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FROM BOUND DUTIES TO ACTUAL PROTECTION: INDUSTRIAL LIBERALISATION IN THE DOHA ROUND

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Abstract

This study proposes a CGE assessment of multilateral liberalisation of non-agricultural market access. Scenarios considered include the so-called Girard proposal (with alternative choices for the involved coefficient), the removal of tariff peaks and complete liberalisation. This study is the first one to take duly into account the difference between bound and applied tariffs, while accounting for all enforced preferential trade arrangements and computing tariff cuts at the detailed product level (HS-6 classification). While non-agricultural market access liberalisation is found to be welfare-enhancing at the world level, cross-country distributive impacts prove significant. A soft liberalisation would not lower significantly applied duties in developing countries, due to their significant binding overhang. In contrast, a deep liberalisation would entail fierce price-competition between developing countries, largely specialised on similar sectors and on the same quality range.

JEL Classification: D58; F12; F13

Key Words: Doha Development Agenda; Applied Tariffs; Preferential Trade Agreements; Binding Overhang; Computable General Equilibrium Model.

1. INTRODUCTION

Cancún's failure crudely recalled how difficult striking a deal between almost 150 countries over some 20 issues is. Negotiation is a research for a compromise, though, and success mainly depends on the solution found on a handful of sensitive topics, and on the underlying balance of offensive and defensive interests for the main categories of countries. Market access for non-agricultural products is certainly among these important items. Doha's Ministerial declaration states that negotiations should aim "by *modalities to be agreed*, to reduce or as appropriate eliminate tariffs, including the reduction or *elimination of tariff peaks*, *high tariffs*, and tariff escalation (...)". The Declaration also emphasises the need to "take fully into account the special needs and interests of developing and least-developed country participants, including through *less than full reciprocity in reduction commitments*, (…)".

This agenda for liberalisation of market access for non-agricultural products is ambitious. This work aims at studying the underlying stakes, while putting special emphasis on developing countries. Many developing countries are reluctant to liberalising their own market access for non-agricultural products, and others condition any progress in this area to an improved access to developed countries' market for agricultural products. Do these positions really reflect mixed gains for developing countries as a result of non-agricultural liberalisation, why and according to which pattern? These are the main questions addressed in this study.

Since Doha's Ministerial Conference, negotiations on non-agricultural market access (NAMA) have given raise to a number of proposals. To date, the basis for future negotiations is Geneva's framework agreement of August 2nd, 2004 (WTO, 2004), the so-called "July package". This text is important by its mere existence, since it sets the stage for future negotiations. It also takes stock of the agreement reached on important issues, such as the objective of binding all tariffs and of applying a non-linear tariff cutting formula (except for countries with a low initial binding coverage), the principle of less than full reciprocity (already present in the Doha declaration) and the principle of exempting Least Developed Countries (LDCs) from any liberalisation commitment.[1] Still, this Framework Agreement does not address the key issue: the tariff-cutting formula to be applied. In this respect, as emphasised in the Agreement itself,[2] the basis for future negotiations remains the Draft Elements of Modalities put forward in May 2003 by Ambassador Girard, then chairman of WTO's Negotiating Group on NAMA, and revised in August 2003 (WTO, 2003a, 2003b; the revised version will be referred to below as the Girard proposal).

Assessing the impact of this type of tariff-cutting formula raises various issues. First, as stated in July's Framework Agreement, it should be "a non-linear formula applied on a line-by-line basis" (WTO, 2004, p. B-1). In order to account for the corresponding harmonising effect on tariffs, tariff cuts must be computed at the detailed level. Second, such formula is to be is applied to *ad valorem* duties or *ad valorem* equivalent (AVEs) of specific duties.[3] These AVEs must therefore be appropriately calculated. Third, the tariff cuts posted concern bound

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[1] The only contribution expected from LDCs is to "substantially increase their level of binding commitments".

[2] Annex B of the Framework Agreement "confirm[s] [Member countries'] intention to use [the Chair's Draft Elements of Modalities] as a reference for the future work of the Negotiating Group" (WTO, 2004, p. B-1).

[3] With the exception of the American proposal which aims at directly reducing specific tariffs.

duties. Evaluating how this influences trade flows requires to know how it is reflected in applied tariffs.

Several recent studies have dealt with the impact of liberalising NAMA. Bacchetta and Bora (2001, 2003) brush a detailed picture of protection in industrial products, both in terms of bound and applied MFN protection. They show that market access is still "unfinished business" (in the wording of WTO, 2002), since applied protection is still substantial in numerous countries (most of all developing countries). In addition, the scope of binding is far from complete in most developing countries, and the binding overhang, i.e. the gap between bound and applied MFN duties, is large in many cases, most of all in developing countries. Assessments of the impact of liberalisation are generally carried out using CGE models (see e.g. Francois et al., 2003; World Bank, 2003), although partial equilibrium models are also used in some instances (see e.g. Hoekman et al., 2002). Among recent noteworthy improvements, Francois et al. (2003) introduced a refined policy scenario, taken into account through a pre-experiment simulation. Building on the work of Walkenhorst and Dihel (2002) aiming at characterising the extent of the binding overhang, Lippoldt and Kowalski (2003) take into account how posted tariff cuts would be reflected in applied tariffs. However, the binding overhang (*i.e.*, the gap between bound and applied duties) is only computed and accounted for at the GTAP sector level,[4] i.e. at a very aggregated sector level. Laird et al. (2003) compare six important, recent proposals, among which the Girard proposal. They are the first ones to compute the corresponding tariff cuts at the detailed level (HS-6), but this is done basically on MFN tariffs. Preferential trade agreements are not taken into account, and the binding overhang is not either.

Our work builds on this literature and brings several original contributions. The CGE model used, nicknamed MIRAGE[5], includes imperfect competition, increasing returns to scale and horizontal product differentiation. This model is comparable to those used for instance by Francois et al. (1995), Harrison et al. (1995) or Francois et al. (2004). One distinctive feature, however, is to account for the quality difference between products exported by developed and developing countries. This vertical differentiation, now well documented by empirical studies (see e.g. Fontagné et al., 1997; Schott, 2004), can significantly influence the nature of the consequences involved by a given liberalisation scenario. With the exception of protection data, the model is calibrated using the GTAP 6.03 database, the base year of which is 2001 (see Dimaranan and McDougall, 2005).

The main contribution of this work lies in the measurement of border protection and in the computation of actual liberalisation resulting from a tariff-cutting formula. Bound and applied duties (whether ad valorem, specific, mixed or compound) are consistently and accurately measured at the HS-6 product level (the most disaggregated level for which harmonised information exists). All preferential agreements enforced in 2001 are accounted for. Incidentally, we also take into account commitments not already implemented in 2001, included those made by recently acceded countries. A pre-experiment simulation is carried out, in which all these commitments are assumed to be implemented.

For the first time ever when dealing with multilateral liberalisation of non-agricultural market access, we are therefore able to account at the same time for trade preferences, for the binding overhang and for the non-linearity of the formula. This is likely to influence deeply the

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[4] We refer here to the sector classification of the Global Trade Analysis Project (GTAP) database, in its version 6.

[5] Modeling International Relationships in Applied General Equilibrium.

assessment, as compared to simplifying assumptions used so far in the literature. WTO agreements use to cut bound tariffs, which leaves applied duties unchanged in many cases, in particular when the gap between initial bound and applied duties is significantly higher than the applied duty. Francois and Martin (2004) rightly emphasised that lowering bound tariffs entails a gain in itself, given the stochastic nature of tariffs, and this should be kept in mind while interpreting our results. However, in a deterministic set-up such as the one considered here, only applied tariffs actually matter.

Given the background described above, it is natural to use the Girard proposal as the basis for assessing the stakes of NAMA liberalisation in the Doha Round. This proposal builds upon the so-called Swiss Formula, initially proposed during the Tokyo Round, and allowing for harmonising, non-linear tariff cuts. However (possibly inspired by the Chinese proposal), Girard's proposal introduces a flexibility, by making the formula's coefficient of reduction depend on the initial average tariff of each country.

It is finally worth stressing that this exercise does not aim at giving an evaluation of the gains to be expected for the Round. Other items of the Agenda listed above, such as (remaining) Singapore issues, are not included here; but their modelling is generally ad hoc[6]. More importantly, our central set of simulation does not capture the gains associated to increased market access, domestic support and export subsidies in agriculture (see e.g. FAPRI, 2002; Francois *et al.*, 2003; Bouët *et al.*, 2005; Hoekman *et al.*, 2002-b). In the same way, gains to liberalisation in services should be added; but here, we are collectively missing reliable data. We believe that non-agricultural market access deserves a specific analysis, and this is why it is treated separately. Now, this approach of course raises the question of the separability of the topics, not in terms of negotiation (by definition, topics are tied by the single undertaking principle), but in terms of analysis: does adding the impacts found separately for different topics provide with a satisfactory proxy of the global impact? Or, equivalently, does the impact of liberalisation in one field strongly depend on the outcome in other fields? In order to sort this out, the sensitivity analysis presented here includes introducing agricultural liberalisation in the pre-experiment. Since the results show that this does not modify substantially the assessed impact on non-agricultural liberalisation, this validates our assumption that studying separately non-agricultural market access is worthwhile, even though the negotiation covers a large variety of other topics.

The paper is organised as follows. Section 2 presents the model used to simulate the scenarios. Section 3 presents the experiment design and stresses how the baseline has been defined. Section 4 presents the results of the simulations. Section 5 provides with a sensitivity analysis. Section 6 draws the first conclusions.

2. THE MODEL

This Section proposes a brief overview of the CGE model used, namely a static version of the MIRAGE model.[7] The main characteristics of the model concern the assumptions made about products quality ranges, imperfect competition, and macro-economic closure.

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[6] See Lippoldt and Kowalski (2003) on trade facilitation, for instance.

[7] The list of the model's equations is provided in Appendix. For a detailed presentation, see Bchir et al. (2002).

Demand

The demand side is modelled in each region through a representative agent, whose utility function is intra-temporal, with a fixed share of the regional income allocated to savings, the rest used to purchase final consumption.[8] Below this first-tier Cobb-Douglas function, consumption trade-off across sectors is represented through a LES-CES function. Each sectoral sub-utility function is a nesting of CES functions, comparable to the standard nested Armington – Dixit-Stiglitz function (see e.g. Harrison et al., 1997), with two exceptions. Firstly, domestic products are assumed to benefit from a specific status for consumers, making them less substitutable to foreign products than foreign products between each other.

Secondly, products originating in developing countries and in developed countries are assumed to belong to different quality ranges. This is motivated by the fact that, following Abd-El-Rahman (1991), several empirical works have shown that, even at the most detailed level of classification (Combined Nomenclature, 10 digits, including more than 10,000 products), unit values differences are able to reveal quality differences (see e.g. Fontagné et al., 1998; Greenaway and Torstensson, 2000). In addition, this specialisation is closely linked to education and wealth level, and "the share of intra-industry trade in vertically differentiated products increases with the economic distance between countries" (Fontagné et al., 1997, p. 10). Based on a very detailed analysis of US imports, Schott (2004) emphasises as well the importance of "within-product" specialisation, i.e. vertical differentiation along the quality ladder, as revealed by unit value differences. Schott shows that "unit values within products vary systematically with exporter relative factor endowments and exporter production techniques" (*ibid*., p. 647).

This is likely to have direct consequences in the transmission of liberalisation shocks since, as shown in particular by Fontagné and Freudenberg (1999), the elasticity of substitution is lower across different qualities than across products within a given quality. Absent systematic information suitable for incorporation in a worldwide modelling exercise such as the one undertaken here, vertical differentiation is modelled in an ad hoc fashion: developed countries and developing countries are assumed to produce goods belonging to two different quality ranges; substitutability is assumed to be weaker across these two quality ranges, than between products belonging to the same quality range. Practically, this is modelled by introducing in the demand nesting a tier corresponding to the trade-off between the two quality ranges. This tier is the first one in the consumer choice within each sector, before any other choice in terms of geographical origin.

Supply

Production makes use of five factors: capital, labour (skilled and unskilled), land and natural resources. The first three are generic factors, the last two are specific factors. The production function assumes perfect complementarity between value added and intermediate consumption. The sectoral composition of the intermediate consumption aggregate stems from a CES function. For each sector of origin, the nesting is the same as for final consumption, meaning that the sector bundle has the same structure for final and intermediate consumption.

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[8] The structure of the demand function is shown in Appendix 6.

The structure of value added is intended to take into account the well-documented skill-capital relative complementarity. These two factors are thus bundled separately, with a lower elasticity of substitution (0.6), while a higher substitutability (elasticity 1.1) is assumed between this bundle and other factors.

Constant returns to scale and perfect competition are assumed to hold in agricultural sectors. In contrast, firms are assumed to face increasing returns to scale (through a constant marginal cost and a fixed cost, expressed in output units) in industry and services. In those sectors, firms compete *à la Cournot*, with zero conjectural variations, no Ford effect, and no strategic interaction. Each firm enjoys some market power, and sets its mark-up depending on the extent of product differentiation in the sector, but also of its own market share. This modelling captures the pro-competitive effect of trade liberalisation.

Capital, markets clearing and macroeconomic closure

The capital good is the same whatever the use sector, and capital is assumed to be perfectly mobile across sectors within each region. At the region-wide level, capital stock is assumed to be constant in the core simulations of this paper. However, given the potentially high welfare impact of the assumption made in this respect (see e.g. Francois et al., 1995), the sensitivity analysis includes an alternative modelling where the real interest rate is held constant, while region-wide capital stock is endogenous.

Natural resources are also perfectly immobile and may not be accumulated. Both types of labour, as well as land, are assumed to be perfectly mobile across sectors. Production factors are assumed to be fully employed. All production factors are immobile internationally.

As to macroeconomic closure, the current balance is assumed to be exogenous (and equal to its initial value in real terms), while real exchange rates are endogenous.

3. PRE-EXPERIMENT SIMULATION AND EXPERIMENT DESIGN

The measurement of border protection and the computation of actual liberalisation resulting from a tariff-cutting formula used in this study bring substantial improvements compared to previous works. Our simulations are based upon a measurement of ad valorem equivalent protection resulting from ad valorem and specific (included compound and mixed) duties, together with tariff rate quotas (TRQs), at the six-digit level of the harmonised system (hereafter, HS-6 level), for 163 countries and 208 partners in 2001, drawn from the MAcMap 2001 (version 1) database.[9] The distinctive feature of this database is to take into account all enforced preferential agreements (reciprocal as well as non-reciprocal).[10]

But WTO negotiations deal with consolidated, not applied protection. The difference is sizeable. In order to assess properly the possible impact of a given cut in bound tariffs, a

[9] Market Access Map is a database of trade barriers jointly developed by ITC and CEPII. A detailed presentation of the methodology used in calculating ad-valorem equivalents is presented in Bouët et al. (2004), available at www.cepii.fr.

[10] We use an aggregation method based on imports by groups of countries. Five groups of countries are considered, as a result of a hierarchical clustering analysis on PPP GDP per capita and on trade openness. See Bouët et al. (2004) for details. This minimises the extent of the well-known endogeneity bias that arises when bilateral imports are used as weighting scheme in order to aggregate tariffs.

worldwide database of AVE bound duties has been put together for the purpose of this study. Based on the WTO's Consolidated Tariff Schedule database, as well as on countries notifications and additional national sources, AVEs of (ad valorem and specific) bound tariffs have been calculated at the HS-6 level for all WTO members. Not yet enforced consolidation commitments are also taken into account. Special emphasis has been put on ensuring the consistency with AVE applied tariffs used.[11]

Applied and bound protection are thus consistently and accurately measured at the HS-6 product level, making it possible to account at the same time for trade preferences, the binding overhang and the non-linearity of the formula.

Before considering any liberalisation scenario, we account for the commitments not already implemented in 2001, and for commitments made by recently acceded countries. This is done through a pre-experiment simulation. Indeed, the base year of our data is 2001, while any agreement in the Doha Round is unlikely to be enforced before year 2007 (at best). The pre-experiment simulation aims at filling this gap by taking into account planned changes in policy variables (see e.g. Francois et al., 2003). In the present case, it includes the following shocks:

- 2004 EU's enlargement. The 10 acceding countries are supposed to adopt the Common External Tariff and to face the same tariffs faced by before 2004 by the EU;

- MFA dismantling. The corresponding quota rents are removed;

- entry of newly acceded members to the WTO (among which China). Their exports are assumed to face no more than the MFN tariff, in each market (this change is also assumed to hold for Russia, Algeria and Libya, the accession of which we take as granted). Their tariffs are also liberalised according to the commitments made upon their accession, as reflected in their consolidated tariff schedules;

- full application of AGOA. In 2001, only a few African countries were qualified for benefiting from this Act, while the majority of them will be qualified in 2005. Accordingly, we adopt a simplifying assumption, by assuming that sub-Saharan African countries face a zero protection in the US market.[12]

The equilibrium of the world economy obtained as a result of this pre-experiment simulation is used as the baseline for subsequent simulations.

Except otherwise stated (i.e. in scenario (g), see below), the scenarios considered cut bound duties. This means that, for each product, the bound duty is first cut according to the formula considered. The new applied duty is then computed as the minimum between the initial applied duty and the liberalised bound duty. This means that, as indeed will be the case in any WTO agreement, applied duties are lowered only insofar as the new bound duty is low enough to be constraining. When the initial bound duty is substantially higher than the applied duty, as is often the case in developing countries, the applied duty might well remain

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[11] See Bchir et al. (2005) for details on the methodology used to compute AVE bound duties.

[12] The protection planed in AGOA is not zero for all products and this assumption may be considered as an optimistic proxy for the effect of AGOA. However, assuming 2001 level of protection to hold in 2005 would probably be worse.

unchanged. This calculation is made separately for each HS-6 product. New applied duties are then aggregated up in the model's classification.

The scenarios considered are the following (the liberalisation hypotheses are only applied to non-agricultural products, according to the WTO definition, and only between WTO member countries):

(a) Peaks elimination: peak tariffs in non-agricultural products, i.e. *ad valorem* equivalent tariffs above 15%, are replaced by a 15% AVE tariff.

(b) Complete liberalisation: tariffs are completely removed for all non-agricultural products.

(c) Girard 0.65: Girard's proposal, coefficient B=0.65.

(d) Girard 1: tariff cut according to the formula included in Girard's proposal, using a coefficient B=1.

(e) Girard 2: Girard's proposal, coefficient B=2.

(f) Girard 1+SDT: Special and differential treatment introduced in scenario (d). In the Girard formula applied to tariffs of developing countries having consolidated at least 35% of their tariff lines, the coefficient B takes the value B= 2.

(g) Girard 1 on applied tariff: Applied (rather than bound) tariffs are cut according to the formula of scenario (d).

Scenario (a) corresponds to "eliminating excessive protection", in the words of Hoekman *et al.* (2002). Scenario (b) is given for the sake of comparison.

The last four scenarios correspond to variants of the tariff-cutting formula proposed by Ambassador Girard (WTO, 2003b). This formula is defined as:

$$T_1 = \frac{B \times t_a \times T_0}{B \times t_a + T_0}$$

Where T_0 and T_1 refer respectively to the initial and final base duty. *B* is a coefficient common to all countries, and t_a is the simple average of *ad valorem* equivalent base rates across non-agricultural products. “Base rates” are defined as bound rates or, for unbounded duties, as twice the MFN applied rate (with a minimum of 5%). For initially unbound duties, this formula thus entails both binding protection and lowering the level of the binding. An, importance and original device of this formula is that, for a given initial base rate, the higher the initial average protection level in a country (as measured through base rates), the lesser the tariff cut applied.

In accordance with July 2004 Framework Agreement (WTO, 2004, Annex B, paragraphs 6 and 9), we assume in each scenario that LDCs and countries with binding coverage of non-agricultural tariff lines of less than 35% should not be required to liberalise their market access. The Agreement states that they shall only be required to commit to extend their level

of binding commitments,[13] but this should not have any direct impact on their level of applied duties.

In order to keep the model tractable and to allow for a large regional breakdown, we limit our analysis to 20 sectors, with a focus on non-agricultural goods, in particular in those where huge swings in protection levels have to be expected (such as wearing or leather). 22 regions are considered: the EU-25, the US, Japan, Canada, Mexico, ANZCERTA, Argentina, Brazil, China, India, Korea, the Tigers, South Asia, Hong-Kong Taiwan and Singapore, SACU, the rest of sub-Saharan African countries (hereafter SSA), the Maghreb, Russia, EFTA, Turkey, and the rest of the world[14] (see details in Appendix 1).

Initial average protection for these regions in our benchmark (*i.e.* after the pre-experiment changes) is shown in Table 1. Three groups of exporters, respectively industrialised, intermediate and poorest countries, are considered separately while measuring this average protection. Differences in protection faced by these three groups may be linked to preferential agreements, to differences in unit values (which influence the AVE of specific tariffs[15]) and to difference in export specialisation.[16]

Without any exception, protection is higher in textiles-wearing-leather-shoes (hereafter referred to as textiles-wearing, for the sake of simplicity) than in the rest of non-agricultural products, whatever the country and the group of partners. Protection in this sector is seldom inferior to 10%, and frequently above 15%. In a given market, developing countries rarely face a lower protection than rich ones. In several instances, on the contrary, protection faced by developing countries is higher; this is due both to their specialisation in low unit value exports (for which specific tariffs have a higher AVE), and in product on which protection is higher (of course, this is likely to be endogenous). This also reflects the fact that many preferential schemes granted to developing countries exclude a large share of textile-wearing products.

For other non-agricultural products, protection in industrialised countries is very low (in most cases below 4%), in particular with respect to the poorest ones,[17] although the differences across partners remain limited. The contrast is strong with developing countries, which apply quite substantial protection for these products. Average protection in other industrial products outreaches 10% in Argentina, Brazil, Maghreb, SSA, South Asia, and is as high as almost 30% in India. It is also worth mentioning that widespread preferential schemes (such the GSP, as well as special scheme for LDCs) are reflected by a significantly lower level of protection faced by developing countries exporters in the markets of rich countries (in particular in the Quad).

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[13] The July 2004 Framework Agreement also allows developing countries to benefit from a special and differential treatment, by defining a list of products for which lesser commitments will be made. Given the difficulty to figure out the products retained in practice when using this additional flexibility, this clause is not taken into account here.

[14] The rest of the world is treated similarly to other regions in terms of tariffs, since we have information on roughly all countries (208 in total).

[15] Note however that specific duties are not current in non-agricultural products, especially outside the textile-clothing sector, except in Switzerland, Sri Lanka and Thailand. See e.g. Bacchetta and Bora (2003, 2004).

[16] As mentioned above, sector specialization is accounted for here through the export structure of the exporting country toward the reference group of the importing country.

[17] ANZERTA stands as a clear exception to this rule, due to its substantial protection in products of interest for poor countries.

In sum, average protection is clearly inferior in industrialised countries than in developing countries, and higher in the poorest countries. Beyond this general pattern, the Maghreb[18] and most of all India stand as the most protectionist areas.

Table 1: Initial average protection for non-agricultural products (AVE tariff duty, %)

		Textile-wearing, from:				Other industrial prod., from:			
		Industrialised ctries	Developing ctries	Poorest ctries	world	Industrialised ctries	Developing ctries	Poorest ctries	world
Industrialised ctries		**8.0**	**7.5**	**5.2**	**7.5**	**2.3**	**1.0**	**0.7**	**2.0**
of which:	EU25	8.1	6.7	3.2	6.7	2.6	0.9	0.3	2.1
	Japan	9.3	9.5	5.9	9.2	0.6	0.2	0.5	0.5
	US	9.1	10.3	12.3	9.7	1.7	0.9	1.3	1.6
	ANZCERTA	13.1	16.1	16.3	14.3	3.7	3.2	2.7	3.6
	Canada	11.2	12.6	14.6	11.9	2.3	0.8	1.3	2.1
	EFTA	0.9	4.1	4.3	2.2	0.5	1.3	5.5	0.6
	HKTaSgp	2.5	2.9	3.1	2.7	3.1	1.7	1.1	2.9
	Korea	10.6	11.4	10.8	10.9	4.8	4.4	4.6	4.8
Developing ctries		**14.3**	**19.3**	**15.8**	**15.4**	**8.7**	**10.4**	**11.4**	**8.9**
of which:	Argentina	19.4	18.4	19.7	19.1	13.1	11.9	12.8	12.9
	Brazil	18.4	18.2	17.1	18.3	13.1	12.3	11.9	13.0
	China	10.7	11.1	8.8	10.7	6.7	6.6	7.0	6.7
	INDIA	30.4	30.5	22.9	30.3	28.1	31.0	29.4	28.6
	Maghreb	46.7	73.6	37.6	51.2	15.4	17.0	17.5	15.6
	Mexico	15.6	27.1	27.7	19.5	8.8	13.0	14.2	9.4
	Row	9.4	14.3	15.9	10.8	5.9	6.8	7.2	6.0
	RSAm	13.0	12.9	12.8	13.0	8.1	8.1	7.7	8.1
	Russia	14.7	16.1	16.1	15.2	10.1	9.0	10.4	10.0
	SACU	25.0	27.5	24.6	25.8	6.1	6.3	3.6	6.1
	Tigers	14.0	15.1	11.8	14.2	9.2	10.3	7.0	9.3
	Turkey	4.9	12.3	7.9	6.1	1.3	4.7	2.5	1.8
Poorest ctries		**20.7**	**23.6**	**25.7**	**21.8**	**11.3**	**12.3**	**11.9**	**11.4**
of which:	AFR	24.6	24.1	24.7	24.4	10.8	11.6	13.6	10.9
	SouthAsia	19.7	23.4	27.7	21.0	11.5	12.5	11.2	11.7
	World	10.1	8.5	5.8	9.1	3.8	2.3	2.7	3.5

Source: MAcMap database, authors' calculations.

Note: Row headings indicate markets, country groups in column indicate exporters. "DCs" refers to developing countries, other than those included in the "poorest" group. Calculation based on specific tariffs converted using reference groups unit values (see text for details).

[18] The Maghreb includes Algeria, Libya and Egypt, which are not WTO members. However, these countries trade relatively little, and as a consequence their protection is weakly weighted when calculating the average for the whole region.

Given these large initial disparities in protection patterns, the liberalisation scenarios considered have quite different implications across countries (Table 2; more detailed results are given in Appendix 3). Note first that, due to special provisions for LDCs and countries with low scope of binding, SSA and South Asian countries are almost entirely exempted from undertaking any liberalisation, whatever the scenario.

Tariff peaks elimination has virtually no impact on industrialised countries' protection, except in textile-wearing in Canada, the US and ANZCERTA. In developing countries, tariff peaks removal mainly results in lower protection in textiles and wearing. The only regions[19] where the impact is important are the Maghreb and India.[20]

Applying the Girard formula with a coefficient B=1 has a more widespread impact on protection. In developed countries, average protection for industrial products is approximately halved, with a stronger cut in textiles-wearing, for which the harmonising effect is significant. The decline on average tariff duties is weaker in relative terms in developing countries, but it is stronger in absolute terms. This tariff-cutting formula also entails a strong harmonising effect across developing countries, especially in textiles-wearing, where the resulting average protection does not exceed 20%, except in India and Maghreb.

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[19] However, had SSA and South Asia not been exempted from any commitment, the impact would also be significant (around three percentage points) for these two regions.

[20] Noteworthily, the average tariff duty resulting from tariff peaks removal remains superior to 15% in India for textiles and wearing. This is because some of the products included in these GTAP sectors are classified in the WTO nomenclature as agricultural products, and accordingly excluded from the liberalization scenario considered here.

Table 2: Resulting average protection level for non-agricultural products, by liberalisation scenario and by market (AVE applied tariff duty, %)

		Initial base tariff	Initial applied Tarif	(a) Peaks elimination	(b) Total liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(g) Girard 1, on applied tariffs
Industrialised ctries		**4.5**	**2.5**	**2.3**	**0.0**	**1.0**	**1.2**	**1.5**	**1.1**
of which:	EU25	4.0	2.6	2.6	0.0	1.1	1.4	1.7	1.3
	Japan	1.5	1.2	1.2	0.0	0.4	0.5	0.7	0.5
	US	2.6	2.2	2.1	0.0	0.7	0.9	1.1	0.8
	ANZCERTA	11.4	4.5	4.1	0.1	2.8	3.2	3.5	2.5
	Canada	4.2	2.9	2.8	0.0	1.2	1.4	1.7	1.3
	EFTA	6.5	0.8	0.4	0.0	0.2	0.3	0.3	0.2
	HKTaSgp	8.9	2.9	1.6	0.0	0.8	0.9	1.0	0.7
	Korea	13.2	5.3	5.3	0.1	3.3	4.0	4.9	3.1
Developing ctries		**23.2**	**9.5**	**7.3**	**1.2**	**6.3**	**7.1**	**8.0**	**6.0**
of which:	Argentina	32.9	13.3	11.8	0.3	10.5	12.2	13.3	9.1
	Brazil	30.8	13.5	11.5	0.2	10.0	11.7	12.9	8.9
	China	8.1	7.1	6.4	0.2	2.9	3.6	4.7	3.5
	INDIA	41.0	28.7	13.6	1.0	15.1	18.9	24.4	16.5
	Maghreb	36.8	19.0	10.1	0.3	13.2	15.6	16.9	13.3
	Mexico	35.3	10.0	8.1	0.4	7.8	8.9	9.6	6.8
	Row	30.1	8.5	7.9	1.4	7.1	7.6	8.0	6.2
	RSAm	20.8	6.4	6.1	4.2	5.8	6.0	6.1	5.6
	Russia	20.7	10.3	9.4	0.1	7.7	8.9	9.8	6.5
	SACU	17.6	7.5	5.4	0.2	3.7	4.2	4.9	3.5
	Tigers	23.8	9.7	6.1	0.2	5.1	5.8	6.5	4.8
	Turkey	13.7	2.2	1.9	0.1	1.7	1.9	2.0	1.5
Poorest ctries		**30.5**	**12.2**	**12.1**	**11.9**	**12.1**	**12.1**	**12.1**	**12.0**
of which:	AFR	36.1	11.7	11.5	11.1	11.4	11.4	11.5	11.4
	SouthAsia	28.2	12.5	12.4	12.2	12.3	12.4	12.4	12.3
World		**8.5**	**4.0**	**3.4**	**0.4**	**2.2**	**2.5**	**2.9**	**2.2**

Source: MAcMap database, authors' calculations.
Note: For details about scenarios implementation, see text. Scenario (f) is not reported, but its results can be inferred directly from scenarios (d) and (e).

The impact of such tariff-cutting formula on applied protection strongly depends on the extent of the initial binding overhang. As emphasised above, applied tariffs are only lowered insofar as the liberalised bound tariff becomes inferior to the initial applied tariff. The extent to which the cuts in bound duties are actually transmitted to applied duties is illustrated by comparing the impact of the standard Girard formula (coefficient B=1, scenario (d)), with the same formula, but cutting directly applied duties (scenario (g)). This does not make a significant difference as far as developed countries are concerned, except for Korea. For developing countries, in contrast, cutting directly applied duties delivers far deeper liberalisation, thus showing by contrast that the rather large initial binding overhang significantly dampens the

impact of the tariff-cutting formula. For intermediate countries as a whole, a Girard formula cutting directly applied tariffs would lower average applied protection in industrial products by 3.5 percentage points (6.1 points in textiles-wearing, 2.7 points in other products), while the cut only reaches 2.4 points (4.7 points in textile-wearing, 1.7 points elsewhere) when the formula is applied to bound tariffs. For some countries, the binding overhang absorbs the bulk of the liberalising effect of the formula. For Argentina, for instance, applied protection is cut by 1.1 points with the Girard formula, while it would be cut by 4.2 points if the formula was cutting directly applied tariffs. The situation is similar for Brazil.

How much difference does choosing a different B coefficient make, in applying the Girard formula? The answer is that the higher initial average protection (and hence the coefficient t_a used in the formula), the higher the sensitivity of the result with regard to this coefficient. For rich countries, the low initial average protection rate in non-agricultural products implies that the outcome hardly depends on the value of B. This is far from being the case for developing countries, and in particular for countries such as India, the Maghreb countries, as well as Argentina and Brazil. India is the extreme case: while a Girard formula using B=0.65 almost halves average protection, using B=2 instead cuts initial applied duties by less than 15% on average.

Noteworthily, tightening the formula by lowering the B coefficient from 1 down to 0.65 makes a difference of comparable importance, for most developing countries, as the switch from 2 to 1. While a limited liberalisation is largely absorbed by the binding overhang (the cut in applied tariffs is far lesser than in bound tariffs), this is not true of additional liberalisation. This magnifies the link between tightness of liberalisation and balance between developed and developing countries.

4. SIMULATION RESULTS

The scenarios considered have widespread and contrasted impacts. In order to be as specific as possible, we will focus the comments in a first step on the impact of a Girard formula with coefficient B=1 (scenario (d)). The analysis will then be extended to the other scenarios.

The impact of applying the Girard formula with coefficient B=1

Multilateral liberalisation is generally expected to increase import prices, at least for these products experiencing the largest liberalisation. Lowered trade barriers increase the world demand for imports, therefore inducing an upward pressure on their price. This is not the case here as a result of applying the Girard formula with coefficient B=1 (Table 3). On the contrary, world import prices decline for most industrial products, and in particular for textiles, wearing and motor vehicles, which are among the most protected industrial products around the world. The extent of the international division of labour in place in most industrial sectors helps explaining this finding. Imported intermediate inputs account for a substantial share of total cost for many products. Lowered tariff duties thus mean, for most producers, cheaper intermediate inputs, hence lower production cost.[21] When imports prices are only

[21] Arguably, the tariff escalation observed in many cases is likely to dampen the extent of this mechanism. Although tariffs are measured at a very detailed level, the social accountancy matrices used are rather aggregated. It is thus likely that tariff escalation is poorly measured here.

measured based on the price of value added, the broad picture is reversed: in accordance with the standard theoretical analysis, the prices of value added[22] incorporated in world imports is increased for all industrial sectors. This price increase is very moderate, though, not exceeding 0.35% except for textiles, wearing, leather and electronics, and reaching 0.45% as a maximum (for electronic products).

These price changes lead to a slight terms of trade improvement for industrialised countries (+0.07% on average), benefiting in particular Asian developed countries (+0.49% in Japan, +0.46% in Korea, +0.29% for Hong Kong-Taiwan-Singapore), and despite a slight deterioration in North America (-0.25% in Canada, -0.24% in the US). In contrast, the deterioration of terms of trade is general for developing countries, with the only exception of China and Russia, although its extent is limited (-0.10% for intermediate countries). As a result of their high initial level of protection India (-1.61%) and Maghreb (-0.83%) experience the largest deteriorations.

[22] This calculation is made here based on the value added by the exporting sector, i.e. by the value added of the last production stage. A more complete calculation is of course possible, but it is very demanding in terms of computation. In addition, carrying out such a calculation based on the data used here would lack accuracy, since the data does not take into account, for each sector, the difference in import ratio between final and intermediate goods.

Table 3: Impacts of applying the Girard proposal (with coefficient B=1) on world import prices, as measure through output and value added prices, and impact on industrial exports (% change)

		world import prices		
		measured through output prices	measured through value added prices	World exports
Primary				
of wich:	Progcrops	-0.10	-0.04	0.5
	OtherAg	-0.02	0.09	1.2
	Livestock	-0.01	0.05	0.4
	Primary	-0.07	0.08	1.6
Manufacturing				
of wich:	Textiles	-0.26	0.38	11.0
	Wearing	-0.42	0.38	16.7
	Leather	-0.13	0.36	9.5
	WoodPap	-0.07	0.08	1.0
	Chem	-0.02	0.18	3.2
	FerMetals	0.08	0.23	1.2
	MetalsNec	-0.12	0.13	2.2
	MetalProd	0.06	0.21	2.3
	MotorVeh	-0.24	0.19	6.8
	TrspEqNec	-0.04	0.12	1.2
	Electronic	0.25	0.45	-0.3
	Machinery	0.05	0.19	1.5
	OtherManuf	-0.05	0.20	2.7
Services				
of wich:	ServOth	0.09	0.17	0.1
	Transp	0.02	0.13	0.1
	BusServ	0.07	0.12	0.0

Source: Authors' simulations.

Note: The world GDP price is used as the numeraire. For each sector, the average price of value added incorporated in imports is calculated as the average of value added prices across producing countries, weighted by world exports. All prices indices are computed as Fischer indices.

Given the trade balance constraint, changes in industrial imports and exports are closely linked. Industrial trade is strongly increased in those countries where initial protection is high, such as India, Maghreb and SACU. It is also significantly raised in countries with a strong competitive position in industrial products taken as a whole, in particular China, Japan and Korea. SSA and South Asia, mostly gathering countries exempted from any requirements, do not experience any significant increase in industrial imports. But they do not either benefit from any increase in industrial exports; on the contrary, their industrial exports are slightly decreased. Indeed, these countries initially benefit from widespread preferential scheme on their main markets, either targeted on Africa (by the EU under the Cotonou Agreement, by the US under the AGOA) or targeted on LDCs, as mentioned previously. For these two regions, multilateral liberalisation does not involves much improvement in market access, it is most of all synonymous of eroded preferences.

EFTA, Turkey, Canada and Mexico are characterised by very weak or negative import creation. Involved in a deep preferential trade arrangement with a large neighbour, these countries had already largely opened their domestic market for industrial products. Since these arrangements are reciprocal, the mirror image of this effect is a low increase or even a decrease in industrial exports, since multilateral liberalisation entails for these countries an erosion of preferences on their main export market.

Table 4: Impacts of applying the Girard proposal (with coefficient B=1) on industrial added value, industrial exports, industrial imports, terms en trade and welfare (% change)

		Industrial added value	industrial exports	industrial imports	Terms of trade	Wefare
Industrialised ctries		**0.04**	**2.85**	**2.80**	**0.07**	**0.04**
of which:	EU25	-0.00	2.90	3.59	0.09	0.03
	Japan	0.34	4.07	5.01	0.49	0.14
	US	-0.07	2.92	2.51	-0.24	0.01
	ANZCERTA	0.29	7.98	3.90	0.04	0.15
	Canada	-0.57	-0.92	-0.10	-0.25	-0.06
	EFTA	-0.44	0.34	0.93	-0.05	0.02
	HKTaSgp	1.18	2.81	1.50	0.29	0.11
	Korea	0.66	4.45	5.66	0.46	0.35
DC		**-0.01**	**3.95**	**4.29**	**-0.15**	**0.03**
of which:	Argentina	-0.14	2.60	2.28	-0.09	-0.00
	Brazil	-0.41	2.71	3.34	-0.28	-0.02
	China	0.61	5.97	8.74	0.04	-0.37
	INDIA	0.13	10.93	15.12	-1.61	-0.15
	Maghreb	-6.53	8.92	6.02	-0.83	1.96
	Mexico	-0.24	0.24	0.75	-0.34	-0.02
	Row	-0.58	-0.08	0.92	-0.20	-0.02
	RSAm	-0.03	3.56	1.88	-0.11	-0.03
	Russia	-0.16	2.69	2.72	0.05	0.14
	SACU	0.02	7.20	7.74	-0.13	0.09
	Tigers	1.00	3.89	4.79	-0.01	0.17
	Turkey	-0.18	-0.21	0.32	-0.09	0.04
Poorest		**-0.38**	**-0.57**	**0.14**	**-0.12**	**-0.02**
of which:	AFR	-0.46	-1.04	0.16	-0.15	-0.04
	SouthAsia	-0.27	-0.05	0.07	-0.03	-0.00
World		**0.03**	**3.15**	**3.19**	**-0.00**	**0.04**

Source: Authors' simulations.

On the whole, the increase in world trade in industrial products is rather weak (+3.2% on average). Quite strikingly, it is concentrated in a handful of sectors: wearing (+16.7%), textiles (+11.0%), leather (+9.5%), motor vehicles (+6.8%) and chemicals (+3.2%) are the only sectors where world exports are increased by more than 3%. However, these rather low

aggregate figures hide in some cases a significant reshuffling of industrial activity world-wide, in particular for the above-mentioned sectors. In the wearing sector, for instance, Asian countries strongly benefit from the liberalisation, with a value added in this sector increased by 12 to 18% in China, the Tigers, Korea, and Hong Kong-Taiwan-Singapore, and by almost 20% in India. In contrast, value added in the wearing sector is halved in Maghreb countries, and it is reduced by more than 10% in Canada and in Mexico. Here again, the erosion of preferences is the main reason for this sharp downsizing of the wearing sector, which would require from Maghreb economies in particular a substantial adjustment. In textiles, the so-called Dragoons (Korea, Hong Kong, Taiwan and Singapore) record a substantially increased value added, mainly at the expenses of Canada, SACU, ANZCERTA and Mexico. In the leather-shoes sector, valued added is increased by 11% in China and by 9% in the Tigers, while a steep decrease is observed in Japan and SACU, and to a lesser extent in South Asia, Canada, Russia and the US. The motor vehicles sector also experiences substantial changes, with Korea and Japan, already large producers initially, increasing their value added by 12% and 8% respectively. In contrast, value added in this sector declines by more than 25% in Hong Kong-Taiwan-Singapore, and by 15% in the Tigers. In this reshuffling of industrial market shares, Asian countries thus play a prominent role, illustrating the strong offensive interests of China and the Tigers in light industry, and of Korea and Japan in motor vehicles.

As measured through equivalent variation, world-wide income gains appear to be very limited (+0.04%). Among developed countries, Asian countries are the main gainers, which does not come as a surprise given their strong competitive positions in the world trade of industrial products. These gains mainly stem from an improved access to export markets, entailing sizeable terms of trade gains, as illustrated by the decomposition of welfare gains (see Appendix 5). "Offensive interests" are thus dominant here, in particular as far as Asian developed countries are concerned. The number of domestic firms generally raises, thus increasing the variety of goods available to the consumers, who in addition also benefit from an easier access to foreign goods (although this effect is weak, due to the limited magnitude of initial protection). In the production of non-agricultural goods characterised by increasing returns to scale, increased output also translates into efficiency gains. Canada is the only looser among developed countries, due to deteriorated terms of trade, stemming for eroded preferences in North American markets.

Among developing countries, the outcome is far more contrasted. Maghreb countries enjoy a strong income gain (almost +2%), and Russia, SACU, the Tigers and Turkey record slight gains. However, all other developing countries suffer from an income loss as a result of this liberalisation, in most cases due to a deterioration of their terms of trade. Although these losses are of a low order of magnitude, this result is quite striking, in particular in contrast with the one observed for developed countries.

The results for India and Maghreb might seem puzzling. While these regions are the two most protectionist ones and present some similarities in their exports structure (strongly oriented toward textiles and clothing), they exhibit opposite outcomes: India features as the greatest looser, whereas Maghreb is the greatest winner.[23] This explanation is mainly twofold. Firstly, liberalisation entails higher consumer gains in Maghreb because initial protection is very inefficient, with not only a high average level, but also a strong contrast across products and

[23] It should be noted in addition that Maghreb region is an heterogenous region. Algeria and Lybia are not WTO members and exhibit high protection level. Even though Morocco and Tunisia account for the bulk of the region's foreign trade, this might blur the analysis.

partners. Liberalisation thus entails strong allocative efficiency gains for Maghreb countries (+1.7% of equivalent variation), which is far less the case for India (+0.3%). Secondly, the adjustment in India entails a large output decrease in several fragmented sectors (chemistry, ferrous and metals products, other metal products, motor vehicles, other transport equipment and wood and paper). Since these are sectors where adjustment takes place mainly through changes in the number of firms and varieties, this leads to a large decrease in the number of domestic varieties, with negative consequences for consumers' surplus (-0.3% of equivalent variation is due to factors other than terms of trade and allocative efficiency).

The income loss observed for China is an unexpected result, given the strong offensive interests of the Chinese economy in the industrial sector, as illustrated by the increased value added in this sector, when trade is liberalised in our central scenario. But the country's does not earn any significant terms of trade gains, because of the tough price competition between developing countries (most of which experience a depreciation of their real exchange rate) faced in its main export sectors (textile and clothing in particular). Meanwhile, China is reducing its output in numerous sectors where the previously protected domestic industry was offering a large number of varieties. The specialisation in other sectors is associated with a more limited number of varieties, hence explaining the welfare loss. Relying on perfect competition would make this effect vanish, as we will check below.

Comparing the outcome under various scenarios

A complete liberalisation of trade in non-agricultural products (scenario (b)) would increase world trade in volume by 9% (Appendix 3). This is six times as much as the increase resulting from tariff peaks elimination, and approximately three times more than under the Girard proposal. The differences of outcomes across the Girard proposal's application with different B coefficients remains limited at the world level: world trade is increased by 4% with a coefficient 0.65, by 3% with a coefficient equal to unity, and by 2% with a coefficient B=2. Lastly, applying the liberalisation formula on applied tariffs rather than on bound tariffs leads to an overestimation of the trade creation effects of the liberalisation in the ranges of 20%.

The distribution of industrial import creation across countries closely follows the hierarchy of initial protection: highest import increases are recorded in Maghreb and in India (with respectively a 48% and 45% increase in volume following complete liberalisation). Argentina and Brazil record a 28% and 23% trade increase, respectively. Logically, these high-protection countries are also those where the choice of B coefficient in the Girard formula matters most. Indian imports increase by 16% in volume with B=0.65, to be compared to 4% only for B=2. South Korea and ANZCERTA are the only developed regions where the import surge reaches a magnitude in line with what is recorded for developing economies. On the whole, the largest trade increases are recorded for intermediate developing countries: 13% with complete liberalisation, to be compared with 7% for industrialised countries. Under this benchmark scenario, the volume of exports of the poorest countries would however decline by 1%. Only a liberalisation limited to an elimination of the tariff peaks would allow these countries to increase their exports.

Since the current balance is held constant, the impacts observed on exports are necessarily closely linked to those on imports (Appendix 4). Any ex-ante import surge over and above the export increase would entail real depreciation, hence further (industrial and agricultural) export growth. This is why strong export growth is recorded in countries such as India and the

Maghreb, and not because liberalisation would ex-ante create a strong increase in the foreign demand addressed to their products.

A complete liberalisation translates into a 0.6% increase in the terms of trade of industrialised countries (Table 5). In contrast, developing countries record a 1.3% deterioration and LDCs a 0.6% deterioration. Accordingly, the results of our central scenario are magnified. With a coefficient 0.65 for the Girard formula this impact is smoothed (resp. +0.1 / -0.3 / -0.2), and even more with a coefficient 2 (resp. – 0.0 / +0.0 / - 0.1). Lastly, introducing a SDT (scenario (f)) profoundly modifies the results for intermediate developing countries: their terms of trade are slightly improved in this case, in particular to the benefit of Argentina, China, Russia and the Tigers. Countries that were facing large terms of trade worsening, such as India, also sharply limit their loss.

Table 5: Impacts on terms of trade, by region (% change)

		(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(f) Girard 1 + SDT	(g) Girard 1, on applied tariffs
Industrialised ctries		**0.16**	**0.61**	**0.14**	**0.07**	**-0.01**	**-0.04**	**0.15**
of which:	EU25	0.25	0.81	0.17	0.09	0.01	-0.03	0.24
	Japan	0.23	1.58	0.67	0.49	0.29	0.37	0.63
	US	0.08	-0.01	-0.21	-0.24	-0.25	-0.31	-0.19
	ANZCERTA	0.22	-0.25	0.01	0.04	0.07	-0.01	-0.09
	Canada	-0.01	-0.29	-0.26	-0.25	-0.21	-0.27	-0.23
	EFTA	-0.01	0.11	-0.04	-0.05	-0.07	-0.09	-0.02
	HKTaSgp	0.12	1.20	0.43	0.29	0.12	0.13	0.39
	Korea	0.25	0.96	0.52	0.46	0.40	0.30	0.46
DC		**-0.35**	**-1.33**	**-0.31**	**-0.15**	**0.02**	**0.08**	**-0.34**
of which:	Argentina	-0.28	-2.25	-0.38	-0.09	0.09	0.13	-0.61
	Brazil	-0.48	-2.49	-0.61	-0.28	-0.00	0.06	-0.76
	China	-0.05	-0.53	-0.07	0.04	0.21	0.35	0.03
	INDIA	-3.22	-5.99	-2.43	-1.61	-0.47	-0.42	-2.22
	Maghreb	-1.92	-4.28	-1.32	-0.83	-0.57	-0.56	-1.34
	Mexico	-0.34	-1.93	-0.53	-0.34	-0.16	-0.16	-0.57
	Row	-0.19	-1.26	-0.31	-0.20	-0.11	-0.10	-0.39
	RSAm	-0.24	-1.90	-0.25	-0.11	0.02	0.04	-0.48
	Russia	-0.15	-0.65	-0.03	0.05	0.10	0.16	-0.17
	SACU	0.10	-0.50	-0.15	-0.13	-0.18	-0.16	-0.30
	Tigers	-0.28	-0.79	-0.11	-0.01	0.11	0.18	-0.14
	Turkey	0.05	-0.36	-0.13	-0.09	-0.02	-0.03	-0.13
Poorest		**-0.09**	**-0.56**	**-0.18**	**-0.12**	**-0.05**	**-0.06**	**-0.17**
of which:	AFR	-0.09	-0.63	-0.21	-0.15	-0.08	-0.09	-0.22
	SouthAsia	-0.07	-0.34	-0.09	-0.03	0.05	0.02	-0.03
World		**-0.00**	**-0.02**	**-0.01**	**-0.00**	**-0.00**	**-0.00**	**-0.01**

Source: Authors' simulations.

Terms of trade effects are thus detrimental to developing countries when liberalisation is significant, while this is not the case for lesser tariff cuts. This results from the association of an initial high protection level, with a significant binding overhang.

Beyond a certain tariff cut, any further liberalisation is almost directly transmitted to applied duties, even in developing countries. In this case, the higher initial protection rate of developing countries translates into larger tariff cuts in absolute terms, as compared to developed countries. Liberalisation then entails for developing countries higher ex-ante import than export creation. A real depreciation is therefore necessary in order to maintain the current account balance. But many developing countries share a similar specialisation, with in particular the textile-clothing sector playing a key role. In addition, their export products belong to the same quality range, which is reflected in our model through a higher substitutability between each other. As a result, developing countries exporters are close competitors one to the other. This means that the real depreciation of other developing

countries reduces substantially the competitive advantage each country draws from its own depreciation, hence the need for further depreciation.

Such terms of trade loss is expected for these net industrial importers with a high initial protection level, like Maghreb and India, as well as for Argentina, Brazil and Mexico to a lesser extent. As a result of this increased competition between developing countries, however, even countries such as China or the Tigers also suffer from terms of trade deterioration when one implements ambitious scenarios such as the Girard proposal with coefficient 0.65 or full liberalisation.

Table 6: Impacts on welfare, per country (equivalent variation, % change)

		Initial level (GDP)	(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(f) Girard 1 + SDT	(g) Girard 1, on applied tariffs
Industrialised ctries		**2415**	**0.04**	**0.15**	**0.05**	**0.04**	**0.03**	**0.02**	**0.06**
of which:	EU25	765	0.05	0.16	0.05	0.03	0.01	0.01	0.06
	Japan	401	0.05	0.33	0.17	0.14	0.10	0.12	0.16
	US	1009	0.02	0.05	0.01	0.01	0.00	-0.01	0.02
	ANZCERTA	39	0.16	0.13	0.15	0.15	0.14	0.13	0.12
	Canada	66	0.00	-0.10	-0.07	-0.06	-0.05	-0.07	-0.06
	EFTA	39	0.05	0.07	0.02	0.02	0.02	0.01	0.03
	HKTaSgp	52	0.11	0.67	0.20	0.11	0.01	0.01	0.18
	Korea	43	0.18	0.63	0.41	0.35	0.29	0.26	0.35
DC		**572**	**0.04**	**-0.50**	**-0.02**	**0.03**	**0.07**	**0.08**	**-0.03**
of which:	Argentina	26	-0.02	-0.51	-0.05	-0.00	0.01	0.02	-0.10
	Brazil	46	-0.05	-0.54	-0.08	-0.02	0.02	0.03	-0.11
	China	115	-0.13	-0.86	-0.44	-0.37	-0.27	-0.25	-0.39
	INDIA	47	-0.38	-1.11	-0.27	-0.15	-0.02	-0.01	-0.20
	Maghreb	23	2.18	1.02	1.91	1.96	1.94	1.94	2.01
	Mexico	62	0.03	-0.48	-0.03	-0.02	-0.01	-0.01	-0.04
	Row	100	0.00	-0.32	-0.05	-0.02	0.00	0.00	-0.07
	RSAm	58	-0.03	-0.62	-0.06	-0.03	-0.00	0.00	-0.13
	Russia	30	0.00	-0.02	0.15	0.14	0.11	0.15	0.10
	SACU	11	0.21	-0.21	0.09	0.09	0.06	0.06	-0.01
	Tigers	42	-0.07	-0.78	0.08	0.17	0.29	0.36	0.05
	Turkey	14	0.05	0.03	0.04	0.04	0.05	0.05	0.04
Poorest		**30**	**0.00**	**-0.09**	**-0.04**	**-0.02**	**-0.01**	**-0.02**	**-0.03**
of which:	AFR	20	0.01	-0.11	-0.05	-0.04	-0.02	-0.03	-0.05
	SouthAsia	10	-0.02	-0.06	-0.01	-0.00	0.02	0.01	0.00
World		**3017**	**0.04**	**0.03**	**0.04**	**0.04**	**0.03**	**0.03**	**0.04**

Source: Authors' simulations.

Note: Initial levels are expressed in tens of billions of 2001 US dollars.

As evidenced by a welfare gains decomposition, this terms of trade deterioration plays a key role in explaining the welfare losses found for many developing countries as soon as an ambitious liberalisation is undertaken, and for almost all of them when liberalisation is complete. Although positive in most cases, allocative efficiency gains do not counterbalance this loss.

Accordingly, the comparison of scenarios (a) to (e) points out the more uneven impact of more ambitious liberalisation scenarios. India is a good illustration of this: the welfare loss is –0.15% in our central scenario. It doubles when we use a parameter 0.65 instead of unity in the Girard formula. It is even four times as large with a complete liberalisation, whereas the welfare loss becomes negligible with a coefficient 2 in the Girard formula. This highly uneven

distribution of welfare changes among countries and across scenarios will therefore lead to challenging issues for negotiators, if the objective of an ambitious round favouring development is to be pursued.

Finally, it is noteworthy that, even though almost all of them are exempted from any liberalisation commitment, SSA countries are adversely affected in welfare terms in all scenarios, with the exception of the tariff peaks elimination. This loss, of limited amount, is the result of preference erosion (in particular for textiles and clothing in the EU and US market), and of the relative price decline of their main export products (primary and agricultural products).

5. SENSITIVITY ANALYSIS

The type of broad assessment carried out in the previous sections calls for a careful sensitivity analysis. In what follows, we use as a baseline the results obtained in the simulation of the Girard proposal (coefficient 1) described above (scenario (c)).

The first issue is trade elasticities. The values used in our benchmark simulations are those used in the GTAP model[24] (Hertel, 1997). As pointed out for instance by Harrison et al. (1997), differences in (Armington type) substitution elasticities strongly influence the assessed impact of multilateral liberalisation, in terms of trade but also of welfare, and it is arguable whether higher elasticities should not be used. To test for the sensitivity of the results in the present case, an alternative simulation is carried out using doubled values for all substitution elasticities between products in the model. A back of the envelope calculation would double the change in world exports if one doubles the elasticity.

The impact on world import prices of such change is negligible in most non-agricultural sectors. The exception is labour-intensive products initially highly protected: textiles, wearing, leather, where doubling the elasticity translates into larger price increases than in the central scenario. This larger response of trade flows translates into more contrasting changes in industrial value added: higher increases in ANZCERTA, Hong Kong-Taiwan-Singapore, Korea, China and the tigers; steeper decreases in Southern America and poor countries. This change in the parameterisation of the model accordingly slightly magnifies the uneven nature of the welfare changes across regions, with a more favourable outcome for intermediate countries, but a worsened impact for poor countries.

An alternative departure from our initial set of assumption is to switch from imperfect to perfect competition, while keeping the vertical differentiation of products. By getting rid of increasing returns and variety effects, the corresponding simulation (reported in the third column of Tables 7 to 9) allows several issues referred to above to be clarified. Perfect competition is associated with larger price increases than in our central scenario, and this change is the most pronounced for initially highly protected sectors, namely textiles, wearing and leather, where the price increase can be twice as large under perfect competition. Another largely impacted sector is other manufacturing, including light industries mostly exported by developing economies. Regarding welfare, abandoning the imperfect competition mostly

[24] More specifically, for each sector, the Armington elasticity of substitution used in the GTAP model to describe the sourcing choice between different origins (including the domestic one) is used here as the default value to describe the sourcing between different foreign providers.

affects China, which recovers a positive welfare change; this is consistent with the above-mentioned negative impact of the decreased number of domestic varieties in the default setting. The Tigers record a higher welfare gain. LDCs are also (even modestly) on the positive side now, and in particular African losses are wiped out.

Another possible change in the structure of the model is to get rid of the vertical differentiation of products. Our default model assumes that products are differentiated according to their origin (North, South) into two qualities (resp. low, high). One might criticise such assumption on the ground of intra-firm trade, international sub-contracting, outsourcing practices, etc. After all, one does not care where his sportswear has been produced, given it is the fashionable brand. We thus report the impact relaxing this assumption while keeping imperfect competition. This results in a significantly improved welfare gain for China, Hong Kong-Singapore-Taiwan and India; the poorest countries in South Asia and Africa are also now on the positive side. By contrast, this sensitivity analysis illustrates the role potentially played by differences in quality ranges between developed and developing countries: as long as developing countries are producing low quality goods, they are mainly competing between each other. Insofar as liberalisation results for most of them in an ex-ante negative competitive shock, the real depreciation required to maintain a balanced current account is higher, because it is shared by close competitors, thus limiting the effect of the substitution effect.

So far, we assumed capital stock to be fixed. Assuming instead that each economy's capital stock is endogenous, while the real return to capital is held constant, significantly alters the results, in relation to the ex-ante impact on the marginal productivity of capital. This results in a magnification of changes in industrial value added. At the world level, the increase in value added is twice as large with endogenous capital. The changes are the most pronounced in Asian industrialised economies. This contrasts with the negative change observed in North America. Regarding intermediate developing economies, such change of assumption magnifies the observed negative impact on value added. Argentina, Brazil and Mexico are the most affected; India, which was recording an increase in its value added now faces the opposite evolution as a result of a negative evolution of the return to capital. The poorest countries do also face additional losses, for similar reasons. In total, endogenising capital formation emphasises the uneven nature of the changes in industrial value added at the world level. In welfare terms, gains are magnified in the North (noticeably in Asia), as are welfare losses in the poorest countries. Intermediate developing economies are generally worse off, with the exception of China, the Tigers, Russia and SACU.

Finally, the results might also be sensitive to the design of the simulation exercises, and not to the structure of the model or its parameterisation. Indeed, we consider trade liberalisation in non-agricultural products alone, while negotiations concern other aspects, and in particular agricultural products. This might influence the assessment, mainly because agricultural liberalisation has an impact on trade specialisation and on the sectoral allocation of resources. In order to control this possible influence, while still focusing on the item of the Agenda we are interested in, we introduce agricultural liberalisation in the pre-experiment. All instruments of protection in agriculture (tariffs, domestic support, export subsidies) are halved in all countries in the pre-experiment. This last change hardly affects the results. Such outcome does not mean that there are no additional gains to liberalising agriculture: these gains are incorporated in the pre-experiment, not in the simulation. But the results do show that studying separately agricultural and non-agricultural product does not introduce any significant bias.

Table 7: Compared impacts on world import prices, as measure through value added prices of the Girard proposal (B=1) under different model's specifications (% change)

		Mirage	Sigma x 2	Perfect comp'n	No vertical diff'n	K endog	Mirage, after agric lib'n
Primary							
on wich:	Progcrops	-0.04	0.02	0.06	0.07	0.02	0.04
	OtherAg	0.09	0.15	0.18	0.20	0.16	0.09
	Livestock	0.05	0.11	0.11	0.12	0.12	-0.03
	Primary	0.08	0.13	0.14	0.19	0.10	0.07
Manufacturing							
on wich:	Textiles	0.38	0.53	0.65	0.67	0.45	0.40
	Wearing	0.38	0.59	0.82	0.81	0.57	0.37
	Leather	0.36	0.45	0.77	0.76	0.57	0.36
	WoodPap	0.08	0.10	0.19	0.20	0.12	0.07
	Chem	0.18	0.21	0.23	0.25	0.23	0.19
	FerMetals	0.23	0.24	0.27	0.29	0.25	0.23
	MetalsNec	0.13	0.18	0.16	0.17	0.15	0.11
	MetalProd	0.21	0.22	0.34	0.35	0.32	0.20
	MotorVeh	0.19	0.19	0.15	0.16	0.24	0.22
	TrspEqNec	0.12	0.10	0.16	0.17	0.18	0.12
	Electronic	0.45	0.50	0.57	0.59	0.51	0.43
	Machinery	0.19	0.19	0.24	0.25	0.25	0.19
	OtherManuf	0.20	0.22	0.42	0.40	0.23	0.20
Services							
on wich:	ServOth	0.17	0.18	0.24	0.26	0.24	0.17
	Transp	0.13	0.14	0.16	0.18	0.16	0.12
	BusServ	0.12	0.13	0.17	0.19	0.15	0.11

Source: Authors' simulations.

Table 8: Compared impacts on terms of trade of the Girard proposal (B=1) under different model's specifications (% change)

		Mirage	Sigma x 2	Perfect comp'n	No vertical diff'n	K endog	Mirage, after agric lib'n
Indus C		**0.07**	**0.04**	**0.04**	**0.05**	**0.06**	**0.07**
of which:	EU25	0.09	0.04	0.06	0.06	0.08	0.09
	Japan	0.49	0.38	0.40	0.43	0.48	0.53
	US	-0.24	-0.26	-0.30	-0.32	-0.25	-0.24
	ANZCERTA	0.04	0.28	0.03	0.03	0.08	-0.11
	Canada	-0.25	-0.24	-0.23	-0.20	-0.25	-0.24
	EFTA	-0.05	-0.05	-0.03	0.02	-0.05	-0.07
	HKTaSgp	0.29	0.34	0.40	0.47	0.30	0.32
	Korea	0.46	0.49	0.56	0.61	0.46	0.51
DC		**-0.15**	**-0.09**	**-0.11**	**-0.14**	**-0.14**	**-0.16**
of which:	Argentina	-0.09	-0.01	-0.12	-0.09	-0.04	-0.08
	Brazil	-0.28	-0.21	-0.22	-0.24	-0.24	-0.31
	China	0.04	0.08	0.14	0.01	0.07	0.02
	INDIA	-1.61	-1.51	-1.59	-1.82	-1.61	-1.38
	Maghreb	-0.83	-0.46	-0.84	-0.84	-0.80	-0.78
	Mexico	-0.34	-0.19	-0.36	-0.34	-0.30	-0.34
	Row	-0.20	-0.16	-0.15	-0.09	-0.16	-0.19
	RSAm	-0.11	-0.12	-0.00	0.01	-0.10	-0.12
	Russia	**0.05**	**0.09**	**0.04**	**0.06**	**0.05**	**0.04**
	SACU	-0.13	-0.06	-0.38	-0.42	-0.12	-0.17
	Tigers	**-0.01**	**-0.01**	**0.02**	**0.00**	**-0.07**	**-0.04**
	Turkey	-0.09	0.01	0.02	0.09	-0.07	-0.07
Poorest		**-0.12**	**-0.11**	**0.05**	**0.13**	**-0.10**	**-0.11**
of which:	AFR	-0.15	-0.11	-0.04	0.02	-0.13	-0.14
	SouthAsia	-0.03	-0.13	0.28	0.44	-0.02	-0.03
World		**-0.00**	**-0.00**	**-0.00**	**-0.00**	**-0.00**	**-0.00**

Source: Authors' simulations.

Table 9: Compared welfare impacts of the Girard proposal (B=1) under different model's specifications, per country (equivalent variation, % change)

		Mirage	Sigma x 2	Perfect comp'n	No vertical diff'n	K endog	Mirage, after agric lib'n
Indus C		**0.04**	**0.06**	**0.04**	**0.05**	**0.14**	**0.04**
of which:	EU25	0.03	0.04	0.03	0.04	0.14	0.03
	Japan	0.14	0.14	0.09	0.10	0.65	0.14
	US	0.01	0.01	0.00	0.01	-0.13	0.01
	ANZCERTA	0.15	0.29	0.13	0.15	0.44	0.08
	Canada	-0.06	-0.05	-0.04	-0.02	-0.33	-0.06
	EFTA	0.02	0.07	0.12	0.16	-0.01	0.09
	HKTaSgp	0.11	0.16	0.27	0.33	0.88	0.12
	Korea	0.35	0.53	0.46	0.54	2.07	0.31
DC		**0.03**	**0.19**	**0.14**	**0.18**	**-0.10**	**0.02**
of which:	Argentina	-0.00	0.03	0.01	0.03	-0.14	-0.01
	Brazil	-0.02	0.02	0.03	0.04	-0.29	-0.04
	China	-0.37	-0.38	0.15	0.16	0.27	-0.37
	INDIA	-0.15	0.20	0.05	0.11	-1.71	-0.14
	Maghreb	1.96	3.23	1.70	2.01	1.82	1.99
	Mexico	-0.02	0.11	-0.04	-0.03	-1.57	-0.02
	Row	-0.02	0.06	-0.01	0.03	-0.25	-0.03
	RSAm	-0.03	-0.01	0.03	0.05	-0.14	-0.03
	Russia	0.14	0.25	0.14	0.20	0.40	0.15
	SACU	0.09	0.39	-0.00	0.05	1.13	0.09
	Tigers	0.17	0.69	0.44	0.55	2.48	0.13
	Turkey	0.04	0.18	0.06	0.09	0.03	0.02
Poorest		**-0.02**	**-0.16**	**0.03**	**0.07**	**-0.14**	**-0.03**
of which:	AFR	-0.04	-0.24	0.01	0.04	-0.17	-0.04
	SouthAsia	-0.00	-0.00	0.08	0.14	-0.09	0.00
World		**0.04**	**0.08**	**0.06**	**0.07**	**0.09**	**0.04**

Source: Authors' simulations.

6. CONCLUSION

This paper proposes the first ever assessment of the stakes of a multilateral liberalisation of non-agricultural market access taking properly into account the actual structure of protection at the detailed level, both for bound and for preferential duties. As already emphasised for instance by Francois and Martin (2004), lowered bound duties involve a gain in themselves. However, the actual impact on applied duties is far from proportional, and this is another example of a trade policy issue where "the devil is in the details". Our simulations show that the detailed design of the tariff-cutting formula might matter a lot, in particular as far as the sharing of welfare gains is concerned.

Weak liberalisation would hardly modify applied protection in developing countries, because of the large binding overhang in these countries. On the contrary, an ambitious liberalisation

would spur price competition between developing countries exporters, often specialised on similar product and quality ranges, hence terms of trade loss for a number of them. And changing Girard's formula coefficient B from 0.65 up to 2 appears to be enough to switch from the first case to the second one. Seemingly secondary issues or technicalities might thus significantly impact the outcome.

Additional gains to the conclusion of the Round, associated in particular to agriculture and services, should be kept in mind. However, the sensitivity analysis carried out validates the assumption that non-agricultural market access can be studied independently from agricultural liberalisation without significant bias.

As far as economic analysis is concerned, various aspects would deserve further research. In particular, our work shows the importance of properly accounting for differences in product quality. This is a domain where improvements would be most welcome in terms of applied analysis.

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APPENDICES TO

FROM BOUND DUTIES TO ACTUAL PROTECTION: INDUSTRIAL LIBERALISATION IN THE DOHA ROUND

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Appendix 1: Sector aggregation

Sectors (type of comptition)	GTAP sector (code)
Progcrops (Perfect)	Paddy rice (pdr), Wheat (wht), Cereal grains nec (gro)
OtherAg (Perfect)	Vegetables, fruit, nuts (v_f)
Progcrops (Perfect)	Oil seeds (osd), Sugar cane, sugar beet (c_b), Plant-based fibers (pfb), Crops nec (ocr)
Livestock (Perfect)	Cattle, sheep, goats, horses (ctl), Animal products nec (oap), Raw milk (rmk)
OtherAg (Perfect)	Wool, silk-worm cocoons (wol), Forestry (for), Fishing (fsh)
Primary (Perfect)	Coal (col), Oil (oil), Gas (gas), Minerals nec (omn)
Livestock (Imperfect)	Meat: cattle, sheep, goats, horse (cmt), Meat products nec (omt)
OtherAg (Imperfect)	Vegetable oils and fats (vol)
Livestock (Imperfect)	Dairy products (mil)
Progcrops (Imperfect)	Processed rice (pcr), Sugar (sgr)
OtherAg (Imperfect)	Food products nec (ofd), Beverages and tobacco products (b_t)
Textiles (Imperfect)	Textiles (tex)
Wearing (Imperfect)	Wearing apparel (wap)
Leather (Imperfect)	Leather products (lea)
WoodPap (Imperfect)	Wood products (lum), Paper products, publishing (ppp)
Primary (Imperfect)	Petroleum, coal products (p_c)
Chem (Imperfect)	Chemical,rubber,plastic prods (crp)
Primary (Imperfect)	Mineral products nec (nmm)
FerMetals (Imperfect)	Ferrous metals (i_s)
MetalsNec (Imperfect)	Metals nec (nfm)
MetalProd (Imperfect)	Metal products (fmp)
MotorVeh (Imperfect)	Motor vehicles and parts (mvh)
TrspEqNec (Imperfect)	Transport equipment nec (otn)
Electronic (Imperfect)	Electronic equipment (ele)
Machinery (Imperfect)	Machinery and equipment nec (ome)
OtherManuf (Imperfect)	Manufactures nec (omf)
ServOth (Imperfect)	Electricity (ely), Gas manufacture, distribution (gdt), Water (wtr), Construction (cns), Trade (trd)
Transp (Imperfect)	Transport nec (otp), Sea transport (wtp), Air transport (atp)
BusServ (Imperfect)	Communication (cmn), Financial services nec (ofi), Insurance (isr), Business services nec (obs)
ServOth (Imperfect)	Recreation and other services (ros), PubAdmin/Defence/Health/Educat (osg), Dwellings (dwe)

Appendix 2: Geographical aggregation

Region in the model	GTAP country (code)
ANZCERTA	Australia (aus), New Zealand (nzl)
China	China (chn)
HKTaSgp	Hong Kong (hkg)
Japan	Japan (jpn)
Korea	Korea (kor)
HKTaSgp	Taiwan (twn)
Tigers	Indonesia (idn), Malaysia (mys), Philippines (phl)
HKTaSgp	Singapore (sgp)
Tigers	Thailand (tha)
SouthAsia	Vietnam (vnm), Bangladesh (bgd)
INDIA	India (ind)
SouthAsia	Sri Lanka (lka), Rest of South Asia (xsa)
Canada	Canada (can)
US	United States (usa)
Mexico	Mexico (mex)
RSAm	Central America, Caribbean (xcm), Colombia (col), Peru (per), Venezuela (ven), Rest of Andean Pact (xap)
Argentina	Argentina (arg)
Brazil	Brazil (bra)
RSAm	Chile (chl), Uruguay (ury), Rest of South America (xsm)
EU25	Austria (aut), Belgium (bel), Denmark (dnk), Finland (fin), France (fra), Germany (deu), United Kingdom (gbr), Greece (grc), Ireland (irl), Italy (ita), Luxembourg (lux), Netherlands (nld), Portugal (prt), Spain (esp), Sweden (swe)
EFTA	Switzerland (che), Rest of Eur Free Trade Area (xef)
RoW	Albania (alb), Bulgaria (bgr), Croatia (hrv)
EU25	Czech Republic (cze), Hungary (hun), Malta (mlt), Poland (pol)
RoW	Romania (rom)
EU25	Slovakia (svk), Slovenia (svn), Estonia (est), Latvia (lva), Lithuania (ltu)
Russia	Russian Federation (rus)
RoW	Rest of Former Soviet Union (xsu)
EU25	Cyprus (cyp)
Turkey	Turkey (tur)
RoW	Rest of Middle East (xme)
Maghreb	Morocco (mar), Rest of North Africa (xnf)
AFR	Botswana (bwa)
SACU	Rest of South Afr C Union (xsc)
AFR	Malawi (mwi), Mozambique (moz), Tanzania (tza), Zambia (zmb), Zimbabwe (zwe), Other Southern Africa (xsf), Uganda (uga), Rest of Sub-Saharan Africa (xss)
RoW	Rest of World (xrw)

Appendix 3: Resulting average protection level for each liberalisation scenario, by market (AVE tariff duty, %)

		Textiles		Wearing		Leather		Chem		WoodPap		FerMetals		MetalsNec	
		Initial applied duties	Girard 1	Initial applied duties	Girard 1	Initial applied duties	Girard 1	Initial applied duties	Girard 1	Initial applied duties	Girard 1	Initial applied duties	Girard 1	Initial applied duties	Girard 1
Indus C		**6.6**	**2.7**	**8.3**	**3.1**	**8.1**	**3.2**	**2.4**	**1.4**	**0.7**	**0.5**	**0.6**	**0.4**	**1.6**	**1.0**
of which:	EU25	5.9	2.8	7.2	3.2	7.4	3.6	2.6	1.6	0.5	0.4	0.4	0.3	1.8	1.0
	Japan	6.2	2.6	9.1	3.2	16.1	4.2	1.6	1.0	0.6	0.4	0.1	0.1	1.4	0.8
	US	8.7	2.2	10.8	2.6	10.0	2.6	2.3	1.1	0.3	0.2	0.2	0.1	1.6	0.9
	ANZCERTA	11.9	6.1	20.5	8.8	8.5	6.0	2.9	2.5	3.8	3.4	3.9	3.3	1.5	1.1
	Canada	10.1	3.5	15.3	4.2	9.8	3.6	3.0	2.0	1.3	0.8	0.3	0.2	0.6	0.5
	EFTA	2.5	1.1	2.7	1.4	0.8	0.4	0.3	0.2	0.8	0.4	0.3	0.2	0.4	0.3
	HKTaSgp	2.5	1.2	3.4	1.4	1.8	1.1	1.4	0.9	1.1	0.8	1.8	1.0	0.6	0.4
	Korea	10.1	6.8	12.4	7.6	10.0	6.0	5.6	3.8	2.1	1.7	0.7	0.5	4.6	3.7
DC		**13.5**	**10.0**	**22.9**	**12.8**	**13.4**	**9.8**	**9.0**	**7.2**	**8.9**	**7.4**	**9.1**	**7.6**	**8.5**	**6.8**
of which:	Argentina	18.4	16.0	21.2	16.6	17.3	14.3	12.8	11.3	13.0	12.3	13.1	13.0	8.1	8.0
	Brazil	18.2	15.8	21.4	16.4	15.1	12.8	11.3	10.0	11.7	11.1	12.8	12.5	8.5	8.3
	China	9.7	4.8	15.5	6.2	10.7	6.0	6.9	4.4	3.8	2.5	4.9	3.4	3.9	2.7
	INDIA	29.5	20.1	34.6	22.6	31.2	23.6	33.6	23.0	28.0	20.2	34.7	22.8	33.3	22.2
	Maghreb	32.4	26.8	154.8	56.3	29.6	27.8	16.4	15.3	23.0	21.6	14.4	13.8	13.8	13.4
	Mexico	15.0	11.7	25.6	13.8	24.9	14.9	10.2	9.2	9.4	8.6	12.8	11.8	7.1	7.0
	Row	10.0	8.9	14.1	10.1	8.4	7.7	5.0	4.8	6.5	6.1	5.5	5.3	4.6	4.5
	RSAm	12.0	9.8	17.0	14.6	12.3	10.9	7.6	7.0	9.3	8.5	8.0	6.9	7.0	6.7
	Russia	12.3	10.2	19.5	13.8	17.8	11.7	9.6	8.7	13.0	10.6	6.6	6.1	11.7	9.2
	SACU	21.5	9.7	37.1	12.5	21.3	9.7	5.8	3.7	8.1	5.3	5.1	4.7	2.3	1.9
	Tigers	13.2	9.7	21.3	11.8	8.7	5.8	8.0	6.0	9.3	6.5	8.8	7.3	5.5	4.1
	Turkey	6.2	4.7	6.4	5.1	5.4	4.7	2.5	2.5	1.6	1.6	7.3	5.7	2.1	2.1
Poorest		**19.8**	**19.6**	**31.5**	**30.4**	**22.0**	**21.7**	**9.7**	**9.7**	**15.7**	**15.7**	**10.5**	**10.5**	**4.7**	**4.7**
of which:	AFR	18.7	17.8	40.9	37.4	28.6	27.2	9.5	9.3	16.7	16.4	11.3	11.2	7.7	7.6
	SouthAsia	20.1	20.1	27.2	27.2	19.9	19.9	9.8	9.8	15.4	15.4	10.3	10.3	4.2	4.2
World		**8.5**	**4.8**	**9.8**	**4.2**	**8.9**	**4.2**	**4.0**	**2.9**	**2.2**	**1.7**	**3.0**	**2.4**	**2.8**	**1.9**

		MetalProd		MotorVeh		TrspEqNec		Electronic		Machinery		OtherManuf	
		Initial applied duties	Girard 1	Initial applied duties	Girard 1	Initial applied duties	Girard 1	Initial applied duties	Girard 1	Initial applied duties	Girard 1	Initial applied duties	Girard 1
Indus C		**2.3**	**1.4**	**5.7**	**2.3**	**0.9**	**0.6**	**0.6**	**0.4**	**1.4**	**1.0**	**1.8**	**0.9**
of which:	EU25	2.1	1.4	7.1	3.3	1.6	1.1	0.8	0.5	1.2	0.9	1.3	0.9
	Japan	0.9	0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.1	1.4	0.8
	US	2.2	1.0	3.1	1.2	0.3	0.1	0.4	0.2	1.4	0.8	1.8	0.7
	ANZCERTA	5.8	4.5	9.2	6.7	0.5	0.5	0.7	0.6	3.4	2.8	2.5	2.5
	Canada	3.3	2.0	4.6	2.4	2.0	0.5	0.2	0.1	1.5	1.1	2.3	1.3
	EFTA	0.4	0.3	0.4	0.3	0.1	0.1	0.1	0.1	0.2	0.2	12.5	0.3
	HKTaSgp	2.2	1.2	12.0	1.6	0.3	0.1	0.4	0.2	1.2	0.8	0.9	0.6
	Korea	7.1	5.4	8.2	6.9	2.0	1.6	1.3	1.0	6.2	4.7	5.8	4.2
DC		**11.7**	**9.3**	**19.0**	**10.9**	**5.5**	**4.4**	**4.5**	**4.1**	**8.1**	**6.6**	**13.6**	**9.8**
of which:	Argentina	17.4	15.9	18.1	15.4	5.8	5.5	9.1	8.8	14.6	14.0	18.7	15.6
	Brazil	16.8	15.4	25.4	14.8	4.7	4.5	11.3	10.7	13.5	12.7	18.4	15.4
	China	9.3	4.6	17.6	6.0	4.7	3.0	1.8	0.8	7.0	3.9	15.5	5.5
	INDIA	33.7	24.6	54.3	25.6	21.0	12.0	3.0	2.2	25.4	17.8	33.5	25.2
	Maghreb	23.4	21.0	34.0	27.3	7.4	5.9	9.8	8.7	12.7	11.5	23.9	19.8
	Mexico	11.3	10.0	12.8	11.7	7.4	6.9	5.5	5.2	9.8	9.3	16.5	12.4
	Row	8.0	7.5	8.2	7.7	5.2	5.0	5.4	5.3	5.9	5.7	7.9	6.8
	RSAm	10.4	9.2	15.0	12.2	5.2	4.7	6.0	5.8	7.3	6.8	14.1	12.5
	Russia	13.6	11.1	12.0	9.5	14.1	10.7	8.6	8.3	8.5	7.8	16.2	12.0
	SACU	7.6	5.4	21.2	10.6	0.4	0.2	1.9	1.4	3.7	2.9	9.4	4.6
	Tigers	12.9	9.4	39.4	14.4	2.6	2.1	1.4	1.1	5.4	4.3	10.4	7.7
	Turkey	1.3	1.3	2.8	2.2	0.5	0.5	0.7	0.7	0.8	0.8	2.3	1.9
Poorest		**15.6**	**15.6**	**29.0**	**27.9**	**8.0**	**8.0**	**8.2**	**8.2**	**9.2**	**9.1**	**24.5**	**24.4**
of which:	AFR	15.5	15.3	19.5	18.3	7.8	7.8	8.0	7.9	9.6	9.5	26.7	26.3
	SouthAsia	15.7	15.7	33.9	32.9	8.2	8.2	8.3	8.3	9.0	8.9	23.4	23.4
World		**4.4**	**3.3**	**8.0**	**3.8**	**2.0**	**1.5**	**1.4**	**1.1**	**3.1**	**2.4**	**3.0**	**1.9**

Source: MAcMap database, authors' calculations.

Appendix 4: Detailed simulation results

Table A.1: Impacts on industrial exports (in volume), per country (% change)

		Initial level	(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(f) Girard 1 + SDT	(g) Girard 1, on applied tariffs
Industrialised ctries		**180.5**	**0.81**	**7.31**	**3.56**	**2.85**	**2.04**	**2.59**	**3.37**
of which:	EU25	53.0	0.86	8.65	3.82	2.90	1.93	2.52	3.60
	Japan	31.0	1.10	9.55	4.96	4.07	2.94	3.74	4.62
	US	45.0	0.36	5.34	3.35	2.92	2.33	2.84	2.92
	ANZCERTA	2.2	5.11	19.87	9.34	7.98	6.70	7.78	9.69
	Canada	14.3	-0.34	-0.92	-0.99	-0.92	-0.72	-0.98	-0.79
	EFTA	7.4	0.61	0.48	0.29	0.34	0.34	0.26	0.41
	HKTaSgp	16.1	1.87	7.59	3.43	2.81	2.25	2.36	3.72
	Korea	11.6	0.76	14.52	6.20	4.45	2.35	4.10	6.00
DC		**79.0**	**2.51**	**12.53**	**5.05**	**3.95**	**2.78**	**2.93**	**5.18**
of which:	Argentina	0.7	3.53	27.59	5.40	2.60	0.13	0.22	7.50
	Brazil	2.7	2.07	23.12	4.90	2.71	1.23	1.58	6.76
	China	27.0	0.59	12.36	7.19	5.97	4.24	4.58	6.34
	INDIA	2.9	17.66	45.31	16.27	10.93	4.41	4.59	15.27
	Maghreb	1.0	34.79	48.34	13.51	8.92	6.40	5.56	13.83
	Mexico	10.0	1.35	7.09	0.78	0.24	-0.02	-0.08	1.42
	Row	7.7	0.04	0.06	-0.25	-0.08	0.17	0.07	0.24
	RSAm	3.3	1.33	16.57	4.48	3.56	2.93	2.99	6.16
	Russia	3.3	1.04	13.09	4.21	2.69	1.35	1.71	4.79
	SACU	1.9	6.45	17.54	8.86	7.20	5.00	4.91	8.10
	Tigers	16.6	3.03	10.98	4.51	3.89	3.47	3.66	5.22
	Turkey	1.8	2.02	4.25	-0.01	-0.21	-0.01	-0.34	0.78
Poorest		**2.1**	**0.17**	**-1.35**	**-0.86**	**-0.57**	**-0.16**	**-0.54**	**-0.39**
of which:	AFR	1.1	0.36	-1.93	-1.38	-1.04	-0.57	-1.08	-0.94
	SouthAsia	1.0	-0.04	-0.71	-0.28	-0.05	0.31	0.07	0.21
World		**261.6**	**1.32**	**8.82**	**3.97**	**3.15**	**2.25**	**2.67**	**3.88**

Source: Authors' simulations.

Note: Initial levels are expressed in tens of billions of 1997 US dollars.

Table A.2: Impacts on industrial imports (in volume), per country (% change)

		Initial level	(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(f) Girard 1 + SDT	(g) Girard 1, on applied tariffs
Industrialised ctries		**190.2**	**0.65**	**6.68**	**3.43**	**2.80**	**2.07**	**2.63**	**3.21**
of which:	EU25	47.4	0.72	9.70	4.63	3.59	2.48	3.31	4.18
	Japan	17.2	1.20	11.18	6.04	5.01	3.70	4.63	5.54
	US	73.0	0.36	4.67	2.88	2.51	2.01	2.43	2.60
	ANZCERTA	4.7	1.82	10.68	4.69	3.90	3.15	3.83	5.11
	Canada	14.0	-0.17	0.32	-0.08	-0.10	-0.06	-0.16	0.02
	EFTA	7.9	0.83	1.58	0.99	0.93	0.83	0.84	1.04
	HKTaSgp	18.7	1.29	3.70	1.73	1.50	1.37	1.37	2.04
	Korea	7.3	0.72	19.31	7.95	5.66	2.69	5.32	7.85
DC		**76.9**	**3.06**	**14.95**	**5.67**	**4.29**	**2.87**	**2.98**	**5.89**
of which:	Argentina	1.3	2.51	27.60	5.24	2.28	0.19	0.28	7.88
	Brazil	3.6	3.09	25.19	6.10	3.34	1.27	1.40	7.80
	China	17.3	0.96	18.31	10.55	8.74	6.19	6.58	9.27
	INDIA	2.4	24.96	58.37	22.39	15.12	5.77	5.90	20.01
	Maghreb	2.9	17.42	32.58	9.50	6.02	4.28	4.19	9.65
	Mexico	8.8	1.56	9.17	1.49	0.75	0.32	0.30	2.11
	Row	14.9	0.61	3.74	1.17	0.92	0.65	0.63	1.47
	RSAm	7.5	1.06	12.72	2.65	1.88	1.27	1.30	4.20
	Russia	3.1	1.49	14.75	4.31	2.72	1.35	1.47	5.61
	SACU	1.6	5.49	18.03	9.24	7.74	5.91	5.91	8.96
	Tigers	11.3	4.23	13.88	5.61	4.79	4.10	4.20	6.43
	Turkey	2.1	0.82	3.71	0.54	0.32	0.28	0.20	0.99
Poorest		**4.0**	**0.20**	**0.05**	**0.12**	**0.14**	**0.17**	**0.10**	**0.16**
of which:	AFR	3.1	0.20	0.06	0.14	0.16	0.17	0.12	0.15
	SouthAsia	0.9	0.21	0.01	0.01	0.07	0.14	0.02	0.19
World		**271.0**	**1.33**	**8.92**	**4.02**	**3.19**	**2.27**	**2.69**	**3.93**

Source: Authors' simulations.
Note: Initial levels are expressed in tens of billions of 2001 US dollars.

Table A.3: Compared impacts on industrial added value of the Girard proposal (B=1) under different model's specifications, per country (% change in volume)

		Mirage	Sigma x 2	Perfect comp'n	No vertical diff'n	K endog	Mirage, after agric lib'n
Indus C		**0.04**	**0.18**	**-0.00**	**-0.04**	**0.10**	**0.04**
of which:	EU25	-0.00	0.03	-0.04	-0.09	0.01	-0.01
	Japan	0.34	0.80	0.22	0.28	0.70	0.34
	US	-0.07	-0.07	-0.13	-0.22	-0.21	-0.08
	ANZCERTA	0.29	3.28	-0.13	-0.44	0.46	-0.39
	Canada	-0.57	-1.22	-0.54	-0.63	-0.84	-0.61
	EFTA	-0.44	-0.90	-0.51	-0.56	-0.51	-0.46
	HKTaSgp	1.18	2.49	1.50	1.79	2.09	1.35
	Korea	0.66	1.57	0.76	0.90	2.09	0.78
DC		**-0.01**	**0.12**	**-0.03**	**-0.12**	**-0.07**	**-0.00**
of which:	Argentina	-0.14	-0.35	-0.37	-0.46	-0.28	-0.21
	Brazil	-0.41	-0.69	-0.54	-0.78	-0.74	-0.56
	China	0.61	1.30	0.74	0.86	1.00	0.65
	INDIA	0.13	-0.05	-0.09	-0.56	-1.75	0.05
	Maghreb	-6.53	-7.59	-6.61	-7.38	-6.64	-6.37
	Mexico	-0.24	-0.38	-0.42	-0.51	-1.71	-0.29
	Row	-0.58	-1.12	-0.49	-0.57	-0.88	-0.61
	RSAm	-0.03	-0.43	0.15	0.02	-0.20	-0.04
	Russia	-0.16	-0.09	-0.57	-0.90	-0.03	-0.01
	SACU	0.02	0.46	-0.66	-1.10	0.72	0.03
	Tigers	1.00	1.55	0.94	0.81	2.60	1.26
	Turkey	-0.18	0.12	-0.04	0.17	-0.27	-0.28
Poorest		**-0.38**	**-0.92**	**-0.04**	**0.09**	**-0.58**	**-0.41**
of which:	AFR	-0.46	-0.93	-0.29	-0.34	-0.74	-0.55
	SouthAsia	-0.27	-0.92	0.29	0.65	-0.37	-0.24
World		**0.03**	**0.16**	**-0.01**	**-0.06**	**0.06**	**0.03**

Source: Authors' simulations.

Table A.4: Impacts on world import prices measured through output prices (% change)

		(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(f) Girard 1 + SDT	(f) Girard 1, on applied tariffs
Primary								
on wich:	Progcrops	-0.17	-0.84	-0.21	-0.10	-0.00	0.00	-0.24
	OtherAg	-0.11	-0.47	-0.08	-0.02	0.03	0.04	-0.11
	Livestock	0.01	-0.21	-0.04	-0.01	0.02	0.00	-0.05
	Primary	-0.13	-0.77	-0.15	-0.07	-0.01	-0.01	-0.20
Manufacturing								
on wich:	Textiles	-0.27	-0.98	-0.37	-0.26	-0.12	-0.12	-0.34
	Wearing	-0.48	-1.57	-0.59	-0.42	-0.21	-0.17	-0.54
	Leather	-0.19	-0.89	-0.24	-0.13	-0.01	0.03	-0.24
	WoodPap	-0.01	-0.25	-0.10	-0.07	-0.03	-0.04	-0.09
	Chem	-0.02	-0.15	-0.04	-0.02	0.00	-0.00	-0.04
	FerMetals	-0.05	-0.26	0.05	0.08	0.10	0.12	0.00
	MetalsNec	-0.11	-0.77	-0.20	-0.12	-0.03	-0.05	-0.24
	MetalProd	-0.03	-0.09	0.04	0.06	0.08	0.09	0.03
	MotorVeh	-0.08	-0.51	-0.27	-0.24	-0.20	-0.25	-0.27
	TrspEqNec	0.04	-0.10	-0.04	-0.04	-0.03	-0.05	-0.05
	Electronic	-0.02	0.15	0.24	0.25	0.25	0.30	0.19
	Machinery	0.04	0.00	0.05	0.05	0.05	0.06	0.04
	OtherManuf	-0.23	-0.54	-0.13	-0.05	0.04	0.07	-0.11
Services								
on wich:	ServOth	0.07	0.33	0.13	0.09	0.05	0.06	0.13
	Transp	-0.02	-0.01	0.02	0.02	0.01	0.02	0.02
	BusServ	0.04	0.26	0.09	0.07	0.05	0.05	0.11

Source: Authors' simulations.

Table A.5: Impacts on world import prices measured through value added prices (% change)

		(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(f) Girard 1 + SDT	(g Girard 1, on applied tariffs
Primary								
on wich:	Progcrops	-0.15	-0.62	-0.13	-0.04	0.04	0.05	-0.15
	OtherAg	-0.02	-0.08	0.07	0.09	0.11	0.13	0.05
	Livestock	0.04	0.01	0.04	0.05	0.06	0.05	0.03
	Primary	-0.01	-0.14	0.06	0.08	0.09	0.10	0.04
Manufacturing								
on wich:	Textiles	-0.01	0.85	0.45	0.38	0.30	0.37	0.45
	Wearing	-0.08	0.51	0.41	0.38	0.33	0.42	0.39
	Leather	-0.05	0.49	0.39	0.36	0.32	0.41	0.37
	WoodPap	0.05	0.29	0.11	0.08	0.06	0.07	0.12
	Chem	0.07	0.60	0.24	0.18	0.12	0.14	0.25
	FerMetals	0.05	0.52	0.27	0.23	0.17	0.21	0.26
	MetalsNec	0.08	0.20	0.15	0.13	0.10	0.11	0.11
	MetalProd	0.05	0.61	0.26	0.21	0.14	0.18	0.27
	MotorVeh	0.13	0.72	0.27	0.19	0.11	0.14	0.27
	TrspEqNec	0.09	0.50	0.18	0.12	0.06	0.07	0.18
	Electronic	0.14	1.18	0.56	0.45	0.34	0.41	0.56
	Machinery	0.10	0.63	0.25	0.19	0.12	0.14	0.26
	OtherManuf	-0.08	0.33	0.22	0.20	0.18	0.23	0.22
Services								
on wich:	ServOth	0.11	0.59	0.23	0.17	0.10	0.11	0.24
	Transp	0.07	0.34	0.16	0.13	0.09	0.10	0.16
	BusServ	0.08	0.42	0.16	0.12	0.08	0.09	0.18

Source: Authors' simulations.

Table A.6: Impacts on real unskilled wages, by region (% change)

		(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(f) Girard 1 + SDT	(g) Girard 1, on applied tariffs
Indus C		**0.04**	**0.16**	**0.06**	**0.04**	**0.02**	**0.02**	**0.06**
of which:	EU25	0.06	0.19	0.05	0.03	0.01	0.01	0.07
	Japan	0.07	0.52	0.26	0.21	0.15	0.18	0.24
	US	0.01	-0.03	-0.04	-0.04	-0.03	-0.05	-0.03
	ANZCERTA	0.16	0.01	0.11	0.12	0.12	0.10	0.07
	Canada	-0.03	-0.26	-0.20	-0.18	-0.15	-0.19	-0.18
	EFTA	0.02	0.10	0.02	0.01	-0.00	-0.01	0.03
	HKTaSgp	0.11	1.34	0.58	0.43	0.25	0.30	0.52
	Korea	0.27	1.04	0.71	0.63	0.53	0.51	0.60
DC		**0.01**	**-0.78**	**-0.10**	**-0.01**	**0.07**	**0.10**	**-0.11**
of which:	Argentina	-0.02	-0.61	-0.05	0.01	0.02	0.03	-0.13
	Brazil	-0.19	-1.11	-0.24	-0.10	0.00	0.03	-0.30
	China	-0.10	-0.92	-0.38	-0.27	-0.14	-0.07	-0.31
	INDIA	-0.33	-0.86	-0.12	-0.02	0.08	0.10	-0.05
	Maghreb	2.43	0.80	1.69	1.82	1.83	1.81	1.82
	Mexico	-0.00	-0.76	-0.12	-0.09	-0.05	-0.06	-0.13
	Row	-0.11	-0.82	-0.19	-0.12	-0.05	-0.04	-0.24
	RSAm	-0.09	-1.05	-0.12	-0.05	0.00	0.01	-0.25
	Russia	-0.12	-0.52	0.07	0.11	0.13	0.20	-0.07
	SACU	-0.05	-0.90	-0.26	-0.19	-0.13	-0.12	-0.33
	Tigers	-0.11	-1.05	-0.02	0.10	0.28	0.35	-0.05
	Turkey	0.03	-0.14	-0.02	-0.01	0.02	0.02	-0.04
Poorest		**-0.03**	**-0.17**	**-0.04**	**-0.02**	**0.01**	**0.01**	**-0.04**
of which:	AFR	-0.03	-0.23	-0.07	-0.04	-0.01	-0.01	-0.07
	SouthAsia	-0.02	-0.04	0.01	0.03	0.06	0.05	0.04
World		**0.04**	**-0.01**	**0.03**	**0.03**	**0.03**	**0.03**	**0.03**

Source: Authors' simulations.

Table A.7: Impacts on real skilled wages, by region (% change)

		(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(g) Girard 1 + SDT	(f) Girard 1, on applied tariffs
Indus C		**0.05**	**0.23**	**0.10**	**0.08**	**0.06**	**0.06**	**0.10**
of which:	EU25	0.06	0.24	0.08	0.05	0.03	0.02	0.09
	Japan	0.10	0.68	0.36	0.29	0.22	0.27	0.33
	US	0.02	0.07	0.03	0.03	0.03	0.02	0.04
	ANZCERTA	0.14	-0.13	0.05	0.07	0.07	0.04	0.00
	Canada	-0.02	-0.13	-0.11	-0.09	-0.06	-0.11	-0.09
	EFTA	0.04	0.25	0.09	0.07	0.04	0.04	0.10
	HKTaSgp	0.01	0.73	0.23	0.13	0.01	0.03	0.19
	Korea	0.26	0.55	0.48	0.44	0.40	0.34	0.37
DC		**0.03**	**-0.95**	**-0.11**	**-0.02**	**0.07**	**0.09**	**-0.14**
of which:	Argentina	-0.00	-1.08	-0.10	0.01	0.03	0.04	-0.25
	Brazil	-0.18	-1.28	-0.24	-0.09	0.02	0.04	-0.32
	China	-0.19	-1.51	-0.77	-0.64	-0.47	-0.43	-0.68
	INDIA	-0.50	-1.28	-0.26	-0.12	0.03	0.06	-0.16
	Maghreb	2.95	1.32	2.52	2.65	2.65	2.65	2.67
	Mexico	0.10	-0.49	0.06	0.07	0.08	0.08	0.05
	Row	-0.06	-0.75	-0.14	-0.07	-0.02	-0.01	-0.19
	RSAm	-0.08	-1.18	-0.13	-0.07	-0.02	-0.01	-0.29
	Russia	-0.10	-0.47	0.13	0.16	0.15	0.24	-0.03
	SACU	-0.05	-1.10	-0.29	-0.20	-0.12	-0.12	-0.37
	Tigers	-0.11	-1.69	-0.36	-0.18	0.08	0.12	-0.36
	Turkey	0.03	0.10	0.14	0.12	0.11	0.14	0.09
Poorest		**0.00**	**-0.05**	**-0.02**	**-0.01**	**-0.00**	**-0.01**	**-0.01**
of which:	AFR	-0.01	-0.16	-0.09	-0.07	-0.04	-0.05	-0.08
	SouthAsia	0.03	0.19	0.10	0.09	0.08	0.08	0.12
World		**0.04**	**0.10**	**0.08**	**0.07**	**0.06**	**0.06**	**0.08**

Source: Authors' simulations.

Table A.8: Impacts on capital return, by region (% change)

		(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(g) Girard 1 + SDT	(f) Girard 1, on applied tariffs
Indus C		**0.05**	**0.16**	**0.06**	**0.05**	**0.03**	**0.03**	**0.07**
of which:	EU25	0.04	0.14	0.04	0.02	0.01	0.00	0.05
	Japan	0.07	0.50	0.26	0.21	0.15	0.19	0.24
	US	0.03	0.06	0.02	0.01	0.01	0.00	0.02
	ANZCERTA	0.23	0.20	0.21	0.21	0.21	0.19	0.16
	Canada	-0.00	-0.24	-0.14	-0.12	-0.09	-0.12	-0.13
	EFTA	0.05	-0.08	-0.06	-0.04	-0.01	-0.03	-0.04
	HKTaSgp	0.19	0.46	0.03	-0.04	-0.11	-0.15	0.05
	Korea	0.14	0.44	0.26	0.22	0.18	0.12	0.23
DC		**-0.07**	**-0.88**	**-0.17**	**-0.09**	**-0.01**	**0.01**	**-0.19**
of which:	Argentina	-0.06	-0.65	-0.10	-0.03	0.00	0.01	-0.15
	Brazil	-0.19	-1.19	-0.24	-0.10	0.01	0.04	-0.31
	China	-0.25	-1.22	-0.67	-0.59	-0.49	-0.45	-0.62
	INDIA	-0.94	-2.24	-0.81	-0.53	-0.19	-0.19	-0.70
	Maghreb	2.69	1.44	1.98	2.07	2.05	2.05	2.13
	Mexico	-0.02	-0.79	-0.12	-0.08	-0.04	-0.05	-0.14
	Row	-0.07	-0.67	-0.13	-0.08	-0.02	-0.01	-0.18
	RSAm	-0.08	-0.92	-0.10	-0.04	0.02	0.02	-0.21
	Russia	-0.04	-0.38	0.08	0.11	0.11	0.16	-0.00
	SACU	0.57	0.54	0.48	0.39	0.21	0.20	0.28
	Tigers	-0.16	-1.12	-0.07	0.03	0.15	0.22	-0.13
	Turkey	0.07	-0.02	0.04	0.04	0.06	0.06	0.04
Poorest		**-0.03**	**-0.29**	**-0.11**	**-0.08**	**-0.04**	**-0.06**	**-0.11**
of which:	AFR	-0.01	-0.29	-0.11	-0.08	-0.05	-0.06	-0.11
	SouthAsia	-0.05	-0.29	-0.11	-0.08	-0.03	-0.04	-0.09
World		**0.02**	**-0.06**	**0.01**	**0.02**	**0.02**	**0.02**	**0.01**

Source: Authors' simulations.

Table A.9: Impacts on real exchange rate, by region (% change)

		(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(g) Girard 1 + SDT	(f) Girard 1, on applied tariffs
Oth_Ind								
	EU25	0.42	1.43	0.34	0.18	0.02	-0.02	0.43
	Japan	0.54	2.67	1.05	0.75	0.43	0.54	1.03
	US	0.30	0.60	-0.07	-0.17	-0.26	-0.32	-0.01
	ANZCERTA	0.54	0.86	0.32	0.22	0.12	0.05	0.26
	Canada	0.27	0.41	-0.22	-0.31	-0.36	-0.47	-0.14
	EFTA	0.30	1.19	0.19	0.05	-0.09	-0.14	0.28
	HKTaSgp	0.45	2.50	0.87	0.58	0.29	0.32	0.87
	Korea	0.58	2.72	1.12	0.84	0.56	0.57	1.08
DC								
	Argentina	-0.14	-2.33	-0.40	-0.10	0.06	0.09	-0.65
	Brazil	-0.27	-1.73	-0.48	-0.23	-0.03	0.01	-0.57
	China	0.28	1.05	0.57	0.50	0.47	0.61	0.65
	INDIA	-2.78	-4.78	-2.02	-1.34	-0.37	-0.32	-1.79
	Maghreb	-1.66	-3.60	-1.28	-0.88	-0.71	-0.74	-1.25
	Mexico	-0.04	-1.08	-0.47	-0.40	-0.30	-0.34	-0.44
	Row	0.01	-0.54	-0.16	-0.14	-0.11	-0.12	-0.19
	RSAm	-0.01	-1.31	-0.14	-0.08	-0.01	-0.02	-0.34
	Russia	0.06	0.10	0.14	0.12	0.08	0.13	0.04
	SACU	0.63	0.88	0.34	0.19	-0.03	-0.04	0.19
	Tigers	0.10	0.71	0.35	0.28	0.27	0.34	0.39
	Turkey	0.32	0.46	0.04	-0.01	-0.03	-0.07	0.10
Poorest								
	AFR	0.13	0.09	-0.04	-0.06	-0.06	-0.09	-0.00
	SouthAsia	0.02	0.08	0.01	0.02	0.07	0.04	0.11

Source: Authors' simulations.

Appendix 5: Decomposition of welfare changes

Table A.10: Decomposition of welfare changes in developed countries (equivalent variation, %)

		Scenarios							Sensitivity analysis					
		(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(f) Girard 1 + SDT	(g) Girard 1, on applied tariffs	Baseline	Sigma x 2	Mirage, after agric lib'n	K endog	Perfect comp'n	No vertical diff'n
EU25	Allocative efficiency gains	0.00	0.03	0.02	0.02	0.02	0.02	0.02	0.03	0.05	0.02	0.04	0.03	0.04
	Terms of trade gains	0.04	0.12	0.03	0.01	0.00	0.00	0.04	0.01	0.01	0.01	0.01	0.01	0.01
	Other gains	0.01	0.00	0.00	0.00	0.00	-0.01	0.00	-0.01	-0.01	0.00	0.09	0.00	0.00
	Welfare	0.05	0.16	0.05	0.03	0.01	0.01	0.06	0.03	0.04	0.03	0.14	0.03	0.04
Japan	Allocative efficiency gains	0.01	0.04	0.03	0.02	0.02	0.02	0.02	0.02	0.05	0.02	0.08	0.03	0.04
	Terms of trade gains	0.03	0.18	0.07	0.05	0.03	0.04	0.07	0.05	0.04	0.06	0.05	0.05	0.05
	Other gains	0.02	0.12	0.07	0.06	0.05	0.05	0.06	0.06	0.05	0.06	0.51	0.01	0.01
	Welfare	0.05	0.33	0.17	0.14	0.10	0.12	0.16	0.14	0.14	0.14	0.65	0.09	0.10
US	Allocative efficiency gains	0.00	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.05	0.02	0.03	0.03	0.04
	Terms of trade gains	0.01	0.00	-0.03	-0.03	-0.03	-0.04	-0.03	-0.03	-0.04	-0.03	-0.03	-0.04	-0.04
	Other gains	0.01	0.03	0.02	0.02	0.02	0.02	0.02	0.01	0.00	0.02	-0.12	0.01	0.01
	Welfare	0.02	0.05	0.01	0.01	0.00	-0.01	0.02	0.01	0.01	0.01	-0.13	0.00	0.01
ANZCERTA	Allocative efficiency gains	0.04	0.10	0.08	0.07	0.06	0.07	0.08	0.10	0.19	0.06	0.12	0.10	0.12
	Terms of trade gains	0.05	-0.06	0.00	0.01	0.01	0.00	-0.02	0.01	0.05	-0.03	0.02	0.01	0.01
	Other gains	0.07	0.09	0.07	0.07	0.06	0.06	0.06	0.04	0.05	0.05	0.30	0.03	0.02
	Welfare	0.16	0.13	0.15	0.15	0.14	0.13	0.12	0.15	0.29	0.08	0.44	0.13	0.15
Canada	Allocative efficiency gains	0.01	0.04	0.03	0.03	0.03	0.03	0.03	0.05	0.09	0.03	0.02	0.06	0.07
	Terms of trade gains	0.00	-0.10	-0.09	-0.09	-0.08	-0.10	-0.08	-0.09	-0.08	-0.09	-0.09	-0.08	-0.07
	Other gains	0.00	-0.04	-0.02	-0.01	0.00	-0.01	-0.01	-0.03	-0.05	-0.01	-0.26	-0.02	-0.02
	Welfare	0.00	-0.10	-0.07	-0.06	-0.05	-0.07	-0.06	-0.06	-0.05	-0.06	-0.33	-0.04	-0.02
EFTA	Allocative efficiency gains	0.09	0.10	0.10	0.10	0.09	0.09	0.10	0.34	0.58	0.24	0.33	0.53	0.57
	Terms of trade gains	0.00	0.05	-0.01	-0.02	-0.02	-0.03	0.00	-0.02	-0.01	-0.02	-0.02	-0.01	0.01
	Other gains	-0.04	-0.08	-0.06	-0.05	-0.05	-0.05	-0.06	-0.30	-0.50	-0.12	-0.32	-0.40	-0.43
	Welfare	0.05	0.07	0.02	0.02	0.02	0.01	0.03	0.02	0.07	0.09	-0.01	0.12	0.16
HKTaSgp	Allocative efficiency gains	0.03	0.08	0.05	0.05	0.04	0.04	0.05	0.07	0.12	0.04	0.11	0.06	0.07
	Terms of trade gains	0.08	0.75	0.27	0.18	0.07	0.08	0.24	0.18	0.20	0.19	0.18	0.25	0.30
	Other gains	0.01	-0.16	-0.12	-0.11	-0.10	-0.11	-0.11	-0.13	-0.15	-0.12	0.59	-0.03	-0.04
	Welfare	0.11	0.67	0.20	0.11	0.01	0.01	0.18	0.11	0.16	0.12	0.88	0.27	0.33
Korea	Allocative efficiency gains	0.03	0.30	0.19	0.15	0.10	0.15	0.18	0.13	0.21	0.11	0.26	0.13	0.17
	Terms of trade gains	0.11	0.37	0.21	0.19	0.17	0.12	0.18	0.19	0.20	0.22	0.18	0.23	0.26
	Other gains	0.04	-0.05	0.01	0.01	0.03	0.00	-0.01	0.03	0.12	-0.02	1.63	0.10	0.12
	Welfare	0.18	0.63	0.41	0.35	0.29	0.26	0.35	0.35	0.53	0.31	2.07	0.46	0.54

Table A.11: Decomposition of welfare changes in developing countries (equivalent variation, %)

		Scenarios							Sensitivity analysis					
		(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(f) Girard 1 + SDT	(g) Girard 1, on applied tariffs	Baseline	Sigma x 2	Mirage, after agric lib'n	K endog	Perfect comp'n	No vertical diff'n
Argentina	Allocative efficiency gains	0.03	0.17	0.06	0.03	0.00	0.00	0.08	0.03	0.05	0.03	0.02	0.04	0.05
	Terms of trade gains	-0.03	-0.25	-0.04	-0.01	0.01	0.01	-0.06	-0.01	0.00	-0.01	0.00	-0.01	-0.01
	Other gains	-0.02	-0.44	-0.07	-0.02	0.01	0.01	-0.12	-0.02	-0.02	-0.02	-0.16	-0.02	-0.02
	Welfare	-0.02	-0.51	-0.05	0.00	0.01	0.02	-0.10	0.00	0.03	-0.01	-0.14	0.01	0.03
Brazil	Allocative efficiency gains	0.05	0.14	0.08	0.06	0.03	0.03	0.09	0.07	0.12	0.05	0.04	0.08	0.11
	Terms of trade gains	-0.08	-0.42	-0.10	-0.05	0.00	0.01	-0.12	-0.05	-0.04	-0.05	-0.04	-0.04	-0.04
	Other gains	-0.03	-0.26	-0.06	-0.03	-0.01	-0.01	-0.08	-0.04	-0.06	-0.04	-0.29	-0.02	-0.02
	Welfare	-0.05	-0.54	-0.08	-0.02	0.02	0.03	-0.11	-0.02	0.02	-0.04	-0.29	0.03	0.04
China	Allocative efficiency gains	0.02	0.15	0.12	0.11	0.08	0.09	0.12	0.15	0.33	0.10	0.21	0.26	0.35
	Terms of trade gains	-0.01	-0.19	-0.04	0.00	0.06	0.10	-0.01	0.00	0.00	-0.01	0.00	0.02	-0.03
	Other gains	-0.13	-0.82	-0.52	-0.48	-0.42	-0.43	-0.50	-0.52	-0.71	-0.47	0.05	-0.12	-0.16
	Welfare	-0.13	-0.86	-0.44	-0.37	-0.27	-0.25	-0.39	-0.37	-0.38	-0.37	0.27	0.15	0.16
INDIA	Allocative efficiency gains	0.49	0.74	0.44	0.33	0.15	0.15	0.42	0.43	0.76	0.32	0.36	0.58	0.73
	Terms of trade gains	-0.44	-0.93	-0.32	-0.21	-0.06	-0.05	-0.29	-0.21	-0.20	-0.20	-0.21	-0.21	-0.25
	Other gains	-0.44	-0.92	-0.39	-0.27	-0.11	-0.11	-0.33	-0.37	-0.37	-0.26	-1.87	-0.32	-0.37
	Welfare	-0.38	-1.11	-0.27	-0.15	-0.02	-0.01	-0.20	-0.15	0.20	-0.14	-1.71	0.05	0.11
Maghreb	Allocative efficiency gains	2.71	3.02	1.94	1.74	1.61	1.60	2.08	2.63	3.98	1.76	2.61	2.75	3.08
	Terms of trade gains	-0.66	-1.44	-0.40	-0.25	-0.18	-0.18	-0.41	-0.25	-0.19	-0.26	-0.25	-0.26	-0.27
	Other gains	0.12	-0.56	0.37	0.47	0.51	0.51	0.34	-0.41	-0.56	0.49	-0.54	-0.79	-0.80
	Welfare	2.18	1.02	1.91	1.96	1.94	1.94	2.01	1.96	3.23	1.99	1.82	1.70	2.01
Mexico	Allocative efficiency gains	0.15	0.42	0.14	0.07	0.02	0.02	0.18	0.09	0.20	0.07	-0.06	0.09	0.11
	Terms of trade gains	-0.09	-0.54	-0.13	-0.09	-0.04	-0.04	-0.15	-0.09	-0.05	-0.09	-0.08	-0.09	-0.08
	Other gains	-0.03	-0.37	-0.03	0.00	0.01	0.01	-0.07	-0.02	-0.04	0.00	-1.43	-0.04	-0.05
	Welfare	0.03	-0.48	-0.03	-0.02	-0.01	-0.01	-0.04	-0.02	0.11	-0.02	-1.57	-0.04	-0.03
Row	Allocative efficiency gains	0.03	0.09	0.05	0.04	0.03	0.03	0.05	0.04	0.08	0.03	0.02	0.05	0.06
	Terms of trade gains	-0.06	-0.40	-0.10	-0.07	-0.04	-0.03	-0.12	-0.07	-0.05	-0.06	-0.05	-0.05	-0.03
	Other gains	0.03	-0.02	0.01	0.01	0.01	0.01	0.00	0.00	0.03	0.00	-0.22	0.00	-0.01
	Welfare	0.00	-0.32	-0.05	-0.02	0.00	0.00	-0.07	-0.02	0.06	-0.03	-0.25	-0.01	0.03
RSAm	Allocative efficiency gains	0.02	0.10	0.04	0.03	0.02	0.02	0.06	0.03	0.05	0.03	0.02	0.04	0.06
	Terms of trade gains	-0.06	-0.47	-0.06	-0.03	0.01	0.01	-0.12	-0.03	-0.03	-0.03	-0.02	0.00	0.00
	Other gains	0.00	-0.25	-0.04	-0.03	-0.02	-0.03	-0.08	-0.03	-0.04	-0.03	-0.14	-0.01	-0.01
	Welfare	-0.03	-0.62	-0.06	-0.03	0.00	0.00	-0.13	-0.03	-0.01	-0.03	-0.14	0.03	0.05
Russia	Allocative efficiency gains	0.08	0.41	0.07	0.11	0.06	0.06	0.21	0.12	0.20	0.12	0.16	0.15	0.20
	Terms of trade gains	-0.03	-0.13	0.01	0.03	0.04	0.05	-0.02	0.03	0.04	0.03	0.03	0.03	0.04
	Other gains	-0.05	-0.30	0.07	0.00	0.02	0.04	-0.09	-0.01	0.00	0.01	0.20	-0.04	-0.04
	Welfare	0.00	-0.02	0.15	0.14	0.11	0.15	0.10	0.14	0.25	0.15	0.40	0.14	0.20
SACU	Allocative efficiency gains	0.17	0.22	0.21	0.19	0.17	0.17	0.20	0.28	0.52	0.19	0.38	0.31	0.41
	Terms of trade gains	0.02	-0.17	-0.05	-0.04	-0.04	-0.04	-0.09	-0.04	-0.03	-0.06	-0.04	-0.09	-0.11
	Other gains	0.02	-0.26	-0.07	-0.06	-0.07	-0.07	-0.12	-0.14	-0.10	-0.05	0.79	-0.22	-0.25
	Welfare	0.21	-0.21	0.09	0.09	0.06	0.06	-0.01	0.09	0.39	0.09	1.13	0.00	0.05
Tigers	Allocative efficiency gains	0.49	0.81	0.56	0.52	0.48	0.49	0.58	0.76	1.78	0.45	0.95	0.83	1.03
	Terms of trade gains	-0.17	-0.60	-0.03	0.04	0.13	0.19	-0.06	0.04	0.11	0.02	0.01	0.06	0.05
	Other gains	-0.38	-0.98	-0.44	-0.39	-0.32	-0.31	-0.47	-0.64	-1.20	-0.34	1.52	-0.45	-0.53
	Welfare	-0.07	-0.78	0.08	0.17	0.29	0.36	0.05	0.17	0.69	0.13	2.48	0.44	0.55
Turkey	Allocative efficiency gains	0.02	0.12	0.07	0.05	0.04	0.04	0.07	0.05	0.10	0.04	0.05	0.05	0.05
	Terms of trade gains	0.02	-0.11	-0.04	-0.03	-0.01	-0.01	-0.04	-0.03	0.01	-0.03	-0.02	0.01	0.03
	Other gains	0.01	0.02	0.02	0.01	0.01	0.02	0.01	0.01	0.07	0.01	0.00	0.00	0.01
	Welfare	0.05	0.03	0.04	0.04	0.05	0.05	0.04	0.04	0.18	0.02	0.03	0.06	0.09

Table A.12: Decomposition of welfare changes in poor countries (equivalent variation, %)

		Scenarios							Sensitivity analysis					
		(a) Peaks elimination	(b) Complete liberalization	(c) Girard 0.65	(d) Girard 1	(e) Girard 2	(f) Girard 1 + SDT	(g) Girard 1, on applied tariffs	Baseline	Sigma x 2	Mirage, after agric lib'n	K endog	Perfect comp'n	No vertical diff'n
AFR	Allocative efficiency gains	0.02	0.03	0.02	0.01	0.01	0.01	0.02	0.02	0.02	0.01	0.01	0.02	0.04
	Terms of trade gains	-0.02	-0.19	-0.07	-0.05	-0.03	-0.03	-0.07	-0.05	-0.02	-0.04	-0.04	-0.01	0.01
	Other gains	0.02	0.05	0.00	0.00	-0.01	-0.01	0.01	-0.01	-0.23	-0.01	-0.14	0.00	0.00
	Welfare	0.01	-0.11	-0.05	-0.04	-0.02	-0.03	-0.05	-0.04	-0.24	-0.04	-0.17	0.01	0.04
SouthAsia	Allocative efficiency gains	0.01	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.02	0.04
	Terms of trade gains	-0.01	-0.06	-0.02	-0.01	0.01	0.01	0.00	-0.01	-0.02	-0.01	0.00	0.06	0.10
	Other gains	-0.01	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.00	-0.09	0.00	0.00
	Welfare	-0.02	-0.06	-0.01	0.00	0.02	0.01	0.00	0.00	0.00	0.00	-0.09	0.08	0.14

Appendix 6: The model's equations

Supply

Leontieff relation between value added and intermediate consumption:

Imperfect competition:

$$NB_{i,r}\,(Y_{i,r} + cf_{i,r}) = a_{VAi,r}\,VA_{i,r} = a_{CNTERi,r}\,CNTER_{i,r}$$

$$NB_{i,r}\,PY_{i,r}\,(Yi,r + cf_{i,r}) = PVA_{i,r}\,VA_{i,r} + PCNTER_{i,r}\,CNTER_{i,r}$$

Perfect competition:

$$Y_{i,r} = a_{VAi,r}\,VA_{i,r} = a_{CNTERi,r}\,CNTER_{i,r}$$

$$PY_{i,r}\,Yi,r = PVA_{i,r}\,VA_{i,r} + PCNTER_{i,r}\,CNTER_{i,r} + Pquota_{i,r}\,Quota_{i,r}$$

Determination of factors demand by producers results from the following optimization programs:

$$Min\ \ PVA_{i,r}VA_{i,r} = PL_{i,r}L_{i,r} + PTE_{i,r}TE_{i,r} + PRN_{i,r}RN_{i,r} + PQ_{i,r}Q_{i,r}$$

$$\text{s.t.:}\qquad VA_{i,r}^{1-\frac{1}{\sigma_{VA_i}}} = a_{Li}L_{i,r}^{1-\frac{1}{\sigma_{VA_i}}} + a_{Q_{i,r}}\,Q_{i,r}^{1-\frac{1}{\sigma_{VA_i}}} + a_{RNi,r}\,RN_{i,r}^{1-\frac{1}{\sigma_{VA_i}}} + a_{TEi,r}TE_{i,r}^{1-\frac{1}{\sigma_{VA_i}}}$$

and

$$Min\ \ PQ_{i,r}\,Q_{i,r} = PK_{i,r}\,K_{i,r} + PH_{i,r}\,H_{i,r}$$

$$\text{s.t.:}\qquad Q_{i,r}^{1-\frac{1}{\sigma_{CAP_i}}} = a_{Ki,r}K_{i,r}^{1-\frac{1}{\sigma_{CAP_i}}} + a_{Hi,r}H_{i,r}^{1-\frac{1}{\sigma_{CAP_i}}}$$

Demand

LES-CES (first stage)

$$C_{i,r} - cmin_{i,r} = a_{Ci,r}\,UT_r\left[\frac{P_r}{PC_{i,r}}\right]^{\sigma_C}$$

$$P_r\,UT_r = \sum_i PC_{i,r}\left(C_{i,r} - cmin_{i,r}\right)$$

$$BUDC_r = \sum_i PC_{i,r}C_{i,r}$$

$$PC_{i,r} = PDEMTOT_{i,r}\,(1+taxcc_{i,r})$$

Intermediate consumption (first stage)

$$IC_{i,j,r} = a_{ICi,j,r}\,CNTER_{j,r}\left[\frac{PCNTER_{j,r}}{PIC_{i,j,r}}\right]^{\sigma_{IC}}$$

$$PCNTER_{j,r}\ CNTER_{j,r} = \sum_i PIC_{i,j,r} IC_{i,j,r}$$

$$PIC_{i,j,r} = PDEMTOT_{i,r}\ (1+taxicc_{i,j,r})$$

Capital good (first stage)

$$epa_r\ REV_r = PINVTOT_r\ INVTOT_r$$

$$KG_{i,r} = a_{KGi,r}\ INVTOT_r \left[\frac{PINVTOT_r}{PKG_{i,r}}\right]^{\sigma_{KG}}$$

$$PINVTOT_r\ INVTOT_r = \sum_i PKG_{i,r} KG_{i,r}$$

$$PKG_{i,r} = PDEMTOT_{i,r}\ (1+taxkgc_{i,r})$$

Total demand

$$DEMTOT_{i,r} = C_{i,r} + \sum_j IC_{i,j,r} + KG_{i,r}$$

Groups of regions (second stage)

$$Min\ \ PDEMTOT_{i,r}\ DEMTOT_{i,r} = PDEMU_{i,r}\ DEMU_{i,r} + PDEMV_{i,r}\ DEMV_{i,r}$$

$$\text{s.t.:} \qquad DEMTOT_{i,r}^{1-\frac{1}{\sigma_{GEO_i}}} = a_{U_{i,r}} DEMU_{i,r}^{1-\frac{1}{\sigma_{GEO_i}}} + a_{V_{i,r}} DEMV_{i,r}^{1-\frac{1}{\sigma_{GEO_i}}}$$

Armington (third stage)

$$Min\ \ PDEMU_{i,r}\ DEMU_{i,r} = PDEM_{i,r,r}\ DEM_{i,r,r} + PDEMETR_{i,r}\ DEMETR_{i,r}$$

$$\text{s.t.:} \qquad DEMU_{i,r}^{1-\frac{1}{\sigma_{ARM_i}}} = a_{LOC_{i,r}} DEM_{i,r,r}^{1-\frac{1}{\sigma_{ARM_i}}} + a_{ETR_{i,r}} DEMETR_{i,r}^{1-\frac{1}{\sigma_{ARM_i}}}$$

Regions (forth stage)

For foreign regions of the same level of development:

$$DEM_{i,r,s} = a_{IMPi,r,s}\ DEMETR_{i,s} \left[\frac{PDEMETR_{i,s}}{PDEM_{i,r,s}}\right]^{\sigma_{IMP_i}}$$

$$PDEMETR_{i,s}\ DEMETR_{i,s} = \sum_{r \in Etra(s)} PDEM_{i,r,s} DEM_{i,r,s}$$

For foreign regions of a different level of development:

$$DEM_{i,r,s} = a_{IMPi,r,s}\ DEMV_{i,s} \left[\frac{PDEMV_{i,s}}{PDEM_{i,r,s}}\right]^{\sigma_{IMP_i}}$$

$$PDEMV_{i,s}^{(1-\sigma_{IMPi})} = \sum_{r \in V(s)} a_{IMPi,r,s} PDEM_{i,r,s}^{(1-\sigma_{IMPi})}$$

Varieties (fifth stage, imperfect competition)

$$DEMVAR_{i,r,s} = DEM_{i,r,s}\, NB_{i,r,t}^{1-\frac{1}{\sigma_{VARi}}}$$

$$PDEM_{i,r,s} = PDEMVAR_{i,r,s}\, NB_{i,r,t}^{\frac{1}{1-\sigma_{VARi}}}$$

Commodity market equilibrium

Imperfect competition:

$$Y_{i,r} = \sum_{s} DEMVAR_{i,r,s}$$

$$TRADE_{i,r,s} = NB_{i,r}\, DEMVAR_{i,r,s}$$

Perfect competition:

$$Y_{i,r} = \sum_{s} DEM_{i,r,s} \quad (i \neq TrT)$$

$$Y_{Trt,r} = \sum_{s} DEM_{TrT,r,s} + TRM_{r}$$

$$TRADE_{i,r,s} = DEM_{i,r,s}$$

Transport sector

Transport demand:

$$TR_{i,r,s} = \mu_{i,r,s}\, TRADE_{i,r,s}$$

$$MONDTR = \sum_{i,r,s} TR_{i,r,s}$$

Transport supply:

$$MONDTR = a_T \prod_{r} TRM_{r}^{\theta_r}$$

$$PY_{TrT,r}\,(1+taxp_{TrT,r})\, TRM_r = \theta_r\, PT\, MONDTR$$

Full use of endowments:

$$Lbar_r = \sum_{j} L_{j,r,t}$$

$$TEbar_r = \sum_j TE_{j,r}$$

$$Hbar_r = \sum_j H_{j,r}$$

Mobility:

$$PL_{j,r} = PLbar_r$$

$$PTE_{j,r} = PTEbar_r$$

$$PH_{j,r} = PHbar_r$$

$$PK_{i,r} = Pkbar_r$$

K and Land returns, subsidies included:

$$WK_{i,r} = PK_{i,r} + TsubK_{i,r}$$

$$WTE_{i,r} = PTE_{i,r} + TsubTE_{i,r}$$

Land supply:

$$WTEbar_r\ TEbar_r = \sum_i WTE_{i,r} TE_{i,r}$$

$$TEbar_r = TEbarO_r\ WTEbar_r^{\sigma_{TEbar}} \quad (NB: WTEbarO_r = 1)$$

Land allocation:

$$TE_{i,r} = b_{Ti,r}\ TEbar_r \left(\frac{WTE_{i,r}}{WTEbar_r} \right)^{\sigma_{TE}}$$

Price definition

CIF Price:

$$PCIF_{i,r,s} = \frac{PY_{i,r}}{\left(1 + EP_{i,r,s}\right)} (1+taxP_{i,r})\ (1+TAXEXP_{i,r,s}+taxAMF_{i,r,s}) + \mu_{i,r,s}\ PT \quad \text{(imp. competition)}$$

$$PCIF_{i,r,s} = PY_{i,r}\ (1+taxP_{i,r})\ (1+TAXEXP_{i,r,s}+taxAMF_{i,r,s}) + \mu_{i,r,s}\ PT \quad \text{(perfect competition)}$$

Sale price:

$$PDEMVAR_{i,r,s} = PCIF_{i,r,s}\ (1+DD_{i,r,s}) \quad \text{(imperfect competition)}$$

$$PDEM_{i,r,s} = PCIF_{i,r,s}\ (1+DD_{i,r,s}) \quad \text{(perfect competition)}$$

Revenue

Profits (imperfectly competitive sectors):

$$0 = PY_{i,r} \sum_{s} \frac{TRADE_{i,r,s}}{\left(1 + EP_{i,r,s}\right)} - (PVA_{i,r}\ VA_{i,r} + PCNTER_{i,r}\ CNTER_{i,r})$$

Tax revenues:

$$RECPROD_{i,r} = taxP_{i,r}\ PY_{i,r} \sum_{s} \frac{TRADE_{i,r,s}}{\left(1 + EP_{i,r,s}\right)} \quad \text{(imperfect competition)}$$

$$RECPROD_{i,r} = taxP_{i,r}\ PY_{i,r}\ Y_{i,r} \quad \text{(perfect competition)}$$

$$RECEXP_{i,r} = PY_{i,r}\ (1+taxP_{i,r}) \sum_{s} (TAXEXP_{i,r,s} + taxAMF_{i,r,s}) \frac{TRADE_{i,r,s}}{\left(1 + EP_{i,r,s}\right)} \quad \text{(imp. competition)}$$

$$RECEXP_{i,r} = PY_{i,r}\ (1+taxP_{i,r}) \sum_{s} (TAXEXP_{i,r,s} + taxAMF_{i,r,s})\ TRADE_{i,r,s} \quad \text{(perf. competition)}$$

$$RECDD_{i,s} = \sum_{r} DD_{i,r,s} PCIF_{i,r,s} TRADE_{i,r,s}$$

$$RECCONS_{i,r,} = PDEMTOT_{i,r}\ (taxcc_{i,r}\ C_{i,r} + taxkgc_{i,r}\ KG_{i,r} + \sum_{j} taxicc_{i,j,r} IC_{i,j,r})$$

$$RECTAX_{r} = \sum_{i} RECPROD_{i,r} + RECEXP_{i,r} + RECDD_{i,r} + RECCONS_{i,r}$$

Regional equilibrium:

$$REV_r + SOLD_r = \sum_{i} PRN_{i,r} RN_{i,r} + PTE_{i,r} TE_{i,r} + PK_{i,r} K_{i,r}$$

$$+ PLbar_r\ Lbar_r + PHbar_r\ Hbar_r + RECTAX_r + \sum_{s} rente_{r,s} - rente_{s,r}$$

Savings:

$$BUDC_r = (1\text{-}epa_r)\ REV_r$$

Imperfect competition

Definition of market shares:

$$SE_{i,r,s} = \frac{PDEM_{i,r,s} DEM_{i,r,s}}{\sum_{rr \in Etra(s)} PDEM_{i,rr,s} DEM_{i,rr,s}},\ SU_{i,r,s} = \frac{PDEM_{i,r,s} DEM_{i,r,s}}{\sum_{rr \notin V(s)} PDEM_{i,rr,s} DEM_{i,rr,s}},$$

$$SV_{i,r,s} = \frac{PDEM_{i,r,s} DEM_{i,r,s}}{\sum_{rr \in V(s)} PDEM_{i,rr,s} DEM_{i,rr,s}}, \qquad ST_{i,r,s} = \frac{PDEM_{i,r,s} DEM_{i,r,s}}{\sum_{rr} PDEM_{i,rr,s} DEM_{i,rr,s}}$$

Mark-up in domestic markets:

$$NB_{i,r}\left[EP_{i,r,r} + \frac{1}{\sigma_{VARi}}\right] = \left[\frac{1}{\sigma_{VARi}} - \frac{1}{\sigma_{ARMi}}\right] + \left[\frac{1}{\sigma_{ARMi}} - \frac{1}{\sigma_{GEOi}}\right] SU_{i,r,r} + \left[\frac{1}{\sigma_{GEOi}} - \frac{1}{\sigma_{Ci}}\right] ST_{i,r,r}$$

Mark-up in foreign markets in countries with the same level of development:

$$NB_{i,r}\left[EP_{i,r,s} + \frac{1}{\sigma_{VARi}}\right] = \left[\frac{1}{\sigma_{VARi}} - \frac{1}{\sigma_{ARMi}}\right] + \left[\frac{1}{\sigma_{IMPi}} - \frac{1}{\sigma_{ARMi}}\right] SE_{i,r,s} + \left[\frac{1}{\sigma_{ARMi}} - \frac{1}{\sigma_{GEOi}}\right] SU_{i,r,s} + \left[\frac{1}{\sigma_{GEOi}} - \frac{1}{\sigma_{Ci}}\right] STi,r,s$$

Mark-up in foreign markets in countries with a different level of development:

$$NB_{i,r}\left[EP_{i,r,s} + \frac{1}{\sigma_{VARi}}\right] = \left[\frac{1}{\sigma_{VARi}} - \frac{1}{\sigma_{ARMi}}\right] + \left[\frac{1}{\sigma_{IMPi}} - \frac{1}{\sigma_{GEOi}}\right] SV_{i,r,s} + \left[\frac{1}{\sigma_{GEOi}} - \frac{1}{\sigma_{Ci}}\right] ST_{i,r,s}$$