a few LDCs.
[21] Many LDCs are specialised in highly protected product worldwide, in particular in agriculture and in textile and clothing.

Even a broad picture as the one brushed above stresses that countries are discriminating across products and across partners, in particular as a result of various preferential schemes and of tariff peaks. This is confirmed by a more detailed analysis. The first column of Table 5 shows the coefficient of variation in the power of the tariff (1+t) across partners for each importer of our sample.[22] Unsurprisingly, EU15 is largely discriminating across partners. But Mexico, Korea and to a lesser extent China, Japan and the US are also significantly discriminating across partners. As far as differences across products are concerned, Japan exhibits the highest variation of protection, due to specific features of its agricultural protection (e.g. rice). Some developing countries, such as Mozambique or Madagascar have a rather "flat" protection, hardly discriminating across products.

Table 5: Coefficient of variation in the power of the applied tariff (2001)

	Across Partner	Across Product
Argentina	21.01	9.60
Australia	35.76	23.97
Bangladesh	23.62	11.63
Brazil	44.66	19.88
Canada	68.65	63.03
China	119.95	89.28
European Union (15)	177.41	131.40
India	76.52	49.85
Japan	112.10	176.45
Korea	116.55	164.57
Madagascar	2.77	1.48
Mexico	190.21	67.26
Morocco	35.12	22.94
Mozambique	6.16	3.61
Norway	66.29	80.76
South africa	49.02	27.66
Switzerland	80.28	88.20
Thailand	55.23	40.20
Tunisia	41.78	22.49
Turkey	77.13	46.39
United states of america	102.96	56.84
Vietnam	35.36	24.57

Source: MAcMap

Note: Coefficients of variation across products is computed by first calculating the average applied tariff across partners for each product. Coefficients of variations across partners are computed within each product (as is done in a standard within-between decomposition of variance). All coefficients of variation are computed using MAcMap's weighting scheme.

3.2 Applied versus MFN tariffs and decomposition by instrument

Table 6 presents a worldwide analysis of the difference between applied and MFN tariffs for agricultural

[22] The power of the tariff is an appealing metric, since differences in the power of tariffs are proportionally reflected, *ceteris paribus*, in consumer prices.

products, while considering separately *ad valorem* and specific tariffs.[23] MFN and applied duties often appear to be fairly similar, most of all in developing countries (see e.g. Bangladesh and Vietnam). But the difference turns out to be very large in several instances. In Switzerland, for instance, the average AVE MFN specific tariffs in agriculture is 81.1%, to be compared to an average AVE applied duty of 43.1%. Average AVE applied duties (summing *ad valorem* and AVE specific duties) also amount to approximately two thirds of the MFN duties in the EU, Japan, and the US. The case of China is particular, since the rather large gap between applied and MFN duties stems from unfilled TRQs,[24] the AVE of which is assessed to be the IQTR for applied tariff, and the OQTR for MFN tariffs.

Table 6: Applied and multilateral protection for agricultural products, by instrument (2001)

	Applied Tariff		**MFN Tariff**		Trade (Mios USD)	Rents (Mios QTR)	Tariff Quotas
	Ad Valorem	Ad V. Eq. of Specific Comp.	Ad Valorem	Ad V. Eq. of Specific Comp.			
Argentina	12.0%	0.0%	12.7%	0.0%	960.2	0.0	N
Australia	1.4%	1.3%	1.5%	1.6%	2758.5	0.0	Y
Bangladesh	20.8%	0.0%	20.8%	0.0%	1092.8	0.0	N
Brazil	10.9%	0.0%	11.9%	0.0%	3488.6	0.3	Y
Canada	13.6%	1.2%	27.9%	1.0%	11650.0	366.7	Y
China	24.9%	0.0%	55.3%	0.0%	8803.8	0.0	Y
European Union (15)	4.9%	12.9%	6.5%	17.0%	52719.5	1602.8	Y
India	58.7%	0.3%	58.8%	0.3%	3626.4	0.0	N
Japan	8.7%	26.4%	10.2%	45.1%	30273.4	1132.0	Y
Korea	53.5%	0.0%	69.9%	0.0%	7601.3	1011.5	Y
Madagascar	5.5%	0.0%	6.1%	0.0%	96.1	0.0	N
Mexico	27.0%	1.2%	36.6%	1.2%	9680.0	696.8	Y
Morocco	39.9%	0.0%	43.2%	0.0%	1417.9	96.4	Y
Mozambique	13.4%	0.0%	13.5%	0.0%	288.9	0.0	N
Norway	8.7%	63.2%	4.0%	79.3%	2024.2	23.0	Y
South africa	7.8%	11.3%	8.6%	12.2%	1948.2	159.5	Y
Switzerland	0.0%	43.1%	0.0%	81.1%	4803.0	559.8	Y
Thailand	19.2%	8.7%	19.3%	9.0%	2699.9	101.1	Y
Tunisia	52.9%	0.0%	55.7%	0.0%	815.2	127.8	Y
Turkey	37.6%	0.1%	38.8%	0.1%	2786.8	0.0	N
United states of america	1.8%	3.3%	3.3%	5.0%	43384.4	408.0	Y
Vietnam	25.5%	0.0%	25.5%	0.0%	1101.0	0.0	N

Source: MAcMap

Table 6 also shows that *ad valorem* duties are generally the main protective instrument in agriculture, but that the impact of specific duties is much greater in the European Union, Japan and Norway. In Switzerland, all tariffs are expressed in specific terms.

Another original contribution of MAcMap is to pave the way for a worldwide, systematic analysis of TRQs. 32 importing zones are found to be administrating tariff quotas in 2001, and our estimation of the

[23] See the CEPII website for non-agricultural products.
[24] The Chinese TRQ for soybean is especially large, and accounts for a significant part of this difference.

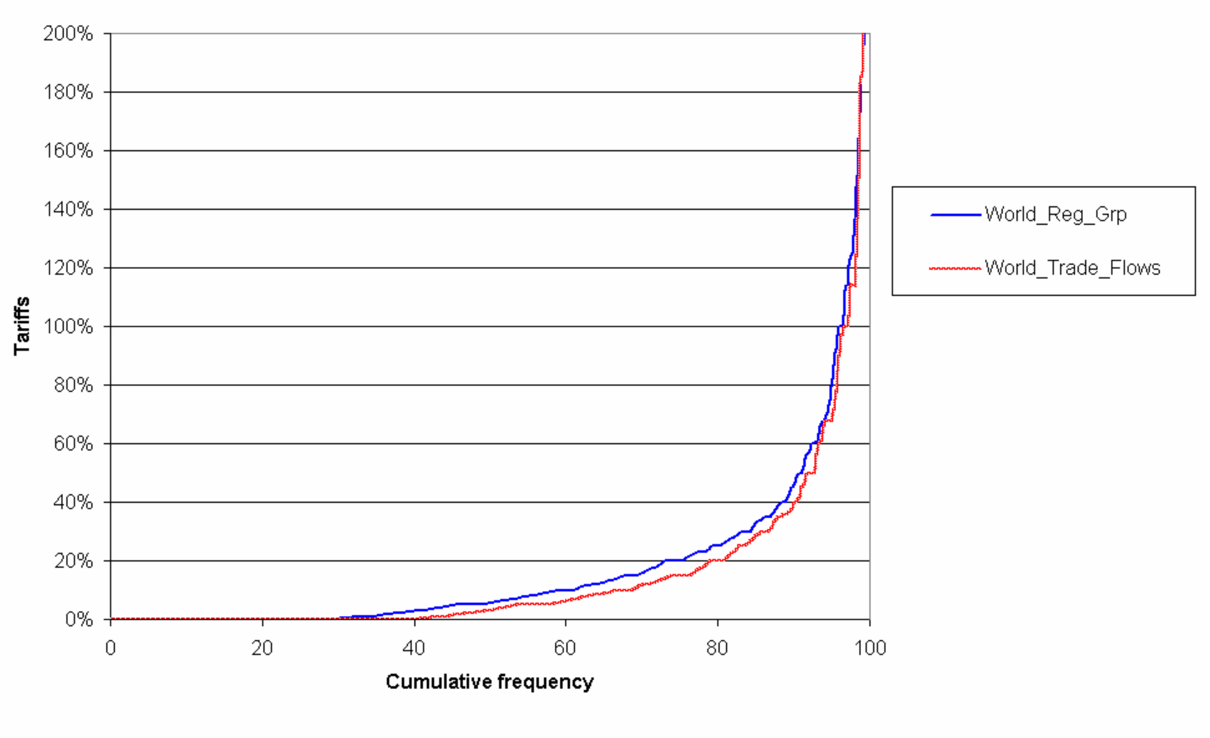
value of TRQ rents in agriculture is reported in Table 6. TRQs rents are especially large in European Union, Japan and Korea. The worldwide amount of quota rents is about USD 6.79 bn.

3.3 Cumulative distribution of tariffs

A synthesis of the information contained in the database as well as an illustration of the peculiarities introduced by our aggregating method is illustrated by the cumulative distribution of tariffs at the HS-6 level in Graphs 1 through 3.

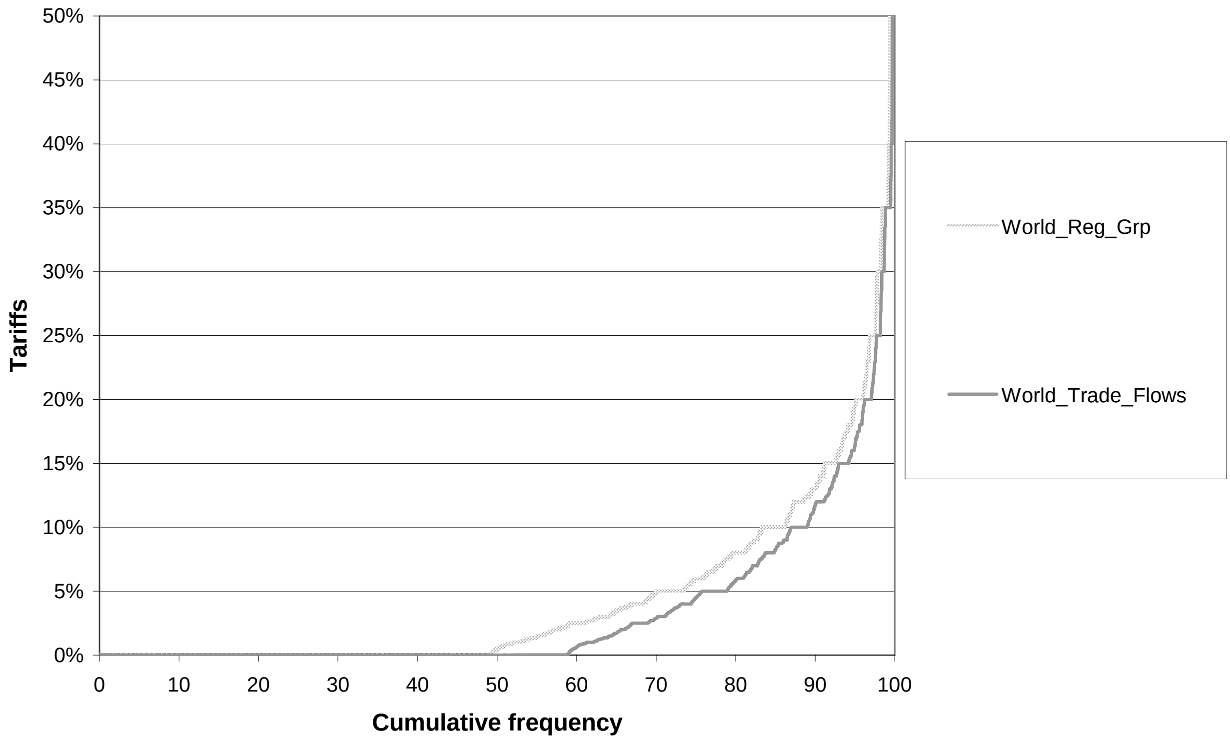
Does the specific reference group weighting scheme specificity in MAcMap significantly change the brushed picture of protection? Graph 1 (resp. 2) plot the distribution of world average tariffs for agricultural (resp. manufacturing) products, using two different metrics: MAcMap reference groups weights (World_Reg_Grp), and usual bilateral trade weights (World_Trade_Flows). It sheds light on the understatement of protection with the latter weighting scheme. The difference between these two curves is not large for agricultural products although, for instance, the share of duty-free imports is found to be approximately 30% using the MAcMap's weighting scheme, as compared to around 40% when referring to bilateral imports. The difference is slightly higher for manufacturing goods. In both cases, however, and whatever the metric used, these graphs also highlight the strong skewness of protection across the world, with a small proportion of world products and markets accounting for a large part of world average protection. This is especially the case in agriculture, and this finding suggests that introducing even limited flexibility (as measured through the number of goods) can strongly undermine the impact of any liberalization agreement.

Graph 1 Global cumulative frequency using alternative metrics (trade flows or reference group weights) for agricultural products, 2001



Note: For the sake of readability, we do not include in this graph the distributions for developed and developing countries as in graph 4. Indeed, the curbs are very close and follow the same order than in graph 4.
Source: MAcMap

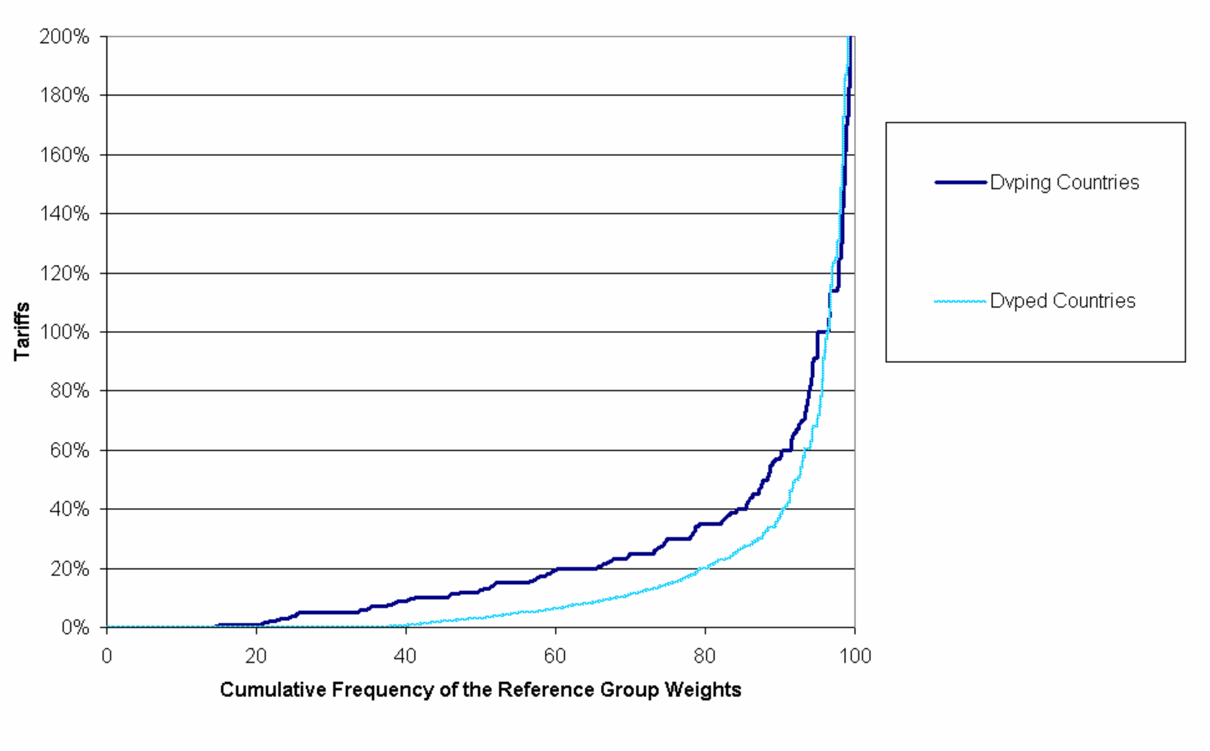
Graph 2: Cumulative frequency for manufacturing goods (2001)



Source: MAcMap

Graph 3 compares the cumulative frequency of tariffs on agricultural products for developing and developed countries. While the former countries impose higher import duties on a very large part of items, the cumulative frequency curve of developed countries is upper in the [95%;100%] area. The concentration of very high tariff peaks on a narrow range of agricultural products is thus especially pronounced in rich countries, consistent with the exclusion of a relatively small number of sensitive products from most liberalization agreements.

Graph 3: Cumulative frequency for developing and developed countries (Agricultural products, 2001)



Source: MAcMap

4 Conclusion

Applied protection is uneasy to assess. It is complex, defined at a very detailed level, and information is frequently scattered; it also raises several methodological issues, with large potential influence on the results. As a result of an unprecedented effort to monitor border protection worldwide at the most detailed level, while accounting exhaustively for PTAs, MAcMap-HS6 allows a consistent picture of border protection to be offered. Many points are certainly arguable in our work. We do not completely address the issue of the endogeneity bias in aggregation, or of the diversely protectionist impact of specific tariffs, for instance. The treatment of TRQs could also certainly be improved. However, based on the feedback collected on previous versions, special attention has been given to ensuring the robustness and transparency of the method, and its adequacy for analytical purposes. As such, we believe that MAcMap-HS6 can be a useful tool in negotiating future liberalization agreements, such as in particular those contemplated in the ongoing Doha Round, and can pave the way for better informed policy decisions.

Although aggregate, the results displayed in this article point to several interesting features of protection worldwide. The divide between agricultural and non-agricultural products, as well as between developed and developing countries is precisely documented. So is the importance of non-ad valorem tariffs, not frequent in average, but strongly over-represented among tariff peaks, especially in a handful of rich countries. Above average results, describing the distribution of protection is also insightful. Unevenness appears as a salient feature of protection in rich countries: across partners, because of widespread preferential agreements; and most of all across products, to the extent that the bulk of protection is in practice concentrated on a small number of products. A detailed analysis such as the one undertaken here is thus not only useful, it is necessary if an accurate understanding of applied protection and of its consequences is to be gained.

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