

## CHAPTER 2: Quantifying trade policy

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## A. Overview and learning objectives

This chapter introduces you to the main techniques used for trade policy quantification. More precisely, it presents the tools used to describe, synthesize and quantify trade policies. Original tariff data may be cumbersome as they need to be aggregated and specific tariffs have to be converted into *ad valorem* equivalent. Three common issues that arise when characterizing tariff structures, namely the calculation of effective rates of protection, the related tariff escalation phenomenon and the under-representation of high tariffs when using import-weighted averages at the aggregate level, are discussed. Regarding non-tariff measures (NTMs), their measurement is more complex given their variety and the difficulty of assessing their stiffness.

We first introduce you to a number of approaches used to characterize various aspects of a trade-policy stance. We start with simple tariff profiles and briefly explain how various tariff indicators can be calculated. We then take a close look at NTMs and how their incidence and effects on trade can be estimated using import-coverage ratios and price-gap methods. We next look at recent attempts to define and calculate overall trade restrictiveness indices. Following this discussion of analytical tools, we take you on a tour of the main sources of data on tariff and NTMs. Finally, in the third part of the chapter, we illustrate how the indicators introduced in the first part can be calculated with the STATA software using the data sources presented in the second part.

The chapter does not discuss the effects of trade measures. Partial and/or general equilibrium analysis of the effects of tariffs, quotas and subsidies on trade and welfare in perfect or imperfect competition can be found in most undergraduate international economics textbooks.

In this chapter, you will learn:

- how to present a tariff profile that summarizes the salient features of a country's tariff structure
- how to aggregate tariffs into simple and weighted averages and what biases are possibly created by aggregation
- how to define and calculate Effective Rates of Protection
- how to measure and interpret tariff escalation
- how to calculate non-tariff measures (NTM) import coverage ratios and what biases are possibly involved in their calculation
- how to calculate the *ad valorem* tariff equivalent of a quantitative restriction (QR) using the price-gap method
- how to assess the overall trade restrictiveness of a trade policy stance
- how tariff and NTM data are presented in the main databases available.

After reading this chapter you will be able to perform a trade-policy analysis that will draw on the appropriate type of information, will be presented in an informative but synthetic way and, like the trade-flow analysis of Chapter 1, will be easy to digest by both specialists and non-specialists alike.

## B. Analytical tools

Trade policies are the policies that governments adopt toward international trade. These policies may involve a variety of different actions and make use of a number of different instruments. Among

those are taxes on imports or exports, quantitative restrictions of international transactions, subsidies and many other measures that for convenience are often divided into two broad categories: tariffs and non-tariff measures (NTMs). Governments typically apply different combinations of measures to each of the thousands of products imported or exported. Moreover, the same measure, for example a tariff, can be set at different levels with sometimes very different effects depending on the products, for example on trade. This chapter explains how a country's trade policy can be summarized and described in synthetic terms in such a way as to make sure that the summary statistics capture and reflect the most important features of the trade policies in place. The challenge is one of aggregating both across products and across very different measures.

While economists typically recognize that trade policies can serve all sorts of purposes, they often focus on their restrictiveness. Why do they care about the restrictiveness of a country's trade policy? The textbook argument is that openness to trade brings gains from pure exchange and from specialization (Ricardo's wine-and-drape demonstration). This argument, however, is awkward because it is essentially static. Static gains from trade opening are of an order of magnitude of less than 5 per cent of GDP spread over a ten-year adjustment period, and they are dwarfed by the rates of growth currently observed in developing countries.<sup>1</sup> So the argument must lie elsewhere — in the association between trade reform and *growth*, not in that between trade reform and static welfare. Because theory has relatively little to say on that relationship,<sup>2</sup> the question is in essence an empirical one.

However, the quest for a robust statistical association between trade openness and growth has proved to be laborious. The first problem was to come up with a measure of openness that would reflect policy stances in a comparable way. We will return to this question below, but suffice it to note here that Sachs and Warner (1995) proposed the earliest comprehensive index based on observed measures.<sup>3</sup> Alternative measures (e.g. Leamer, 1988) were based on regression analysis ("policy openness" being measured by the residual from a regression of observed openness on its exogenous determinants as discussed in Chapter 1).

First-generation studies using cross-sections of countries (see Edwards, 1998 and references therein) generated correlations between openness and growth that proved to be unstable and unconvincing. For instance, Rodriguez and Rodrik (1999) showed that the pure trade components of the Sachs-Warner index — conditions (i) and (ii) as explained in footnote 3 — played little role in the index's overall association with growth. However, more recent studies, in particular Wacziarg and Welsh's (2008) paper, have shown that panel-data techniques (i.e. techniques using both the cross-section and time-series dimensions of data where several countries are observed over several years) generate a more robust correlation between trade openness and growth.<sup>4</sup> Essentially, the additional information comes from a careful identification of *when* trade liberalization took place in each country. Once this is done, large differences between pre- and post-liberalization growth rates are observed. So we are justified in analyzing trade policy from a normative angle where more openness is taken to be better for growth.

## 1. Tariffs

### a. Concepts

A tariff is a tax levied on imports, or more rarely on exports, of a good at the border. Its effect is to raise the price of the imported (exported) product above its price on the world (domestic) market.

Tariffs are usually collected by customs authorities and can be either *ad valorem* or specific. An *ad valorem* tariff is expressed as a percentage of the value of the imported (exported) good (usually as a percentage of the Cost Insurance and Freight import value), while a specific tariff is stated as a fixed currency amount per unit of the good.

*Ad valorem* tariffs are much more widely used than specific tariffs. One reason for this is that they are easier to aggregate and to compare and are thus more transparent, which is important in particular when countries negotiate tariff commitments. Specific tariffs are more difficult to compare across products since they depend on the units in which products are measured. One way to compare them, however, is to calculate their *ad valorem* equivalent (see Box 2.1).

### Box 2.1 Calculation of *ad valorem* equivalents of specific tariffs

*Ad valorem* equivalents (AVEs),  $\tau_{AVE}$ , of specific tariffs can be calculated by dividing the monetary amount per ton (say),  $\tau_{specific}$ , by the international price of a ton of the good,  $p$  (and multiplying by one hundred to get a percentage). That is,

$$\tau_{AVE} = 100 \frac{\tau_{specific}}{p} \quad (2.1)$$

However, this is often easier said than done. The international price ( $p$ ) can be calculated by dividing trade values by volumes, but the result often varies across time and countries, not just because prices themselves vary, but also because of composition effects, i.e. lumping goods of different value per unit. Moreover, systematic biases are likely. A tariff of, say,  $x$  euros per unit is stiffer as a proportion of price for a lower-priced good (say of inferior quality or sophistication) than for a higher-priced one. If poorer countries export, on average, goods of lower quality and hence price – Schott (2004) showed that they do – then, even if they face the same specific tariff as higher-priced exports, their exports face higher protection in AVE terms than these higher-priced exports.

The WITS software (see below) proposes four different methods for the calculation of AVEs. The first approach consists in using (1) import unit values for the reporter calculated at the national tariff line level (8–10 digits), and if those are not available to replace them with (2) import unit values for the reporter calculated at the HS six-digit level and finally, if neither (1) nor (2) are available, to use (3) import unit values for OECD countries. The second approach consists in using only (3), i.e. import unit values for OECD countries. The third approach is based on the methodology for the calculation of AVEs of agricultural non *ad valorem* duties referred to in the draft modalities for agriculture that are currently negotiated at the WTO.<sup>5</sup> Finally, the fourth methodology is the methodology for the calculation of AVEs of non agricultural non *ad valorem* duties referred to in the draft modalities for non agricultural market access currently under negotiation at the WTO.<sup>6</sup> Market access maps (MAcMaps; see below) also calculate AVEs but use unit values computed as the ratios of values to volumes for five specific reference groups defined by cluster analysis in terms of income and openness (using large country groups instead of country pairs reduces the scope for measurement errors).

A characteristic of tariff regimes that should not be overlooked is the possible existence of exemptions by end-use (special projects, categories of users with special status such as multinational companies in export processing zones (EPZs), international organizations and so on). In addition to exemptions “on the books”, governments sometimes grant ad hoc exemptions whose existence can be learned only by investigation on the ground. When exemptions are important, overlooking them leads to over-estimation of the rate of protection. One possible fix consists of calculating the rate of protection as the ratio of collected duties to declared import value (more on this in Chapter 6).<sup>7</sup> However, by averaging over-exempted and non-exempted goods, this leads to under-estimation of the rate of protection on non-exempted goods.

Two further distinctions that relate more specifically to the GATT/WTO need to be taken into account when establishing a country's tariff profile. The first distinction is between most-favoured nation (MFN) tariff rates and preferential tariff rates. MFN tariffs are the ones that WTO members commit to accord to imports from all other WTO members with which they have not signed a preferential agreement. Preferential tariffs are the ones accorded to imports from preferential partners in free trade agreements (FTAs), customs unions or other preferential trade agreements and are more likely than others to be at zero.

The second distinction is between bound and applied tariffs. When governments negotiate tariff reductions in the GATT/WTO, their commitments take the form of MFN tariff bindings. Bound MFN tariff levels, which are listed in a country's tariff schedule, indicate the upper limit at which the government is committed to set its applied MFN tariff.<sup>8</sup> For a given tariff line, the bound tariff must thus be higher than or equal to the applied MFN tariff, which should be higher than or equal to the preferential tariff, if any.

For developed countries, bound tariffs are typically identical or very close to applied tariffs. For developing countries, however, there is often “water” in the tariff, which means that bound rates are typically above applied tariffs and have therefore limited effects on trade flows, even if they are fundamental in WTO negotiations. It is important in applied analysis to apply the right tariffs to the right imports (e.g. not to apply MFN tariffs to imports from preferential partners). However, there is often considerable uncertainty regarding the extent to which preferential tariffs are actually applied in regional integration agreements, especially in South–South agreements.

## b. Empirical tools

### i. *Tariff profiles*

#### Averages

Tariff schedules are typically defined at the HS eight-digit level of disaggregation or higher levels (up to HS 12), meaning that for a given country there are always more than 5,000 tariff lines (the number of HS six-digit sub-headings) and often many more than that.<sup>9</sup> Tariffs can be aggregated in different ways: by simple averaging or by using some weighting scheme. Simple averages are straightforward to calculate by adding the tariffs on all lines and dividing by the number of those tariff lines. As for weighted averages, they take the form:

$$\bar{\tau} = \sum_k w_k \tau_k \quad (2.2)$$

where  $k$  indexes imported goods and  $w_k$  is the weight given to tariff  $k$  in the average (the Greek letter  $\tau$  is used in place of  $t$  to avoid confusion with time indices). A widely used approach is to weigh goods with their share in the country's overall imports.

While both simple and import-weighted averages have the advantage of being relatively easy to calculate, these two methods have drawbacks that are illustrated in Box 2.2. Simple averages give the same weight to products that are not imported and to products that are imported in large amounts. As for import-weighted averages, they correct this bias to some extent but under-weigh high tariffs and would give zero weight to prohibitive tariffs.

### Box 2.2 Simple and import-weighted averages

Consider a country that imports three goods: good 1, whose tariff varies between zero and 500 per cent going down Table 2.1; good 2, with a tariff of 40 per cent; and good 3, with a tariff of 5 per cent. Import demands are given by

$$M_k = a_k e^{-\tau_k / 100} \quad (2.3)$$

with  $a_1 = a_2 = 1,000$  and  $a_3 = 10$ . As a result, imports of good 3 are very small. Simple averaging gives equal weight to all three tariffs. Therefore, it gives excessive weight to good 3. For instance, when the tariffs on goods 1 and 2 are respectively at 50 and 40 per cent, the simple average tariff is 31.7 per cent: it is “pulled down” by good 3 even though the reality is that there is a 40 or 50 per cent tariff on almost all goods that are imported.

**Table 2.1 Simple vs. trade-weighted average tariffs: illustrative calculations**

Good 1		Good 2		Good 3		Total imports	Simple average tariff	Weighted average tariff
Tariff	Imports	Tariff	Imports	Tariff	Imports			
0	1000	40	670	5	10	1680	15.0	15.99
50	607	40	670	5	10	1286	31.7	44.46
100	368	40	670	5	10	1048	48.3	60.75
150	223	40	670	5	10	903	65.0	66.81
200	135	40	670	5	10	815	81.7	66.16
250	82	40	670	5	10	762	98.3	62.19
300	50	40	670	5	10	730	115.0	57.29
350	30	40	670	5	10	710	131.7	52.72
400	18	40	670	5	10	698	148.3	48.97
450	11	40	670	5	10	691	165.0	46.11
500	7	40	670	5	10	687	181.7	44.03

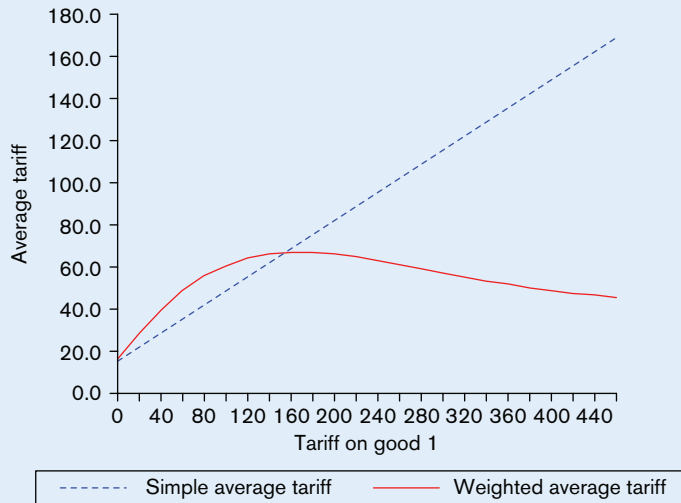
This suggests the use of a weighted average instead. Indeed, in the same line the weighted-average tariff is a more reasonable 44.46 per cent. But then look at what happens when

(Continued)

**Box 2.2 (Continued)**

the tariff on good 1 increases: imports of good 1 decrease and then so does its weight. When the tariff on good 1 rises to almost prohibitive levels (bottom of the table), the weighted average *decreases* and converges to the 40 per cent tariff on good 2. This effect, which is shown graphically in Figure 2.1, is a known important bias of weighted averages that “under-represent” high tariffs.<sup>10</sup>

**Figure 2.1 Bias of trade-weighted average tariffs**



Source: Author calculations based on Table 2.1

The theoretical fix to this problem would be to use unrestricted (free-trade) import levels as weights, but those are unobservable. Leamer (1974) proposed using world trade, but this does not properly represent the unrestricted trade structure of each country. Another approach is to strike a compromise between “national” and “global” weights by defining reference country groups on the basis of income levels. Yet another weighting scheme is proposed by Kee et al. (2005). Their weights are an increasing function of import shares and elasticities of import demand at the tariff line level, which capture the importance that restrictions on these goods would have on the overall restrictiveness (see below). Alternatively, both the simple and weighted averages can be reported as in Table 2.2, which displays MFN tariffs (applied, not bound) and preferential tariffs applied on imports from SADC and COMESA countries. Table 2.2 shows that depending on the products either the simple average or the weighted average can be higher.

### Dispersion

Tariff averages only provide a partial picture of a given tariff structure. The dispersion of tariffs around the mean also matters from an economic point of view: in general, the higher the dispersion,



**Table 2.2** Zambia's MFN and preferential tariffs, by HS section

HS section	Description	# lines	Simple averages			Trade-weighted averages		
			MFN	COMESA	SADC	MFN	COMESA	SADC
1	Live animals	232	20.7	8.3	3.0	23.2	9.3	8.1
2	Vegetables	332	18.1	7.2	3.6	13.2	5.3	7.2
3	Fats & oils	50	16.0	6.4	3.4	19.1	7.6	3.7
4	Food, bev. & tobacc.	203	20.8	8.3	4.3	16.3	6.5	4.5
5	Mineral products	167	9.8	3.9	3.4	10.2	4.1	4.6
6	Chemicals	1109	7.4	2.9	0.8	7.5	3.0	2.6
7	Plastics	495	10.1	4.0	1.9	14.1	5.6	2.8
8	Leather	74	20.3	8.1	3.8	24.6	9.8	5.0
9	Wood	88	23.3	9.3	3.9	24.6	9.8	4.9
10	Pulp & paper	163	13.9	5.6	1.9	16.9	6.8	2.2
11	Textile & clothing	921	18.7	7.5	6.0	19.6	7.8	10.3
12	Footwear	56	23.1	9.3	14.5	24.3	9.7	22.4
13	Stone, glass, cement	149	14.5	5.8	2.4	15.4	6.2	3.0
14	Jewelry	56	19.2	7.7	4.9	21.5	8.6	5.0
15	Base metals	612	11.5	4.6	1.6	10.7	4.3	1.5
16	Machinery	812	10.7	4.3	2.5	10.8	4.3	2.0
17	Transport. equip.	159	11.7	4.7	5.6	15.8	6.3	12.4
18	Optics	270	14.2	5.7	3.4	12.3	4.9	3.3
19	Arms	18	22.4	9.0	5.0	23.3	9.3	4.8
20	Miscellaneous	132	1.9	0.8	0.0	0.0	0.0	0.0
21	Works of art	8	14.3	5.7	2.8	12.8	5.1	3.3
Average			13.6	5.4	3.1			
Standard deviation			9.6	3.8	4.9			
Minimum			0.0	0.0	0.0			
Maximum			25.0	10.0	25.0			

Source: Cadot et al. (2005) using COMTRADE

the more distortion. The dispersion of tariffs can be captured using various statistics. A first option is to present a table of frequencies or a histogram. A second option is to calculate either the standard deviation or the coefficient of variation of tariff rates around the average. The standard deviation is defined as:

$$\sigma = \sqrt{\frac{1}{N} \sum_{k=1}^N (\tau_k - \bar{\tau})^2} \quad (2.4)$$

The coefficient of variation is defined as the standard deviation divided by the average tariff  $\bar{\tau}$ . A third option is to measure the proportion of so-called "peak" tariffs, i.e. the tariffs that exceed a certain benchmark. Two statistics have been used in the literature. The first is the share of tariff items (lines or sub-headings) subject to duties higher than 15 per cent and the second is the share of tariff items subject to duties larger than three times the national average.

In general, the best solution to describe a tariff profile is probably to report a battery of tariff statistics including the averages (simple and weighted) as well as the share of duty free lines, the share of peaks, the minima and maxima and standard deviations, by HS section and overall.<sup>11</sup>

Note that minima, maxima and the measures of dispersion can be calculated either by section or overall, but in any case they should be calculated directly from HS six-digit data or even better from the national tariff line level (often eight digits or more) rather than from aggregates because otherwise they would tend to be underestimated. HS chapters (two digits) represent a good compromise between total aggregation (large information loss) and excessive disaggregation (loss of synthetic value).

## ii. *Effective protection and tariff escalation*

As already mentioned, a tariff provides protection from imports by allowing domestic producers to raise both the price and the production of import-competing domestic products. This, however, is not the end of the story. Domestic producers may be using imported inputs which might be subject to tariffs. Such tariffs on imported inputs would raise the costs for domestic producers and lower their output.<sup>12</sup> This means that if one is interested in the net “protective” effect of tariffs on producers in a particular sector, all tariffs need to be taken into account. This is exactly what the effective tariff does. The concept of effective protection captures the positive or negative stimulus afforded to domestic value-added in a particular sector. Value-added is the difference between the value of output and the cost of purchasing intermediate inputs, which corresponds to the value of output that is available for payments to primary inputs. Thus, effective protection measures the net protective effect of the whole tariff structure on domestic producers in a particular sector.

In general, with several inputs the formula for the effective rate of protection (ERP) is:

$$\tau_j^E = \frac{\tau_j \dot{p}_j - \sum_i a_{ij} \tau_i \dot{p}_i}{\dot{p}_j - \sum_i a_{ij} \dot{p}_i} \quad (2.5)$$

where  $j$  stands for the final good,  $i$  indexes inputs (intermediate goods),  $\dot{p}_j$  and  $\dot{p}_i$  designate their world prices,  $\tau_j$  and  $\tau_i$  their nominal tariffs (zero if the inputs are sourced or the output sold domestically), and  $a_{ij}$  is the value of input  $i$  used in the production of one unit of good  $j$ .

ERPs are difficult to calculate. Input–output coefficients are available only for a few countries for manufactured goods and at high degrees of aggregation (SIC three digits) from the World Bank’s Trade, Protection and Production database. Two choices must then be made. First, how these coefficients are to be divided up between the more disaggregated categories for which ERPs are to be calculated. The simplest method consists of dividing equally the  $a_{ij}$  among the product categories included in the relevant SIC-3 category, but this can only be an approximation. Second, what proportion of each input is imported. Again, this necessarily involves an approximation, and the simplest method is to use import-penetration ratios also calculated at higher degrees of aggregation (since they require domestic production data; see Chapter 1). As the reader has guessed by now, so many approximations are involved that the result is unlikely to be very informative. ERPs would be better calculated using firm-level data from specifically designed questionnaires.

An illustrative calculation is shown in Table 2.3 for a shirt made with only one input, fabric, that is entirely imported.<sup>13</sup> Suppose that the Nominal Rate of Protection (NRP) on the shirt is 15 per

**Table 2.3** Effective rates of protection: illustrative calculation

	<i>Domestic sales</i>	<i>Export to preferential market</i>	<i>Export to world market</i>
Value of a shirt			
At world price	100	100	100
At domestic/applicable price	115	105	100
<i>NRP on shirts (%)</i>	<i>15.0</i>	<i>5.0</i>	<i>0.0</i>
Value of fabric used			
At world price	60	60	60
At domestic/applicable price	66	66	66
<i>NRP on fabric (%)</i>	<i>10.0</i>	<i>10.0</i>	<i>10.0</i>
Value added			
At world price	40	40	40
At domestic/applicable price	49	39	34
<i>ERP (%)</i>	<i>22.5</i>	<i>-2.5</i>	<i>-15.0</i>

*Source:* Author calculations

cent (this is just the tariff rate) while that on imported fabric is 10 per cent.<sup>14</sup> In addition, the table assumes that, at world prices, fabric would account for 60 per cent of the shirt's value, a 40 per cent rate of value added.

For a producer selling on the domestic market, it can be seen from the first column that the tariff on shirts more than compensates for the extra cost due to the tariff on fabrics, resulting in an Effective Rate of Protection (ERP) of 22.5 per cent (the increase in value added from what it would be at world prices). For a producer exporting to a preferential market with a preference margin of 5 per cent, however, the ERP becomes -2.5 per cent because value added at the combined domestic/preferential market price is less than at world prices (the 5 per cent preferential margin fails to compensate for the 10 per cent tariff on fabric). For export to non-preferential markets where no protection applies to shirts the result is even worse, with an ERP of -15 per cent. This illustrates how protection of inputs penalizes exporters of final goods.

Among the many mechanisms devised by governments to avoid negative ERPs, "tariff escalation", by which is meant higher tariff rates for final goods than for intermediate ones, figures prominently.<sup>15</sup> Table 2.4 shows that when all goods have equal nominal tariff rates, ERPs are equal to the common nominal rate (middle column). When final goods have lower rates than intermediate products, ERPs are lower than the nominal rates on final goods (last column); when they have higher rates — the escalating case — ERPs are higher (first column).

The first column shows that moderate differences in nominal rates can result in high ERPs, which explains why economists and international financial institutions (IFIs) have limited enthusiasm for escalating structures. Many customs unions have recently adopted four-band tariff structures with rates between 0–5 per cent and 15–25 per cent differentiated only by end-use (capital goods, raw materials, intermediate goods and final goods). When tariff structures are not as transparent as

**Table 2.4 ERPs and escalating tariff structures**

	<i>Case 1 (escalating)</i>	<i>Case 2 (neutral)</i>	<i>Case 3 (de-escalating)</i>
Value of a shirt			
At world price	100	100	100
At domestic/applicable price	120	110	105
<i>NRP on shirts (%)</i>	<i>20.0</i>	<i>10.0</i>	<i>5.0</i>
Value of fabric used			
At world price	60	60	60
At domestic/applicable price	66	66	66
<i>NRP on fabric (%)</i>	<i>10.0</i>	<i>10.0</i>	<i>10.0</i>
Value added			
At world price	40	40	40
At domestic/applicable price	54	44	39
<i>ERP (%)</i>	<i>35.0</i>	<i>10.0</i>	<i>-2.5</i>

*Source:* Author calculations

this, classifications like the BEC (see Chapter 1) can be used to assess whether a tariff structure is escalating or not.

## 2. Non-tariff measures (NTMs)

### a. Concepts

NTMs are policy measures other than ordinary customs tariffs that affect international trade in goods at the border by changing quantities traded, prices or both. NTMs include a wide range of instruments such as quotas, licences, technical barriers to trade (TBTs), sanitary and phytosanitary (SPS) measures, export restrictions, custom surcharges, financial measures and anti-dumping measures. The more neutral term NTMs has been preferred to the term non-tariff barriers (NTBs) because it leaves open the judgment of whether a given measure constitutes a trade barrier. NTMs may be intrinsically protectionist but they may address market failures as well, such as externalities and information asymmetries between consumers and producers. NTMs which address market failures may restrict trade while at the same time improving welfare. Other NTMs such as certain standards or export subsidies may expand trade. Identifying a measure as an NTM does not imply a prior judgment as to its actual economic effect, its appropriateness in achieving various policy goals or its legal status under the WTO legal framework or other trade agreements. The qualification of NTMs as NTBs can only be done as a result of analysis based on comprehensive data.

Various taxonomies of NTMs/NTBs have been proposed, none of which can be complete since NTMs are defined in terms of what they are not.<sup>16</sup> The recently revised international classification of NTMs includes the categories listed in Table 2.5.<sup>17</sup>

**Table 2.5 International classification of non-tariff measures**

A	Sanitary and phytosanitary measures
B	Technical barriers to trade
C	Pre-shipment inspection and other formalities
D	Price control measures
E	Licences, quotas, prohibitions and other quantity control measures
F	Charges, taxes and other para-tariff measures
G	Finance measures
H	Anti-competitive measures
I	Trade-related investment measures
J	Distribution restrictions*
K	Restrictions on post-sales services*
L	Subsidies (excluding export subsidies)*
M	Government procurement restrictions*
N	Intellectual property*
O	Rules of origin*
P	Export-related measures*

Source: UNCTAD (2010)

Whereas some NTMs such as quotas or voluntary export restraints for example are being progressively phased out, other forms are moving to the forefront. For example, because manufactured products are of increasing complexity, carrying potential health risks and other hazards, the number of product standards can be expected to rise. Similarly, rising traceability demands for foodstuffs mean increasingly complex regulations for foodstuff imports. With the advent of environmental concerns linked to climate change, NTMs will likely assume even greater importance.

## b. Empirical tools

Quantifying NTMs is a challenge because of their heterogeneous nature and because of the lack of data (see below).<sup>18</sup> Most measurement methods use a simple partial equilibrium framework to develop a tariff equivalent to the NTM that reflects by how much supply, demand or trade are affected by the measure. Measurement typically focuses on the change in import price associated with the introduction of the NTM, the resulting import reduction, the change in the price elasticity of import demand or the welfare cost of the NTM. A relatively common approach is to calculate *ad valorem* equivalents of NTMs, i.e. the *ad valorem* tariff rate that would induce the same level of imports as the NTM in question. This is relatively straightforward in the case of quotas as, under perfect competition, their price and quantity effects can be replicated by appropriately chosen taxes on trade. In this subsection we present two of the most common approaches to the measurement of NTMs: the price-gap approach, which aims at deriving a tariff/tax equivalent to the NTM as discussed, and inventory-based frequency measures. These measures have in common that they do not require the use of econometric techniques. Another more sophisticated approach requiring the use of econometric techniques is discussed in Chapter 3.

### i. Price gaps

The so-called “price gap” or “price wedge” method measures the impact of NTMs on the domestic price of a good in comparison to a reference price. The idea behind this method is that NTMs raise the domestic price above what it would be in their absence. The price gap is the difference between the price prevailing in the NTM-constrained market (the “internal price”) and the price prevailing

outside (the “external price”) corrected for the influence of other factors which may influence prices. A simple expression of the tariff equivalent of a given NTM would be:<sup>19</sup>

$$TE_{NTM} = (p_d / p_w) - (1 + \tau + c) \quad (2.6)$$

where  $p_d$  is the internal price, net of wholesale and retail margins,  $p_w$  is the world price, net of wholesale and retail margins,  $\tau$  is the tariff expressed in *ad valorem* terms and  $c$  is the international transport margin (c.i.f./f.o.b. margin) expressed in *ad valorem* terms. This expression is simple because the prices used have already been adjusted for other factors that influence prices, such as wholesale and retail distribution, rents or profits, other taxes than tariffs and subsidies. These factors must be subtracted from the price difference before the mark-up can be attributed to NTMs.

A price gap is a very simple concept which, however, can be difficult to implement. Difficulties in its implementation come from the variety of ways of calculating internal and external prices, which give rise to widely divergent estimates.<sup>21</sup> The external price is often taken as the one prevailing in a comparable but unconstrained market. However, rarely does one have a fully comparable market. In the case of EU bananas (see Box 2.3) for instance, Norway would be a good comparator because shipping distances are comparable and it had no quota when the EU did. But Norway being a very small market, the conditions of competition are not quite comparable. The United States is a better comparator from the point of view of size but it has lower freight rates. The variety of possible comparators generates very different external price estimates. As for the internal price, in principle it should be easier to estimate but in practice this is not necessarily so. For instance, list prices on the domestic wholesale market may have little to do with prices practised in actual transactions; or when importers and distributors are owned by the same firm, transfer prices may be unobservable or uninformative. Table 2.6 shows a few examples of how scattered price-gap estimates can be in practice.

The first three columns report estimates that vary because the external price taken as reference is calculated in three different ways: using (a) the US price, (b) Norway’s price and (c) the EU’s CIF (cost, insurance, freight) price before duty and purchase of import licences. The fourth column comes from a different study. But note that all three estimates give a price gap that is lower than the in-quota tariff of €75/ton, which implies a negative price for import licences. These are clearly unrealistic estimates. The fifth column, by contrast, gives a very high estimate because the external price is unrealistically low.

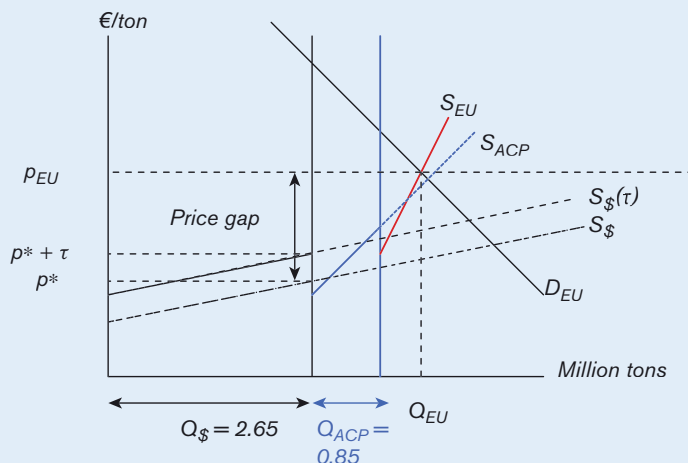
These examples show that price-gap calculations, while conceptually straightforward, can yield results that vary widely with the methods used to calculate internal and external prices. As we have already discussed, it is much easier to work on trade flows than on prices because unit-value data are typically erratic. As an alternative to the calculation of unit values from COMTRADE for commodities, the World Bank regularly publishes price information in its “pink sheet”. This information is typically fairly reliable but comes from private companies that tend to report list prices rather than real-life transaction prices; the difference can be substantial. For food and agricultural products, the FAO also publishes price series but their reliability is uneven.

The price-wedge method suffers from a number of drawbacks. First, in the presence of several different NTMs it only provides an aggregate measure of their effects but does not allow assessment

**Box 2.3 Applying the price-gap method to the EU banana market**

Figure 2.2 shows an application of the price-gap method to the EU banana market under EC Regulation 404, where different quotas were applied to bananas of different origins.

**Figure 2.2 Applying the price-gap method to the EU banana market**



The first step consists of ordering supply curves from different sources by increasing order of costs (lowest-cost to the left, highest-cost to the right).<sup>20</sup> Following this principle the first supply curve is that of so-called “dollar” bananas, imported from Latin American countries under the MFN regime. The supply curve is drawn upward-sloping to reflect the fact that the EU is a large importer and is vertically shifted up by the in-quota specific tariff of €75/ton, up to the quota of 2.6 million tons. The MFN supply curve cuts the vertical quota line at the world or “external” price (because MFN suppliers must be indifferent to the alternatives of selling the marginal banana on the EU market or selling it elsewhere). Next comes the ACP supply, up to the quota of 850,000 tons, followed by the domestic supply (shifted down vertically by the amount of subsidies). The latter’s intersection with the EU demand curve determines the internal price.

**Table 2.6 Price-gap calculations compared: EU bananas**

	Raboy			Borrel-Bauer	NERA
	(a)	(b)	(c)		
Internal price	631	631	631	624	521
External price	563	627	579	560	262
Price gap	68	4	52	64	259

Sources: Borrel and Bauer (2004), NERA Economic Consulting and Oxford Policy Management (2004) and Raboy (2004)

Note: All prices are in current euros.

of the respective contributions of each of the NTMs. Second, quality differences would need to be taken into account but they are hard to quantify. Various extensions of the price-gap approach to calculating tariff-equivalent estimates of NTMs have been proposed in the literature. Some account explicitly for commodity heterogeneity and perceived quality of substitutes and/or trading costs.<sup>22</sup> These extensions sometimes require the use of econometric techniques.

Recent econometric approaches to estimating NTM effects are either price-based or quantity-based. Price-based methods examine international price differences and assess the extent to which NTMs cause certain domestic prices to be higher than they would be in their absence.<sup>23</sup> They extend the intuition behind the price-gap method to many countries and products simultaneously (Ferrantino, 2006). Quantity-based methods, by contrast, are gravity based most of the time, i.e. they use some form of the gravity model (see Chapter 3). The decision to use a price- or quantity-based method is often based on the availability of data. As data on trade flows are abundant even at a highly disaggregated level, while price data are more problematic, quantity analysis is often preferred to price analysis.

## *ii. Inventory-based frequency measures*

Frequency or coverage ratios provide a simple but crude way of assessing the importance of NTMs in a country's trade based on inventories of NTMs such as those presented in Section C below. Frequency ratios are calculated as the share of tariff lines in a certain product category subject to selected NTMs. Similarly, coverage ratios are calculated as the share of imports of a certain category of products subject to NTMs.

Table 2.7 shows an illustrative calculation. Suppose that in HS 87 (transportation equipment), the home country has NTMs in place in HS four-digit categories 8703 (passenger cars) and 8711 (motorcycles) in order to protect a domestic car and motorbike assembly industry. The first step in calculating the automobile sector's coverage ratio consists in "marking" HS four-digit categories with a binary variable equal to one for those categories (8703 and 8711) that have NTMs and zero otherwise. The second step consists of multiplying this binary variable by the import share of each category and taking the sum. This gives a coverage ratio of 32.35 per cent in our example (31.28 per cent + 1.07 per cent).<sup>24</sup> The same calculation can be carried out for a country's entire trade, producing a summary measure of the incidence of NTMs.

However, assessing the effect of NTMs this way is crude because it does not take into account the measures' stiffness. That is, an NTM that barely reduces trade volumes is treated in the same way as one that reduces them drastically (by the nature of the binary coding). Worse, the end-result is subject to the same bias as that shown for average tariffs. That is, a prohibitive quota reducing imports of a certain category of goods to a very low level mechanically reduces the category's share in total imports, resulting in a low coverage ratio. As for frequency indexes, they would give the same weight to products that are not imported and to products that are imported in large amounts. A third drawback is that NTM inventories may be incomplete and their coverage of measures may differ across measures and countries. In spite of these well-known drawbacks, coverage ratios have been widely used as summary measures of the incidence of NTMs. Frequency measures have also been used in gravity equations to identify the effects of NTMs on trade flows (see Chapter 3).



**Table 2.7 Coverage ratio: illustrative calculation**

HS code	Import		NTM	Description
	Import value (US\$ 1,000)	share (%)		
87	58,827,533			Vehicles other than railway or tramway rolling stock
8701	1,975,665	3.36	0	Tractors (other than tractors of heading 87.09)
8702	264,003	0.45	0	Motor vehicles for the transport of ten or more persons, including the driver ...
8703	18,400,000	31.28	1	Motor cars and other motor vehicles principally designed for the transport ...
8704	5,658,077	9.62	0	Motor vehicles for the transport of goods
8705	418,058	0.71	0	Special purpose motor vehicles, other than those principally designed for t ...
8706	435,047	0.74	0	Chassis fitted with engines, for the motor vehicles of headings 87.01 to 87 ...
8707	172,346	0.29	0	Bodies (including cabs), for the motor vehicles of headings 87.01 to 87.05
8708	28,600,000	48.62	0	Parts and accessories of the motor vehicles of headings 87.01 to 87.05
8709	211,767	0.36	0	Works trucks, self-propelled, not fitted with lifting or handling equipment ...
8710	622,752	1.06	0	Tanks and other armoured fighting vehicles, motorized
8711	628,913	1.07	1	Motorcycles (including mopeds) and cycles fitted with an auxiliary motor
8712	62,290	0.11	0	Bicycles and other cycles (including delivery tricycles), not motorized
8713	54,315	0.09	0	Carriages for disabled persons
8714	363,429	0.62	0	Parts and accessories of vehicles of headings 87.11 to 87.13
8715	28,653	0.05	0	Baby carriages and parts thereof
8716	932,218	1.58	0	Trailers and semi-trailers
HS 87 Cov. ratio (%)			32.35	

### 3. Trade policy stance

The discussion in subsection 2 has emphasized the diversity of measures taken by governments that affect trade, whether on the import or on the export side. These forms of trade policy measures differ in several dimensions including how distortionary they are and the extent to which their use is constrained by WTO disciplines. Given the diversity of trade policy measures, summarizing the stance of a trade policy in a way that aggregates across goods and is comparable across countries is a non-trivial task. Many dimensions of policy must be covered, and a good template of how this should be done is provided by the WTO's Trade Policy Reviews (TPRs) available on the WTO's website. The TPRs provide a comprehensive description of WTO members' trade policies and practices. Depending on their share in world trade, members are subject to review every two (for the four largest members), every four (for the next 16) or every six years (for other members). TPRs are composed of a report by the member under review plus another report by the Secretariat of the WTO. The format of the TPR is decided upon by the Trade Policy Review Body. The report by the WTO Secretariat is in four parts:

- Economic environment
- Trade policy regime: framework and objectives
- Trade policies and practices by measure
- Trade policies by sector

Another more quantitative and synthetic approach to the assessment of a trade policy stance consists in calculating so-called trade restrictiveness indexes (TRIs), i.e. indexes that synthesize the effect of all trade restrictions (tariffs and NTMs). The construction of a TRI raises two challenges. First, a single measure of the trade restrictiveness of a 10 per cent tariff, a 1,000 tons quota and a US\$ 1 million

subsidy must be found. Second, all the information from several thousand different tariff lines must be summarized in one aggregate measure. A first generation of TRIs proposed a solution to the first problem. The IMF, for example, developed an index based on a number of observation rules. Countries were given a score for each type of trade barrier: average tariff, proportion of tariff lines covered by QRs, and so on, after which scores were averaged for each country, giving a Trade Restrictiveness Index going from one (most open) to ten (least open). The TRI, the design of which is explained in detail in IMF (2005), was used in IMF research papers but was not indicated in staff reports.

These first generation TRIs brought different types of trade policy instruments to a common metric but they did this using ad-hoc criteria with no economic basis. It is not clear why a 3 per cent average tariff should be equivalent to a 5 per cent NTM coverage. A second generation of TRIs was then developed which proposes a more analytical solution to the first problem but also solves the second problem by using theoretically sound aggregation procedures. Anderson and Neary (1994, 1996) used the equivalence between tariffs and quotas results (see above) to convert QRs into tariffs and to construct a TRI embodying the effects of both tariff and quantitative restrictions. The TRI resulting from their procedure is the uniform *ad valorem* tariff on imports that would be equivalent to the set of existing tariff and quantitative restrictions in terms of the importing country's welfare.

More recently, Kee et al. (2006) constructed a similar Overall Trade Restrictiveness Index (OTRI) defined as the uniform *ad valorem* tariff on imports that would result in the same *import volume* as the set of existing tariff and non-tariff measures (see Box 2.4). Thus both the TRI and the OTRI are based on sound aggregation across instruments. Kee et al. also proposed a mirror image of the OTRI, the uniform *ad valorem* tariff that would be equivalent to the set of existing measures affecting a country on its export market, and called it the MA-OTRI (MA for market access). They also estimated all three indices for a wide range of countries using econometric estimates of import-demand elasticities from a previous paper of theirs (Kee et al., 2004).

#### Box 2.4 OTRI and MA-OTRI

OTRI and MA-OTRI are simply given by a weighted sum of tariffs and AVEs of NTBs at the tariff line level. Weights are an increasing function of import shares and elasticities of import demand at the tariff line level, which capture the importance that restrictions on these goods would have on the overall restrictiveness. The logic of giving less weight to products with a less elastic demand is that a change in the tariff of those products would have less effect on the overall volume of trade. Note that the weights of the OTRI do not solve all the problems of import-weighted averages mentioned above as they continue to take the value of zero in the presence of prohibitive tariffs.

In order to compute the aggregate measure of trade restrictiveness, one needs information on tariffs but more importantly AVEs of NTBs and elasticities of import demand at the tariff line level. These were estimated in two background papers. Kee et al. (2005) provide estimates of import demand elasticities at the tariff line level for 117 countries. The methodology follows closely that of Kohli (1991) and Harrigan (1997) where imports are treated as inputs into domestic production, given exogenous world prices, productivity and endowments.

In a world where a significant share of growth in world trade is explained by vertical specialization, the fact that imports are treated as inputs into the GDP function – rather than as final consumption goods as in most of the previous literature – seems an attractive feature of this approach.

Kee et al. (2006) provide estimates of AVEs of core NTBs (price and quantity control measures, technical regulations, as well as monopolistic measures such as single channel for imports) and agricultural domestic support at the tariff line level for 104 countries. They first measure the impact of NTBs on imports following Leamer's (1990) comparative advantage approach (see also Harrigan, 1993 and Trefler, 1993). The logic of this approach is to predict imports using factor endowments and observe its deviations when NTBs are present. This is done for each HS six-digit tariff line in which at least one country has some type of NTB (around 4,800 tariff lines). The impact of NTBs on imports varies by country (according to country-specific factor endowments). Kee et al. then convert the quantity impact of NTBs on imports into a price equivalent (or AVE) by simply moving along the import demand curve using the import demand elasticities estimated earlier.

## C. Data

There are three main portals through which users can access tariff data and, for the time being, primarily one that gives access to a broad range of non-tariff measures. The WTO provides access to bound, applied and preferential tariffs through two different facilities: the Tariff Analysis Online (TAO) facility and the Tariff Download Facility (TDF). It also provides access to a number of databases containing information on NTMs notified to the WTO by its members. The World Integrated Trade Solutions (WITS) portal provides access to bound, applied and preferential tariffs as well as to the only truly global NTMs database (TRAINS). Finally, the Market Access Map (MAcMap) portal gives access to bound, applied and preferential tariffs and to tariff-quotas, anti-dumping duties and rules of origin. Note that all three portals also give access to trade data. In addition to those three main portals, there are a number of other databases that are accessible online and that provide information on specific measures or specific sectors.

### 1. The WTO's TAO and TDF

The WTO's TAO is one of the two interfaces offered by the WTO to access official tariff data provided or approved by its members. These tariff data are stored in two databases: the Integrated Data Base (IDB) and the Consolidated Tariffs Schedules (CTS) database. The IDB is the repository of the tariff and trade information that WTO members have committed to report to the WTO. Since 2010 this information has been complemented with data provided through other organizations and approved by members. The IDB has contained MFN-applied tariffs and imports of WTO members at the tariff-line level, which often means eight digits or sometimes even ten digits, since 1996. Country coverage depends on the years, reaching up to 90 per cent. Information on *ad valorem* equivalents of specific tariffs as well as preferential tariffs is available for a subset of the countries for which applied tariffs are available. The CTS database contains the bound tariffs of all WTO members. Access is free of charge through the same facilities as IDB.

The TAO interface allows people to generate a variety of reports on bound, applied or preferential tariffs for one country at a time. Users can select information by user-defined tariff and trade criteria, compile 12 reports (including tariff line level reports and summary reports) and export report information to the desktop. The application, in English, French or Spanish, can be accessed at:

<http://tariffanalysis.wto.org/>

The TAO is a complement to the TDF (<http://tariffdata.wto.org/>), which contains information at the level of Harmonized System (HS) six-digit codes. It is planned to merge the two applications in the future. Also, IDB and CTS data will soon be accessible through the WTO's Integrated Trade Intelligence Portal (I-Tip) which is currently developed by the WTO Secretariat to provide unified access to all information on trade and trade policy measures available at the WTO.

## 2. WITS

The WITS software was developed by the World Bank in close collaboration with the United Nations Conference on Trade and Development (UNCTAD). It provides access to five trade and tariffs databases:

- the WTO's **IDB** and **CTS** databases (see above)
- UNSD's **COMTRADE** database (see Chapter 1)
- UNCTAD's **TRAINS** database
- CEPII and IFPRI's **MAcMapHS6v2** database (see below)
- the **AMAD** database.

The TRAINS database (for TRade Analysis and INformation System) contains data on MFN (applied) and preferential tariffs, non-tariff measures (NTMs) and imports at the national tariff line level, starting in 1988.<sup>25</sup> Country coverage depends on the years, reaching up to 140 countries for some years.<sup>26</sup> NTM data are collected from official data sources. These data are complemented with information collected through firm surveys and a web portal, and stored in a distinct database.

Data on NTMs is organized and reported in TRAINS in the form of incidence at the national tariff line level. That is, each NTM is coded in binary form at the level at which measures are reported by national authorities (one if there is one, zero if there is none), allowing for estimating coverage ratios, i.e. the proportion of tariff lines coded as ones in the total number of tariff lines in a given aggregate.

Besides the controversial question of what is a barrier to trade and what is not (see above), one limitation in the reporting of NTMs is their binary form, which does not distinguish between mild and stiff measures. For instance, a barely binding quota is treated the same way as a very stiff one. Unfortunately, there is no perfect fix for this problem and the binary form is probably the best compromise between the need to preserve as much information as is possible and that of avoiding errors in reporting (the more detailed the coding, the larger the scope for errors).

WITS offers the possibility to run quick searches as well as multi-country and multi-product queries. It allows downloading of any number of tariff lines or even entire tariff structures at the national tariff line level and allows this for more than one country at a time. WITS provides two sorts of

tariffs. First, most-favoured nation (MFN) tariffs are reported under the code “MFN”. Note that these are applied, not bound, tariffs (see Section 2 (a) above for definitions). Second, effectively applied tariffs, which may vary across partner countries depending on preferences granted and RTAs, are reported under the code “AHS”.<sup>27</sup> WITS calculates *ad valorem* equivalents of non *ad valorem* tariffs. WITS also provides utilities such as classifications and concordances between different classifications as well as a tariff and trade simulation tool. This tool allows assessment of the impact of tariff cutting proposals on bound and applied tariffs (see Box 2.5) and on trade and welfare using a partial equilibrium model (for more details see Chapter 5).

WITS is free. However, access to databases themselves can be fee-charging depending on one's status.<sup>28</sup> See the WITS information web page for more information at:

<http://wits.worldbank.org/>

#### Box 2.5 Simulating WTO tariff reduction commitments

As part of the negotiations on market access, WTO members need to agree on the modalities they want to use to reduce their tariffs. Regarding these modalities, they have to decide whether they want to apply a tariff cutting formula or some other approach. If they decide to use a formula, they will further have to choose the formula they want to use and the tariffs to which they want to apply it. If, as in the current round of negotiations, they decide to apply a non-linear formula to the bound rates, there will be a need to assess the effect of such cuts on the applied tariff rates. This is because the level of the bound rate after the cut can be higher, equal to or lower than the level of the currently applied tariff. Only if the bound level is lower than the level of the applied rate will the applied tariff need to be lowered to the level of the binding.

The tariff and trade simulations section of the WITS software (see above) and the detailed analysis menu of the Market Access Maps software propose a simulation tool that allows assessment of the effects of the various tariff cutting proposals on both bound and applied tariffs. It is obviously also possible to simulate the tariff cutting proposals using STATA, but that would require ad hoc programming.

### 3. Market Access Maps

The Market Access Maps (MAcMap) facility, developed jointly by the International Trade Centre (ITC) and the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII), provides access to a database of current applied MFN and preferential tariffs and trade at the tariff line level as well as to the bound tariffs from the WTO's CTS database. The MAcMap database provides *ad valorem* equivalents (AVEs) of all non *ad valorem* tariffs. MAcMap also includes a treatment of tariff-rate quotas (the original data being from AMAD).<sup>29</sup> The methodology used in MAcMap is discussed in detail in Bouët et al. (2005).

The MAcMap facility allows the extraction of one or several tariffs at a time for one or more countries. It also proposes various reports on trade regimes or on a country's trade and tariffs as well as a tool to simulate tariff cuts. Its main limitation is that it does not allow downloading of

complete tariff structures at the national tariff line level. Since 1 January 2008, access to Market Access Maps is free of charge for developing countries at:

<http://www.macmap.org/>

Two further databases are by-products of the MACMap dataset. The first one is the MACMapHS6 database, which is a harmonized version of the MACMap database available for the years 2001 and 2004. It provides bilateral tariffs at the HS six-digit level for 163 reporters and 208 partners. MACMapHS6v2 for 2004, which was developed by CEPII and IFPRI, can be downloaded free of charge through WITS (see above). The second one is the MACMap for GTAP database, which is an aggregated version of MACMapHS6 using the GTAP nomenclature. This version of the MACMapHS6 database is ready to use with the GTAP model and software. It is freely available from CEPII.

## 4. Other data sources

### a. Global anti-dumping database

This rich database, put together by Chad Bown with funding from the World Bank, provides detailed information on more than 30 different national governments' use of the anti-dumping trade policy instrument as well as all WTO members' use of safeguard measures. It includes determination and affected countries, product category (at the HS eight-digit level), type of measure, initiation, final imposition of duties, revocation dates, and even information on the companies involved. The database is available for free online at:

[http://people.brandeis.edu/~cbown/global\\_ad/](http://people.brandeis.edu/~cbown/global_ad/)

### b. AMAD

The Agricultural Market Access Database (AMAD) resulted from a cooperative effort of Agriculture Canada, the EU Commission, the US Department of Agriculture, the FAO (Food and Agricultural Organization), the OECD (Organisation for Economic Co-operation and Development) and UNCTAD. It includes data on agricultural production, consumption, trade, unit values, tariffs and "tariff-quotas" (tariffs applied only on limited quantities, after which they jump to typically higher levels). Fifty countries were covered from 1995 to the mid-2000s. Some of the tariff-quotas are reported at the HS four-digit level rather than the HS six level. The AMAD portal provides free access to a user guide and a self-study guide, the MS-Access database and a guide that explains how to convert the Access files into Excel format.

<http://www.amad.org/>

### c. World Bank TPP database

The World Bank's Trade, Production and Protection (TPP) database merges trade flows, production and trade protection data available from different sources into a common classification: the International Standard Industrial Classification (ISIC), Revision 2. Data availability varies, but the

database potentially covers 100 developing and developed countries over the period 1976–2004. This database updates the earlier release made available in Nicita and Olarreaga (2001). It can be downloaded for free at:

<http://go.worldbank.org/EQW3W5UTP0>

#### d. World Bank TBT database

In 2004, John Wilson and Tsunehiro Otsuki at the World Bank completed a survey on technical barriers to trade (TBTs) and standards of 689 firms in 17 developing countries. The resulting database includes information on both mandatory technical regulations (e.g. costs of meeting standards and technical barriers required in major export markets) as well as the use of voluntary standards, and can be freely downloaded from the World Bank's Research page.

#### e. WTO notifications databases

A number of databases containing information from WTO members' notifications can be accessed online. WTO members have committed to report various measures under a number of agreements. For example, Article 7 of the SPS Agreement requires members to report changes in their sanitary and phytosanitary measures. As compliance with these requirements is not always satisfactory, notifications-based data should be interpreted with caution. Information from notifications submitted under the SPS Agreement is freely accessible through the SPS Information Management System (SPSIMS) (see WTO website). Similarly, information from notifications submitted under the TBT Agreement is accessible through the TBT Information Management System (TBTSIMS). Information from notifications will soon be accessible through the I-Tip portal.

#### f. Country or region specific databases

The TARIC database provides all information on tariffs of the European Union, including seasonal tariffs, exclusions, additional duties for agricultural components of processed products, etc. This database is freely accessible online but does not allow extractions beyond a very small number of data.

[http://ec.europa.eu/taxation\\_customs/dds2/taric/taric\\_consultation.jsp?Lang=en&redirectionDate=20110224](http://ec.europa.eu/taxation_customs/dds2/taric/taric_consultation.jsp?Lang=en&redirectionDate=20110224)

The Asia Pacific Economic Cooperation (APEC) tariff database contains detailed (HS eight-digit level) tariff information of most of the APEC member economies.<sup>30</sup>

<http://www.apec.org/Groups/Committee-on-Trade-and-Investment/Rules-of-Origin/WebTR.aspx>

The United States International Trade Commission (USITC) interactive tariff and trade database provides international trade statistics and US tariff data to the public free of charge. US import statistics, US export statistics, US tariffs and future tariffs as well as US tariff preference information are accessible through a user-friendly interface.

<http://dataweb.usitc.gov/>

## D. Applications

### 1. Generating a tariff profile

Objective: Generate the tariff profile of Canada.<sup>31</sup>

The tariff profile includes a summary table with bound and applied tariff averages for both agricultural and non-agricultural products, the distribution of tariffs by duty ranges and a number of tariff statistics at the product group level.

#### a. Downloading the data

Bound and applied tariffs and imports of Canada for the year 2008 will be downloaded at the national tariff line level. In the case of Canada, the national tariff lines are defined at the eight and sometimes ten digit level.

Note: If you do not have an Excel or STATA file with the list of all agricultural tariff lines, you may download the data in two (or three, under option 2 below) groups, i.e. WTO agriculture and WTO non-agriculture under option 1 and WTO agriculture and WTO industrial plus WTO petroleum under option 2.

#### *Option 1: Download data from the World Trade Organization's Tariff Analysis Online (TAO) website*

Note: TAO does not provide *ad valorem* equivalents for the non *ad valorem* tariffs, which means that tariff lines with non *ad valorem* duties will be excluded from the calculation of tariff averages.

Go to <http://tao.wto.org/>

The data needed for this application can be downloaded in four different files: two compressed files containing the agricultural and non-agricultural applied tariffs and import flows respectively and two compressed files containing the agricultural and non-agricultural bound tariffs. The first two compressed files contain three text files: one with the applied tariffs (DutyDetails.txt), one with the imports (TradeDetails.txt) and one with product definitions and other information (TariffDetails.txt). The two other compressed files each include only one text file with the bound rates.

The first compressed file can be downloaded from the TAO website in the following way:

On the home page of TAO, click:  
 Make selection  
     select "Applied Duties and Trade (IDB)"  
     select the relevant country and year  
 Click the "Additional criteria" button on the bottom of the window  
     in the new window, choose the "selected products (required)" thumbnail  
     in the "select product group" dropdown menu  
     select <New Product Group>  
     in the "Classification" dropdown menu  
     select "HS – WTO Agricultural Products Definition"  
     click the "check all" button  
 Click the "Download Data" button on the left hand side of the screen  
     in the "Select Report" dropdown menu  
     choose "Tariff Line Duties"  
     select "Text" as "File Type" and pick a name (e.g. CAN08\_AG)  
     click the "Export" button on the right hand side.  
     check the status of your download and click on "refresh"

For the other files follow the same steps.



*Option 2: Download data from the WITS portal*

Note: You may download information from either the IDB or the TRAINS database; note that *ad valorem* equivalents are provided in TRAINS only. The IDB/CTS data that you can download through WITS are exactly in the same format as the IDB/CTS information that we just downloaded through TAO.

Here we download information from the TRAINS database.

Go to <http://wits.worldbank.org/>

The data needed for this application can be downloaded in three different files but you need files with the list of all agricultural products according to the WTO definition in all relevant nomenclatures (made available with this guide). You first download the bound rates, and then you download the applied tariffs; finally you download the bilateral imports.

On the WITS home page, click:  
Quick Search  
select "Tariff-View and Export Raw Data"  
select "WTO-CTS" as data source  
select the relevant market  
Click the "Download" button  
select "Text" as "File Type"  
Click the "Download" button

For the applied rates:

select "Tariff – View and Export Raw Data"  
select data type: Trains-Total (incl. AVE)  
select reporter and year  
select Duty code: MFN rates  
select Estimation method: . . .  
Click the "Download" button  
select "Text" as "File Type"

For the trade flows:

select "Trade – View and Export Tariff line imports"  
select data source: Trains  
select reporter and year  
select Partners: World  
select Product code: All Product Code  
. . .

Note that if the trade data provided by TRAINS is not in the same nomenclature as the tariff data, you can use trade data from the WTO.

**b. Importing the data into STATA***Option 1: Import data downloaded from TAO*

Note: As explained earlier, the data downloaded from TAO is in eight different text files, four for agricultural products and four for non-agricultural products. For both agricultural and non-agricultural products, three of the four files include information on applied tariffs and trade and one includes the bound rates.

We want to append the file containing the agricultural tariffs with the one containing the non-agricultural tariffs. To do this we first import the text (or comma separated values) file containing applied agricultural tariffs and we save it in STATA format (.dta).<sup>32</sup>

```
insheet using CAN08_AG_DutyDetails_TL.txt, clear tab names
save CAN_AG_DutyDetails.dta, replace
```

Three options are used with the “insheet” command: “clear” cleans the memory of STATA, “tab” specifies that the delimiter used is the tabulation, and “names” assigns the first row as the variable name. The “replace” option allows us to overwrite a file that would have the same name.

We do the same with the file containing the non-agricultural applied tariffs. Having done this, we append the two datasets:

```
use CAN_AG_DutyDetails.dta, clear
append using CAN_NAG_DutyDetails.dta
save CAN_DutyDetails.dta
```

We then do the same with the two files containing the bound rates, those containing the imports, and those containing the definitions.

Note: You should not forget to browse the data files to make sure that there are no problems with the structure of the dataset. Be aware that problems may occur in the files containing the bound rates as some observations may not be imported appropriately. A STATA commands file which addresses some of these import-related issues is provided with this guide.

This leaves us with four STATA data (.dta) files:

```
CAN_DutyDetails.dta;
CAN_TradeDetails.dta;
CAN_TariffDetails.dta;
CAN_Bounds.dta;
```

We also need the relevant HS nomenclature in order to calculate certain statistics (e.g. the binding coverage). We thus merge the HS1996 nomenclature with the bound tariff schedule.

```
merge hs6 ag using HS96Complete.dta
```

Finally, we create three dummy variables. The first one takes the value 1 for agricultural tariff lines and the value 0 for non-agricultural tariff lines. The second takes the value 1 if the duty is non *ad valorem* (NAV) and zero otherwise, while the third one takes the value 1 when the duty is bound and zero otherwise.

```
gen ag = 0 if productclassification == "HS - WTO Non-agricultural Products Definition"
replace ag = 1 if productclassification == "HS - WTO Agricultural Products Definition"
gen nav = 0
replace nav = 1 if boundduty nature ~="A"
gen bind = 1
replace bind = 0 if boundduty bindingstatus ~="B"
```

Remark: “A” stands for *ad valorem* and “B” stands for binding.

*Option 2: Import data downloaded from WITS*

Note: The file containing the bound tariffs is exactly the same as the one that can be downloaded from TAO, which means that all the caveats regarding the importation mentioned under option 1 apply. The STATA commands for the importation are the same as under option 1, only (a) the names of the variables in the applied duties and trade files are different, and (b) you need to merge all three files with the nomenclature files that also allow for distinguishing agricultural from non-agricultural products.

**c. Summary of tariffs and imports***Bound tariffs*

We start with the calculation of the simple average of bound tariffs (“bounddutyav”) for agricultural, non-agricultural and all products. Note that the calculation is done in four stages. Before doing any calculations we drop the lines with non *ad valorem* tariffs which appear as missing values and are thus treated as zeros when using the “collapse” STATA command. When the tariff lines are defined at the ten-digit level, we calculate averages at the eight-digit level (“t1”). We then calculate averages at the six-digit level. And finally, these averages are used to calculate the aggregate averages.

```
drop if bounddutyav == .
collapse(mean) bounddutyav nav bind, by(t1 hs6 ag)
collapse(mean) bounddutyav nav bind, by(hs6 ag)
egen Total = mean(bounddutyav)
bys ag: egen boundbyAgNAg= mean(bounddutyav)
```

We calculate next the overall binding coverage and the binding coverage for agricultural and non-agricultural tariff lines. The binding coverage is calculated as the share of all six-digit sub-headings which do not include at least one bound tariff line.

```
egen binding = sum(bind)
gen BindingCoverage = binding / _N * 100
bys ag: egen binding_byag = sum(bind)
bys ag: gen BindingCoverageNAg = binding_byag / _N * 100
```

where `_N` represents the number of observations (tariff lines).

We also compute the share of NAV duties. When only part of the HS six-digit sub-heading is subject to NAV duties, the percentage share of these tariff lines is used.

```
egen nrt1 = count(nav)
egen TotalNAV = sum(nav)
gen TotalNAVshare = TotalNAV / nrt1 * 100
```

*Simple and weighted averages of applied tariffs*

We first calculate the corresponding simple averages for applied tariffs using the same commands as for the bound rates.

Having done this, we calculate the import-weighted average of applied tariffs. This requires matching import and applied tariff data. Import data downloaded from the WTO website for Canada is by country of origin but only total imports need to be kept. Import and tariff data are matched at the national tariff line level.

```
use CAN_DutyDetails.dta, clear
collapse(mean) avdutyrate , by(t1 hs6 ag)
sort t1
merge t1 using CAN_TradeDetails.dta
```

Weighted averages are first calculated at the six-digit level and then aggregated.

```
drop if avdutyrate == .
collapse (mean) avdutyrate (sum) value, by(hs6 ag)
egen Mtot = total(value)
bys ag: egen MtotAgNonAg = total(value)
egen Totaltwav = total( avdutyrate * value)/Mtot
bys ag: egen AgNonAgtwav = total( avdutyrate * value)/MtotAgNonAg
```

The last step consists in generating the table displaying the results (see the STATA command file in the annex).

**Table 2.8 Summary statistics**

Summary	Total	Ag	Non-Ag
Simple average final bound	5.14	3.64	5.35
Share of non <i>ad valorem</i> duty in bound duty	2.91	17.78	0.65
Simple average MFN applied	3.60	3.21	3.66
Share of non <i>ad valorem</i> duty in MFN applied	0.02	12.69	0.05
Trade weighted average MFN applied	2.73	3.20	2.70
Imports in billion US\$	397.09	26.14	370.95
Share of non <i>ad valorem</i> duty in imports	0.02	11.66	0.06

Reminder: non *ad valorem* duties are not taken into account in the calculation of average tariffs. Given that they account for 17 per cent of bound and 13 per cent of applied duty sub-headings in agriculture, the tariff averages for agriculture need to be interpreted with caution.

#### d. Frequency distribution of tariffs and imports by duty ranges

We also wish to present the tariffs and imports by duty ranges at the tariff line level. To do this, we first define the ranges.

```
gen range = "Duty-free" if bounddutyav == 0
replace range = "0 <= 5" if bounddutyav > 0 & bounddutyav <= 5
...
replace range = "> 100" if bounddutyav > 100
replace range = "N.A." if bounddutyav == .
```

Then we calculate the frequency distribution for the bound tariffs:

```
collapse (mean) bounddutyav , by(range hs6 tl ag)
bys range ag: gen freqbnd = _N
bys ag: gen freqBndAgNonAg = freqbnd / _N * 100
```

Note that each ten-digit tariff line is individually allocated to one single range. We then do the same for the applied tariffs and import flows. Finally, we generate the table displaying the results.

**Table 2.9** Frequency distribution

	Agricultural products			Non-agricultural products		
	Final bound	MNF applied	Imports	Final bound	MNF applied	Imports
Duty-free	33.08	39.04	50.86	34.54	53.82	59.04
0 <= 5	11.19	10.67	5.94	9.93	11.47	5.38
5 <= 10	18.33	15.86	15.11	41.16	22.88	31.70
10 <= 15	5.49	5.41	10.03	8.69	6.21	0.95
15 <= 25	0.69	0.73	0.12	5.03	5.45	2.91
25 <= 50	0.48	0.51	2.00	0.00	0.00	0.00
50 <= 100	0.14	0.15	0.00	0.00	0.00	0.00
> 100	0.27	0.29	0.00	0.00	0.00	0.00
NAV	0.00	27.34	15.94	0.00	0.17	0.01

### e. Tariffs and imports by product groups

For each of 22 product groups (10 for agriculture and 12 for non-agricultural products), and for both bound and applied tariffs, we want to present the simple average tariff, the share of duty-free tariff lines, the maximum tariff and the share of bound rates. We also want to calculate the share of imports (total and duty-free only) by product group. Starting with the bound rates, we merge the tariff information with the definition of the product groups.

```
use CAN_Bounds.dta, clear
merge hs6 ag using ProdGrp_hs96at6dig.dta
```

Having done this we can compute the maximum rate among bound duties, the average, the percentage of bound duty-free sub-headings in the total number of six-digit sub-headings and the share of bound sub-headings in the total number of six-digit sub-headings.

```
gen dutyfree = 1 if bounddutyav == 0
bys grpname: egen maxbndduty = max(bounddutyav)
collapse(mean) bounddutyav maxbndduty bind nav dutyfree, by(hs6 ag grpname)
bys grpname: egen avbndduty = mean(bounddutyav)
bys grpname: egen nrdutyfree = sum(dutyfree)
bys grpname: gen shbnddutyfree = nrdutyfree / _N*100
bys grpname: egen totbind = sum(bind)
bys grpname: gen binding = totbind / _N*100
```

Note that the “collapse” command computes the shares as *pro rata* of the tariff lines.

Similar calculations can be done for the applied rates and for the shares of imports by product groups. The results are presented in Table 2.10.

Table 2.10 Tariffs and imports by product groups

Groups	Bound Duties				Applied MFN Duties			Imports			
	Average	Max.	Duty-Free Share	NAV Binding	NAV Share	Average	Max.	Duty-Free Share	Share	Duty-Free Share	NAV Share
Animal products	4.89	238.3	49.77	100	29.70	3.98	238	67.97	0.56	53.98	12.84
Dairy products	7.46	11.2	0.00	100	77.50	7.41	11	0.00	0.11	0.00	84.75
Fruits, vegetables, plants	2.74	19.1	58.73	100	10.50	2.74	19	58.63	1.73	82.28	2.12
Coffee, tea	1.81	8	55.00	100	23.06	1.38	6	76.04	0.55	67.79	0.00
Cereals and preparations	7.64	94.7	15.59	100	38.86	6.35	94.5	31.29	1.23	25.72	9.51
Oilseeds, fats & oils	3.78	11.2	51.08	100	1.17	3.49	11	53.29	0.48	66.18	0.00
Sugars and confectionery	7.09	12.8	7.81	100	38.76	4.30	12.5	28.13	0.22	6.48	49.51
Beverages and tobacco	4.99	16	26.84	100	27.84	4.65	16	34.42	1.19	26.86	51.60
Cotton	0.80	8	90.00	100	0.00	0.50	5	90.00	0.00	84.20	0.00
Other agricultural products	1.69	16	67.37	100	2.62	0.99	10.5	78.95	0.51	54.80	1.21
Fish and fish products	1.25	11.3	76.97	100	0.88	0.94	11	81.09	0.51	74.79	0.00
Minerals and metals	2.71	15.7	49.82	99.46	1.22	1.72	15.5	68.70	13.68	72.61	0.00
Petroleum	6.78	8	0.00	51.67	48.33	2.69	8	58.67	10.54	98.72	0.00
Chemicals	4.49	15.7	26.68	100	0.13	2.81	15.5	50.55	11.23	47.15	0.10
Wood, paper, etc.	1.50	15.7	77.26	100	0.00	1.15	15.5	83.15	4.74	77.94	0.00
Textiles	10.74	18.2	9.66	100	0.00	6.54	18	47.22	1.64	16.35	0.05
Clothing	17.23	18	0.85	100	0.00	16.92	18	3.04	1.87	0.28	0.00
Leather, footwear, etc.	7.38	20	23.83	100	0.00	5.34	20	40.88	1.97	18.83	0.00
Non-electrical machinery	3.44	14.3	45.78	100	0.04	1.49	9.5	74.65	15.23	77.98	0.00
Electrical machinery	4.33	11.3	35.51	100	0.00	2.53	11	53.83	8.94	65.11	0.00
Transport equipment	5.67	15.7	24.71	93.22	6.78	5.79	25	41.13	16.90	16.39	0.00
Manufactures, n.e.s.	3.91	18.2	41.66	99.55	1.13	3.04	18	52.18	6.17	70.29	0.00

## 2. Assessing the value of preferential margins

This application presents the computation of two market access measures. The first one captures direct market access conditions, i.e. the overall tariff faced by exports. The second captures relative market access conditions, i.e. the overall tariff faced by exports relative to that faced by competitors. The index capturing the restrictiveness of the tariffs faced by exports is based on the work of Kee et al. (2009). As explained above, in the aggregation of tariff lines less weight is given to products with a less elastic import demand because for those products a change in tariff would have less effect on the overall volume of trade. Fugazza and Nicita (2011) call this index the “tariff trade restrictiveness index” (TTRI). In formal terms, the TTRI faced by country  $j$  in country  $k$  can be written as:

$$TTRI_{jk} = \frac{\sum_{hs} \exp_{jk,hs} \varepsilon_{k,hs} T_{k,hs}^j}{\sum_{hs} \exp_{jk,hs} \varepsilon_{k,hs}}$$

where  $\exp$  are exports,  $\varepsilon$  is the elasticity of the demand for imports,  $T$  is the applied tariff and  $hs$  are HS six-digit categories.

The second index measures the tariff advantage (or disadvantage) provided to the actual exports of country  $j$  in country  $k$ , given the existing structure of preferences. It is defined as the difference

between the tariff faced by a determined basket of goods when imported from the given country relative to the tariffs faced by the same goods when imported from any other country. In formal terms, the relative preferential margin (RPM) measuring the advantage that exporters of country  $j$  have when they export their goods to country  $k$  can be written as:

$$RPM_{jk} = \frac{\sum_{hs} \exp_{jk,hs} \epsilon_{k,hs} (T_{k,hs}^w - T_{k,hs}^j)}{\sum_{hs} \exp_{jk,hs} \epsilon_{k,hs}}, j \neq k,$$

With

$$T_{k,hs}^w = \frac{\sum_v \exp_{vk,hs} T_{k,hs}^v}{\sum_v \exp_{vk,hs}}$$

where  $v$  are countries competing with country  $j$  in exporting to market  $k$  and where  $T_{k,hs}^w$  is the average HS six-digit (trade weighted) tariff applied by country  $k$  to imports originating from each country  $v$ .

We will now compute the TTRI for Mexico, i.e. the overall trade restrictiveness of Mexican tariffs *vis-à-vis* its trading partners.

We start by opening the PMA\_MEX.dta file provided with this guide.<sup>33</sup> We calculate the numerator and the denominator and calculate the ratio of the former to the latter.

```
bys ccode year pcode: egen num = sum(exp * eps * T)
bys ccode year pcode: egen den = sum(exp * eps)
gen TTRI = num / den
```

where *ccode* is the reporter (Mexico), *pcode* is the partner, *exp* is exports, *eps* is import demand elasticity and *T* is tariff.

We next compute the RPM for Mexico, i.e. the relative preference margin faced by Mexico's trading partners when they export to Mexico. To do this we calculate the trade-weighted average tariff for competitors at the HS level ( $T_{k,hs}^w$ ).

```
bys ccode year hs6: egen TotalexpT = sum(exp * T)
bys ccode year hs6: egen Totalexp = sum(exp)
gen Twc = (TotalexpT - exp * T) / (Totalexp - exp)
```

Having done this, we calculate the sum across products of the numerator and denominator of the weighted averages for the tariff of competitors ( $T_{k,hs}^w$ ) and we compute the ratio of the two. After that, we subtract the ratio for the country's own tariff ( $T_{k,hs}^j$ ), which corresponds to the TTRI that we have already computed.

```
bys ccode year pcode: egen num2 = sum(exp * eps * Twc)
gen TTRI_others = num2 / den
gen RPM = TTRI_others - TTRI
```

The last step consists of summarizing the bilateral TTRI and RPM measures through simple or trade weighted average for each period. In the TTRI case, this can be done as follows:

```
bys ccode year: egen TTRI_avg = mean(TTRI)
bys ccode year: egen Totalexports = sum(exp)
bys ccode year: egen TTRI_wavg = total((TTRI * exports) / Totalexports)
```

Table 2.11 displays the results.

**Table 2.11 Trade restrictiveness indexes and relative preference margins**

<i>year</i>	<i>ccode</i>	<i>TTRI simple avg.</i>	<i>TTRI weighted avg.</i>	<i>RPM simple avg.</i>	<i>RPM weighted avg.</i>
2000	MEX	0.13	0.02	-0.09	0.04
2007	MEX	0.09	0.02	-0.05	0.01



## E. Exercises

### 1. Tariff profile

Objective: Compute the tariff profile of the Philippines.

1. Preliminaries
  - a. Download bound and applied tariffs and imports for the Philippines (year 2008) at the national tariff line level from the WTO's TAO website.
  - b. Import the data into STATA, import the relevant HS nomenclatures and create three dummy variables: one indicating whether the line is bound or not, one indicating whether the product is agricultural or non-agricultural and one indicating whether the duty is *ad valorem* or not.
2. Summary and duty ranges of tariffs and imports:
  - a. Report in a table the simple average final bound, average MFN applied, trade weighted average and total imports in billion US\$. Do the same for agricultural and non-agricultural products.
  - b. Determine the binding coverage in total and in agricultural products.
  - c. Determine the share of non *ad valorem* duties overall and for non-agricultural products.
  - d. Determine the frequency distribution of bound and applied duties as well as imports for agricultural and non-agricultural products. The following ranges are considered: duty free;  $0 \leq 5$ ;  $5 \leq 10$ ;  $10 \leq 15$ ;  $15 \leq 25$ ;  $25 \leq 50$ ;  $50 \leq 100$ ;  $>100$ .
3. Tariffs and imports by product groups
  - a. For each product group (10 agriculture and 12 non-agriculture groups), determine the simple average of the final bound and MFN applied duties. Compute the share of duty-free six-digit sub-headings in the total number of sub-headings in the product group for bound and MFN tariffs. Determine the highest *ad valorem* duty within the product group for both tariffs. In addition, for bound duties compute the share of bound HS six-digit sub-headings containing at least one bound tariff line.
  - b. Compute the share of each product group in total imports. Compute the share of MFN duty-free imports in total imports for each product group.
4. Major suppliers and impact of the product mix on the level of duties
  - a. Select the five major suppliers of agricultural and non-agricultural products in terms of total bilateral imports.
  - b. For each of these suppliers, compute the simple and trade-weighted average MFN duty based only on tariff lines with imports. Determine the duty-free imports in terms of tariff lines as a percentage of all traded tariff lines and in terms of share of duty-free trade in per cent of all bilateral trade flows.

### 2. *Ad valorem* equivalents of non *ad valorem* tariffs

Objective: Compare aggregate tariff statistics for South Africa including the *ad valorem* equivalents of NAV tariffs or not including them.

1. Download the data from WITS
  - a. Download applied tariffs for South Africa (2008) from WITS. You will need all the different sets of applied tariffs: one set including only *ad valorem* tariffs and three sets including *ad valorem* equivalents of non *ad valorem* tariffs estimated using the various methods proposed by WITS (UNCTAD 1 and 2 and WTO).
  - b. Examine the tariff data. Are non *ad valorem* equivalents provided for all tariff lines? Which is the nomenclature used for the applied rates?
2. Preliminaries
  - a. Before doing any calculations, the data need to be imported into STATA and reformatted. If you have downloaded the applied tariffs in three different files containing respectively the agricultural lines, the industrial lines and the petroleum lines, you will need to append these three files.
  - b. You will also need to create a dummy variable taking the value 1 for agricultural products and zero otherwise. The tariff line code is considered by STATA as a scalar and needs to be converted into a string of characters (command `tostring`) while the opposite is true for import data which need to be converted into scalars (command `destring`).
  - c. Finally, the data need to be reshaped into three columns each containing a set of tariffs with *ad valorem* equivalents calculated using a different method, plus one without *ad valorem* equivalents.
3. Share of non *ad valorem* duties and duty averages
  - a. Having done all this, calculate the share of non *ad valorem* rates at the HS six-digit level. When only part of the HS six-digit sub-heading is subject to non *ad valorem* duties, the percentage share of these tariff lines is used. Calculate the same statistic for agricultural and non-agricultural products.
  - b. Next, for each of the four sets of tariffs compute the simple average of applied tariffs, first at the HS six-digit level and then overall, for agricultural and for non-agricultural products.
4. Frequency distribution of tariff lines
  - a. The second part of the exercise consists in computing the frequency distribution of tariff lines by duty range respectively for agricultural and non-agricultural products. Remember that the shares by duty range in the frequency distribution are based on the pro-rata shares of tariff line level duties in the standard HS six-digit sub-headings. Start by defining the ranges of your choice, remembering that tariffs can take high positive values (> 100). Include a duty-free category.
  - b. Compute the shares and comment.

### 3. Tariff analysis

Objective: Provide a statistical description of tariffs and NTBs and examine their determinants.

For this exercise, use the World Bank's Trade Production and Protection (TPP) Database (available at "Chapter2\Datasets"). The assignment is as follows:

1. Preliminaries
  - a. Select one country (correction is provided for Colombia and Japan). Check what variables are available for the selected country for what years.
  - b. Indicate what nomenclature is used and at what degree of disaggregation the data are available.
2. Average tariffs and their determinants
  - a. Report in a table descriptive statistics for the tariffs: simple and weighted averages of effectively applied (i.e. taking preferences into account) and MFN applied tariffs along with corresponding median, standard deviation, minimum and maximum, all calculated for the 28 three-digit sub-headings provided in the database.
  - b. Draw a histogram of tariffs and comment on their distribution.
3. Tariffs and NTBs
  - a. Draw a scatter plot where each point is a sector, tariffs are on the horizontal axis and NTB *ad valorem* equivalents (AVE) are on the vertical one. On the basis of your scatter plot, are tariffs and NTBs complements or substitutes? Explain. [*Hint*: When the number of zero values is high, it is best to drop them from the plot to see a clearer picture.]
4. Determinants of tariffs
  - a. Calculate import-penetration ratios for each sector and their change between the first and last three years of the sample. [*Hint*: If there are too many missing observations for the period 2002–2004, consider 1999–2001 or 1998–2000 as the end period.]
  - b. Calculate the average establishment size as the ratio of employees to establishments, the proportion of female workers and wages per employee for each sector.
  - c. Regress average tariffs and NTBs on these variables and comment on your results.

Data sources: All data are from the Trade, Production and Protection 1976–2004 database constructed by the World Bank (Nicita and Olarreaga, 2006), and are available at <http://www.worldbank.org>. They only refer to manufacturing industries.

## Endnotes

1. See for example Piermartini and Teh (2005).
2. See however Grossman and Helpman (1991) for an integrated – if difficult – treatment of the relationship between trade, innovation and growth.
3. The Sachs-Warner index (SW) was a binary one equal to zero (closed economy) if any of the following five conditions were met: (i) an average tariff at or above 40 per cent; (ii) an NTB coverage ratio at or above 40 per cent; (iii) a black-market premium on foreign exchange at or above 20 per cent for a decade; (iv) an export monopoly; or (v) a socialist economy. If none of these conditions was met, the economy was deemed to be open (SW equal to one). The binary nature of this summary measure meant that a lot of information was lost (differences between, say, moderately closed and very closed economies) but minimized the risk of misclassification.
4. Wacziarg and Welsh (2008) showed that correlations that held for the 1970s broke down in the 1980s and 1990s. See also the overview of the literature in the WTO's World Trade Report 2008.
5. The methodology is set out in Annex A to WTO document TN/AG/W/3 of 12 July 2006.
6. The methodology is outlined in WTO document TN/MA/20.
7. This has the additional advantage of correcting for undervaluation of imports, widely used for tariff avoidance. The degree of undervaluation can be inferred by comparing the CIF (cost, insurance, freight) import value declared at destination customs with the FOB (free on board) export value declared at origin customs. The difference between the two should be positive and reflect insurance and freight costs. However, for many developing countries and for many goods it is negative, reflecting undervaluation at destination.
8. WTO members' schedules also list their commitments with regard to "other duties and charges" (ODCs). GATT Article II:1(b) stipulates that the products described in the schedules of commitments "*shall be exempt from other duties or charges of any kind imposed in excess of those imposed at the time a concession was granted*". In the Uruguay Round, members agreed to include any other duty or charge existing on 15 April 1994 in their Schedules and to eliminate all those that had not been notified. ODCs, which are covered in the NTM classification, include all taxes levied on imports in addition to the customs duties which are not in conformity with Article VIII (Fees and Formalities) of GATT 1994. Article VIII stipulates that such taxes should be limited in amount to the approximate cost of services rendered and shall not represent an indirect protection to domestic products or a taxation of imports or exports for fiscal purposes.
9. Note that under the Harmonized System (HS) convention, contracting parties are obliged to base their tariff schedules on the HS nomenclature. To ensure harmonization, they must employ all four- and six-digit provisions without deviation but are free to adopt additional subcategories. This means that while tariff schedules are often defined at a higher level of disaggregation, comparability across countries is not ensured beyond the HS six-digit level.
10. On this, see inter alia Anderson and Neary (1999).
11. See the World Tariff Profiles publication from the WTO, ITC and UNCTAD for a good example. See also the application in subsection D below which explains how the statistics presented in the World Tariff Profiles ([http://www.wto.org/english/res\\_e/reser\\_e/tariff\\_profiles\\_e.htm](http://www.wto.org/english/res_e/reser_e/tariff_profiles_e.htm)) can be calculated.
12. New research suggests that high import tariffs also limited the choice of inputs for producers in India which constrained the introduction of new products (Goldberg et al., 2010).
13. A good discussion of the issues with illustrations can be found in Flatters (2005).
14. It may seem strange to protect the domestic fabric industry with a 10 per cent tariff if it produces nothing that shirt makers can use, but let us suppose for the sake of the argument that it produces another type of fabric, say for bed linen, while the tariff covers *all* types.
15. Several institutional mechanisms have been put in place to prevent negative ERPs for exporters. These include tariff exemptions on inputs (possibly as part of EPZ arrangements) or "duty drawbacks" (refund of tariff payments on justification of export of the final good). South Korea successfully ran a complex system of duty drawbacks for many years, but sub-Saharan countries typically have poorly managed systems where exporters fail to get the refunds or get them very late. In high inflation environments, delays in refunds can be penalizing. Notwithstanding these differences in implementation, such systems should be taken into account whenever possible.

16. See the authoritative paper by Deardorff and Stern (1998) who discuss the definition and propose a taxonomy with five categories.
17. This new classification was elaborated as part of a joint project by international institutions led by a Group of Eminent Persons to improve the collection and dissemination of information on non-tariff barriers (NTBs) (see UNCTAD, 2010). Categories J to P (marked with “”) are included in the classification to collect information from private sectors through survey and web-portals. Note that a classification of procedural obstacles has also been elaborated for the same purpose.
18. Ferrantino (2006) provides a comprehensive survey of recent progress in the quantification of NTMs.
19. This is a basic formula (from Moroz and Brown, 1987 and Linkins and Arce, 2002) as presented in Ferrantino (2006) who also presents three other, more sophisticated price-gap formulae.
20. Only this way of ordering individual supply curves ensures that the price obtained at the intersection of the marginal supplier's curve with the domestic demand is the correct one.
21. Under Annex V of the WTO's Agricultural Agreement, external and internal prices are to be calculated as follows: “External prices shall be, in general, actual average CIF unit values for the importing country. Where average CIF unit values are not available or appropriate, external prices shall be either appropriate average CIF unit values of a near country; or estimated from average FOB unit values of (an) appropriate major exporter(s) adjusted by adding an estimate of insurance, freight and other relevant costs to the importing country. [...] The internal price shall generally be a representative wholesale price ruling in the domestic market or an estimate of that price where adequate data are not available.” (Guidelines for the Calculation of Tariff Equivalents for the Specific Purpose Specified in Paragraphs 6 and 10 of this Annex, Annex 5, WTO Agriculture Agreement, p. 71.)
22. See Ferrantino (2006) and Yue et al. (2006).
23. See for example Dean et al. (2005).
24. The frequency index would be equal to  $2/16 = 0.125$ , i.e. 12.5 per cent.
25. WITS calculates *ad valorem* equivalents of non *ad valorem* tariffs.
26. Gawande et al. (2005) note that the correlation between IDB and TRAINS tariffs is 0.93.
27. TRAINS also reports bound tariffs under the code “BND”.
28. While access to COMTRADE is subject to a fee, imports at the tariff line level are available for a relatively large number of countries in TRAINS or IDB.
29. The treatment is as follows. Suppose that a tariff rate of 20 per cent is levied on imports within a quota of 10,000 tons a year, and a tariff of 300 per cent on any additional quantities, if applicable. First, import volume data are compared with the quota to determine if the latter is binding or not. If binding (import volume above 10,000 tons), the out-of-quota tariff of 300 per cent is used as the tariff equivalent; if not, the in-quota tariff of 20 per cent is used.
30. Australia, Chile, Hong Kong (China), Korea (Republic of), New Zealand, the Philippines, Thailand, Brunei Darussalam, China, Indonesia, Malaysia, Papua New Guinea, Russia, United States, Canada, Chinese Taipei, Japan, Mexico, Peru, Singapore, Viet Nam.
31. The computed profiles correspond broadly to parts A1 and A2 of the Country Profile Tables of the World Tariff Profiles publication. The World Tariff Profiles use data from different years depending on data availability. In addition, there have been several revisions with the data, which makes direct comparison with the tables almost impossible.
32. Problems may arise (STATA may fail to import the full dataset) with the txt files when they are imported into STATA. The problems can be solved by converting the .txt file into a .csv file and importing the latter.
33. Data for this application are sourced from several databases. Bilateral exports are from UN COMTRADE; tariff data are from UNCTAD TRAINS; import demand elasticities are from Kee et al. (2008). See Fugazza and Nicita (2011).

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