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# FROM BOUND DUTIES TO ACTUAL PROTECTION

## INDUSTRIAL LIBERALISATION IN THE DOHA ROUND

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### Abstract

In the background of the Doha Round of trade negotiations, this study proposes a CGE assessment of multilateral liberalisation of market access for non-agricultural products. The scenarios considered include the so-called 'Girard proposal' (with alternative choices for the coefficient involved), the removal of tariff peaks and complete liberalisation. This study is the first to take into account the difference between bound and applied tariffs, while considering all the enforced preferential trade arrangements and computing tariff cuts at the detailed product level (HS-6 classification). Although the liberalisation of market access for non-agricultural products is found to be welfare-enhancing at the world level, cross-country distributive effects prove significant. A soft liberalisation would not significantly reduce applied duties in developing countries, owing to their considerable binding overhang. By contrast, a deep liberalisation would entail fierce price competition among those developing countries that are largely specialised in similar sectors and in the same product quality range.


*JEL classification***:** F58, F12, F13

*Key words*: Doha development agenda, applied tariffs, preferential trade agreements, binding overhang, computable general equilibrium model

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# Contents

# Summary

This work aims at studying the underlying stakes of the ambitious Doha Ministerial Declaration agenda for the liberalisation of market access for non-agricultural products, with special emphasis on developing countries. The latter are either reluctant to liberalise access to their own markets for non-agricultural products, or condition any progress in this area on improved access to developed countries' markets for agricultural products. Do these positions really reflect mixed gains for developing countries as a result of liberalisation in this area, and if so, for what reasons and according to what pattern? These are the main questions addressed in this study.

In the negotiations on market access for non-agricultural products, the design of the tariff-cutting formula that will be applied is a key issue. In this respect, the basis for future negotiations remains the Draft Elements of Modalities put forward in 2003 by Ambassador Dominique Girard, which was revised the same year. Yet properly assessing the impact of such a tariff-cutting formula requires working with tariffs computed at a detailed level as well as the cuts in bound duties, while evaluating how these factors influence trade flows using preferential applied tariffs.

Several recent studies have dealt with the impact of liberalising market access for non-agricultural products in the Doha Round. They show that market access is still 'unfinished business', since applied protection remains substantial in many countries (especially developing ones). 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 most-favoured nation (MFN) duties – is large in many cases, and again is particularly in developing countries.

Assessments of the impact of liberalisation are generally carried out using CGE models. Among recent noteworthy improvements in this type of analysis, pre-experiment simulations, the measurement of the extent of the binding overhang, a careful record of preferential trade agreements and a comparison of scenarios designed at the detailed level of the products have been separately proposed in the literature.

Against this background, our work brings several original contributions, the most important one being the initiative to combine all the previous improvements for the first time. The scenarios considered include the so-called 'Girard proposal' (with alternative choices for the coefficient involved), the removal of tariff peaks and complete liberalisation, with all tariff cuts being computed at the detailed product level (HS-6 classification). All preferential agreements enforced in 2001 are accounted for. Incidentally, we also take into account commitments that were made in 2001 but not yet implemented, and those made by countries that have recently acceded to the WTO. A pre-experiment simulation is carried out, in which all these commitments are assumed to have been implemented.

These particular characteristics of our study are likely to profoundly influence the assessment as compared with the simplifying assumptions used so far in the literature, since cutting bound tariffs leaves applied duties unchanged in many cases, especially when the gap between the initial bound and applied duties is significantly greater than the applied duty. Further, integrating preferences allows us to tackle the so-called 'preference erosion' issue. Finally yet importantly, computing tariff cuts at the most detailed level enables us to track the true impact of the liberalisation formulas.

We consider the following scenarios (which are only applied to non-agricultural products, according to the WTO definition): a) peaks elimination (*ad valorem* equivalent (AVE) tariffs above 15% replaced by a 15% AVE tariff); b) complete liberalisation (tariffs completely removed for all non-agricultural products); c) Girard 0.65 (Girard's proposal, using coefficient

B = 0.65); d) Girard 1 (Girard's proposal, using coefficient B = 1); e) Girard 2 (using coefficient B = 2); f) Girard 1+ the special and differential treatment (SDT) (developing countries that have consolidated at least 35% of their tariff lines use the coefficient B = 2 instead of unity); and g) Girard 1 on the applied tariff (applied rather than bound tariffs are cut according to the formula of scenario d). We assume in each scenario that least developed countries (LDCs) and those countries whose binding coverage on non-agricultural tariff lines is less than 35% should not be required to liberalise their market access.

Applying the Girard formula with coefficient B set to unity has a widespread impact on protection. In developed countries, the average protection for industrial products is approximately halved, with a stronger cut in textiles/clothing, for which the harmonising effect is significant. The decline in average tariff duties is weaker in relative terms in developing countries, but is stronger in absolute terms. This tariff-cutting formula also entails a strong harmonising effect across developing countries (especially in the textiles/clothing sector) except in India and the Maghreb region. The other scenarios produce results in line with their design, provided that the impact of the tariff-cutting formula on applied protection is strongly related to the extent of the initial binding overhang. This creates a significant difference as far as developed countries are concerned, except for Korea. By contrast, for developing countries direct cuts in applied duties deliver far greater liberalisation, thus showing that the rather large initial binding overhang significantly dampens the impact of the tariff-cutting formula.

We introduce this tariff data in a static version of the MIRAGE model. The measurement of border protection and the computation of actual liberalisation resulting from tariff-cutting formulas used in this study bring substantial improvements in comparison with previous work. Our simulations are based on a measurement of *ad valorem* equivalent protection at the six-digit level of the harmonised system for 163 countries and 208 partners in 2001, taking into account all the enforced preferential agreements (reciprocal as well as non-reciprocal).

The pre-experiment simulation includes the EU enlargement in 2004, the dismantling of the Multi-Fibre Agreement (MFA), the entry of newly acceded members to the WTO (including China) and the full application of the US African Growth and Opportunity Act (AGOA). The equilibrium of the world economy obtained as a result of this pre-experiment simulation is used as the baseline for subsequent simulations. In order to keep the model tractable we limit our analysis to 20 sectors, with a focus on non-agricultural goods and 22 regions.

One of the key results of this exercise concerns prices: multilateral liberalisation is generally expected to increase import prices, at least for those products experiencing the greatest liberalisation, since lowered trade barriers increase the world demand for imports. Here this is not the case, however, as a result of applying the Girard formula with coefficient B = 1. The extent of the international division of labour in place in most industrial sectors helps to explain this finding. Imported intermediate inputs account for a substantial share of the total cost for many products. For most producers, lowered tariff duties thus mean cheaper intermediate inputs and hence lower production costs. These price changes lead to a slight improvement in the terms of trade for industrialised countries – benefiting in particular Asian developed countries – despite a slight deterioration in North America. By contrast, the developing countries experience a general if limited deterioration in terms of trade, with the sole exceptions of China and Russia. As a result of their high initial levels of protection, India and the Maghreb experience the greatest deterioration.

A second mechanism must be stressed. Given the trade-balance constraint, changes in industrial imports and exports are closely linked and thus industrial trade increases strongly in those countries where initial protection is high, such as India, the Maghreb and those in the South African Customs Union (SACU). It also increases significantly in countries that have a strong competitive position in industrial products when taken as a whole, particularly in China, Japan

and Korea. The regions of sub-Saharan Africa (SSA) and South Asia, which mostly envelop countries that are exempted from any requirements, do not experience any significant increases in industrial imports. But nor do they benefit from any increase in industrial exports owing to eroded preferences.

As measured through equivalent variation, worldwide income gains appear to be very limited (+0.04%). Among developed countries, Asian countries are the main gainers, which is unsurprising given their strong competitive positions in the world trade of industrial products. Among developing countries, the outcome shows a heightened contrast. The Maghreb countries enjoy a strong income gain (almost +2%), while Russia, SACU, the Tigers and Turkey record slight gains. Meanwhile, all the other developing countries suffer an income loss as a result of this liberalisation, in most cases due to deterioration in their terms of trade. Although these losses are of a low order of magnitude, this result is quite striking, particularly in contrast with the results observed for developed countries.

The comparison of scenarios a) to e) reveals the more uneven impact resulting from more ambitious liberalisation scenarios. India is a good illustration of this: the welfare loss is –0.15% in our main scenario. It doubles when we use a parameter of 0.65 instead of unity in the Girard formula. It is even four times as large with complete liberalisation, whereas the welfare loss becomes negligible with a coefficient of 2 in the Girard formula. Finally, it is noteworthy that although almost all of the SSA countries are exempt from any liberalisation commitment, they are adversely affected in welfare terms in all the scenarios, with the exception of the elimination of tariff peaks. This loss, while of limited amount, is the result of preference erosion and of the relative price decline of their main export products.

It is worth stressing that this exercise does not aim at giving an evaluation of the gains to be expected from the Doha Round. Other items on the agenda, such as trade facilitation or services, are not included here (as their modelling is generally ad hoc and based on loose data, we chose to leave them aside in this study). More importantly, our central set of simulations does not capture the gains associated with increased market access, domestic support or export subsidies in agriculture. Nevertheless, the sensitivity analysis carried out validates the assumption that non-agricultural market access can be studied independently from agricultural liberalisation without significant bias.

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## Industrial Liberalisation in the Doha Round

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## 1. Introduction

The failure to reach an agreement in the Doha Round of trade negotiations in Cancún blatantly highlighted how difficult it is to strike a deal on around 20 issues among nearly 150 different countries. Negotiation requires compromise, and success mainly depends on finding the solutions to a handful of sensitive issues and reaching a balance between the offensive and defensive interests of most countries. Market access for non-agricultural products is certainly among these important items. The Doha Ministerial Declaration states that negotiations should seek "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*".

The agenda for liberalising market access for non-agricultural products is ambitious. This study aims at identifying the underlying opportunities and challenges, with a special emphasis on developing countries. Many developing countries are reluctant to liberalise access to their own markets for non-agricultural products, and others condition any progress in this area on improved access to developed countries' markets for agricultural products. Do these positions really reflect mixed gains for developing countries as a result of non-agricultural liberalisation, and if so, what are the channels through which these effects arise? These are the main questions addressed in this study.[1]

Since the Doha Ministerial Conference, negotiations on non-agricultural market access (NAMA) have given rise to a number of proposals. To date, the basis for future negotiations is the Geneva Framework Agreement of 2 August 2004 (WTO, 2004) – the so-called 'July package'. This text is important by virtue of its mere existence, since it sets the stage for future negotiations. It also takes stock of the agreements 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 low initial binding coverage), the principle of less than full reciprocity (as discussed in the Doha Declaration) and the principle of exempting least developed countries (LDCs) from any liberalisation commitment.[2] Still, this Framework Agreement does not address the key issue: the tariff-cutting formula to be applied. In this respect, as emphasised in the

[1] The authors acknowledge the helpful comments and suggestions by participants of the 2005 GTAP conference, along with those from Paul Baker.

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

Agreement itself,[3] the basis for future negotiations remains the Draft Elements of Modalities put forward in May 2003 by Ambassador Dominique Girard, the then Chairman of the WTO's Negotiating Group on NAMA, revised in August 2003 (WTO, 2003; hereafter the revised version is referred to as the 'Girard proposal').

Assessing the impact of this type of tariff-cutting formula raises various issues. First, as stated in the 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 a formula is to be applied to *ad valorem* duties or the *ad valorem* equivalent (AVEs) of specific duties.[4] These AVEs must therefore be appropriately calculated. Third, the tariff cuts proposed concern bound duties. Evaluating how these cuts influence trade flows requires knowledge of how they are reflected in applied tariffs.

Several recent studies have dealt with the impact of liberalising NAMA. Bacchetta & Bora (2001 and 2003) paint a detailed picture of protection in industrial products, both in terms of bound and applied most-favoured nation (MFN) protection. They show that market access is still an "unfinished business" (in the words of WTO, 2001), since applied protection is still substantial in many countries (most of all in 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 the bound and applied MFN duties – is large in many cases, especially in developing countries.

Assessments of the impact of liberalisation are generally carried out using CGE models (see e.g. Francois & Martin, 2003; World Bank, 2003), although partial equilibrium models are also used in some instances (see e.g. Hoekman et al., 2002a). Among recent noteworthy improvements, Francois & Martin (2003) introduced a refined policy scenario, taking into account a pre-experiment simulation. Building on the work of Walkenhorst & Dihel (2002) aiming at characterising the extent of the binding overhang, Lippoldt & Kowalski (2003) account for the way in which proposed tariff cuts would be reflected in applied tariffs. Yet the binding overhang (the gap between the bound and applied duties) is only computed and accounted for at the GTAP sector level,[5] i.e. at a highly aggregated sector level. Laird et al. (2003) compare six important, recent proposals, among which is the Girard proposal. They are the first to compute the corresponding tariff cuts at the detailed level (HS-6), but this is done basically on MFN tariffs. Neither preferential trade agreements nor the binding overhang are taken into account.

Our work builds on this literature and brings several original contributions. The CGE model used, nicknamed 'MIRAGE',[6] 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. (1997) and Francois & Martin (2004). One distinctive feature, however, is the ability to account for quality differences among products exported by developed and developing countries. This vertical differentiation, now well documented by empirical studies (see e.g. Fontagné et al., 1998; Schott, 2004), can significantly influence the

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[3] 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).

[4] The American proposal is an exception to this, which aims at directly reducing specific tariffs.

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

[6] MIRAGE stands for modelling international relationships in applied general equilibrium.

nature of the consequences induced 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 & 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 that were not yet implemented in 2001, as well as those made by recently acceded countries. A pre-experiment simulation is carried out, in which all of these commitments are assumed to have been implemented.

Thus, for the first time ever in the domain of multilateral liberalisation of non-agricultural market access, we are able to simultaneously account for trade preferences, the binding overhang and the non-linearity of the formula. This is likely to profoundly influence the assessment, as compared with the simplifying assumptions used so far in the literature. WTO agreements have tended to cut bound tariffs, which leaves applied duties unchanged in many cases, particularly when the gap between initial bound and applied duties is significantly large. Francois & 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. In determining a set-up such as the one considered here, however, only applied tariffs actually matter.

Given the background described above, it is natural to use the Girard proposal as the basis for assessing the impact of NAMA liberalisation in the Doha Round. This proposal builds upon the so-called 'Swiss Formula', which was initially proposed during the Tokyo Round and allows for harmonised, non-linear tariff cuts. Nevertheless (and possibly inspired by the Chinese proposal), Girard's proposal introduces new 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 from the Doha Round. Other items on its agenda – such as the (remaining) Singapore issues – are not included here; however, the modelling of these items is generally ad hoc.[7] More importantly, our central set of simulations do not capture the gains associated with increased market access, domestic support or export subsidies in agriculture (see e.g. FAPRI, 2002; Francois et al., 2003; Bouët et al., 2005; Hoekman et al., 2002b). In the same way, gains from the liberalisation of services should be added – yet in this area we are collectively missing reliable data. We believe that non-agricultural market access deserves a specific analysis, which is why it is treated separately. This approach of course raises the question of the degree to which the topics can be separated, not only in terms of negotiation (by definition, topics are tied by the single undertaking principle), but also in terms of analysis: Does combining the effects found separately for different topics provide a satisfactory proxy of the global impact? Or, equally, does the impact of liberalisation in one field strongly depend on the outcome in other fields? In order to test for this, the sensitivity analysis presented here includes introducing agricultural liberalisation in the pre-experiment. Since the results show that this does not substantially modify the assessed impact on non-agricultural liberalisation, our assumption that it is worthwhile to study non-agricultural market access separately is validated, even though the negotiation covers a wide variety of other topics.

[7] See for instance Lippoldt & Kowalski (2003) on trade facilitation.

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 a sensitivity analysis. Section 6 draws the first conclusions.

## 2. The model

This section gives a brief overview of the CGE model used, namely a static version of the MIRAGE model.[8] The main characteristics of the model concern the assumptions made about the quality ranges of the products, imperfect competition and macroeconomic closure.

### 2.1 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 and the rest used to purchase final consumption.[9] 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. First, domestic products are assumed to benefit from a specific status for consumers, making them less substitutable with foreign products than foreign products are among each other. Second, 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 value differences are able to reveal quality differences (see e.g. Fontagné et al., 1998; Greenaway & Torstensson, 2000). In addition, this specialisation is closely linked to education and wealth levels, and "the share of intra-industry trade in vertically differentiated products increases with the economic distance between countries" (Fontagné et al., 1998, p. 10). Based on a very detailed analysis of US imports, Schott (2004, p. 647) also emphasises 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".

This is likely to have direct consequences on the transmission of liberalisation shocks since, as shown in particular by Fontagné & Freudenberg (1999), the elasticity of substitution is lower across different qualities than across products within a given quality. In the absence of 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 range of consumer choice within each sector, ahead of any other choice in terms of geographical origin.

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[8] A list of the equations for the model is provided in the Appendix. For a detailed presentation, see Bchir et al. (2002).

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

## 2.2 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.

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 exist 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 according to its own market share. This modelling captures the pro-competitive effect of trade liberalisation.

## 2.3 Capital, markets clearing and macroeconomic closure

The capital good is the same whatever the sector and capital is assumed to be perfectly mobile across sectors within each region. At the regional level, capital stock is assumed to be constant in the core simulations of this paper. Nevertheless, 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 considered to be 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 internationally immobile.

With respect 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 with previous work. Our simulations are based upon a measurement of *ad valorem* equivalent protection resulting from *ad valorem* and specific (including 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.[10] The distinctive feature of this database is that it takes into account all enforced preferential agreements (reciprocal as well as non-reciprocal).[11]

But WTO negotiations deal with consolidated, not applied protection. The difference is sizeable. In order to properly assess the possible impact of a given cut in bound tariffs, a 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 (*ad valorem* and specific) of bound tariffs have been calculated at the HS-6 level for all WTO members. Consolidation commitments that are not yet in force are also taken into account. Special emphasis has been put on ensuring the consistency with the AVE applied tariffs used.[12]

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

Before considering any liberalisation scenario, we account for the commitments made but not implemented in 2001 and commitments made by recently acceded countries. This is done through a pre-experiment simulation. Indeed, while the base year of our data is 2001, any agreement in the Doha Round is unlikely to be enforced before 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 & Martin, 2003). In the present case, it includes the following shocks:

- the EU's enlargement in 2004 – the 10 acceding countries are supposed to adopt the Common External Tariff and face the same tariffs as the EU before 2004;
- the dismantling of the Multi-Fibre Agreement – the corresponding quota rents are removed;
- entry of newly acceded members to the WTO (including 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 for granted). Their tariffs are also liberalised according to the commitments made upon their accession, as reflected in their consolidated tariff schedules; and
- the full application of the US African Growth and Opportunity Act (AGOA). In 2001, only a few African countries were qualified to benefit from this Act, whereas the majority of them will be qualified in 2005. Accordingly, we adopt a simplifying assumption, by assuming that sub-Saharan African countries face zero protection in the US market.[13]

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

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[10] Market Access Map (MAcMap) is a database of trade barriers jointly developed by the International Trade Centre (ITC) and CEPII. A detailed presentation of the methodology used in calculating *ad valorem* equivalents is presented in Bouët et al. (2004) (retrievable from http://www.cepii.fr).

[11] 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 a weighting scheme in order to aggregate tariffs.

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

[13] The protection planned 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 that 2001 levels of protection hold in 2005 would probably be worse.

Unless otherwise stated (i.e. in scenario (g) below), the scenarios have 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. Thus, 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 could well remain unchanged. This calculation is made separately for each HS-6 product. New applied duties are then aggregated 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 among WTO member countries):

(a) *Elimination of tariff peaks* – specifically 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, using coefficient B = 0.65;

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

(e) *Girard 2* – Girard's proposal, using coefficient B = 2;

(f) *Girard 1+SDT* – special and differential treatment is introduced into scenario (d). In the Girard formula that is applied to the tariffs of developing countries that have consolidated at least 35% of their tariff lines, the coefficient B takes the value B = 2; and finally,

(g) *Girard 1 on the 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. (2002a). 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 duties that are initially unbound, this formula thus entails both binding protection and lowering the level of the binding. An important 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 less the tariff cut applies.

In accordance with the July 2004 Framework Agreement (see WTO, 2004, Annex B, paras. 6 and 9), we assume in each scenario that least developed countries and those 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,[14] 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 those where huge swings in protection levels have to be expected (such as wearing apparel or leather). Here 22 regions are considered: the EU-25, the US, Japan, Canada, Mexico, ANZCERTA,[15] Argentina, Brazil, China, India, Korea, the Tigers, South Asia, Hong Kong, Taiwan and Singapore, SACU, the rest of the sub-Saharan African countries (hereafter SSA), the Maghreb, Russia, the EFTA, Turkey and the rest of the world[16] (see details in Appendix 1).

The 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 the industrialised, intermediate and poorest countries, are considered separately while measuring this average protection. The 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)[17] and to differences in export specialisation.[18]

Without exception, protection is highest in the textiles/clothing/leather/shoes sector (hereafter referred to as 'textiles/clothing' for the sake of simplicity) than for the rest of non-agricultural products, irregardless of the country or group of partners. Protection in this sector is seldom less than 10% and is frequently above 15%. In a given market, developing countries rarely encounter less protection than rich ones. On the contrary, in several instances the protection faced by developing countries is higher, owing to their specialisation in low unit-value exports (for which specific tariffs have a higher AVE) and in products on which protection is higher (of course, this is likely to be endogenous). This situation also reflects the fact that many of the preferential schemes that are applied to developing countries exclude a large share of textile/clothing products.

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

[15] ANZERTA refers to the Australia-New Zealand Closer Economic Relations Trade Agreement.

[16] The rest of the world is treated in a similar manner as other regions in terms of tariffs, since we have information on roughly all countries (208 in total).

[17] Note, however, that specific duties are not used for non-agricultural products, especially for those outside the textile/clothing sector, except in Switzerland, Sri Lanka and Thailand. See for example Bacchetta & Bora (2003 and 2004).

[18] As previously mentioned, sector specialisation is accounted for here through the export structure of the exporting country towards the reference group of the importing country.

*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** |

*Notes*: Row headings indicate markets; country groups in the columns indicate exporters. 'Developing ctries' refers to developing countries other than those included in the 'poorest' group. Calculations are based on specific tariffs, converted using reference groups' unit values (see text for details).

*Sources*: MAcMap database and authors' calculations.

For other non-agricultural products, protection in industrialised countries is very low (in most cases below 4%), in particular with respect to the poorest countries,[19] although differences across partners remain limited. The contrast is strong among developing countries, which apply quite substantial protection for these products. Average protection in other industrial products reaches 10% in Argentina, Brazil, the Maghreb, SSA and South Asia, and is as high as almost 30% in India.

[19] ANZCERTA stands as a clear exception to this rule, owing to its substantial protection in products of interest for poor countries.

In sum, average protection is clearly less in industrialised countries than in developing countries and higher in the poorest countries. Beyond this general pattern, the Maghreb[20] and most of all India stand out as the most protectionist areas.

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

*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** |

*Notes*: For details about the implementation of the scenarios, see the text. Scenario (f) is not reported, but its results can be inferred directly from scenarios (d) and (e).

*Sources:* MAcMap database and authors' calculations.

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

The elimination of tariff peaks has virtually no impact on industrialised countries' protection, except in textile/clothing in Canada, the US and ANZCERTA. In developing countries, the removal of tariff peaks mainly results in lower protection in textiles and clothing. The only regions[21] where the impact is important are the Maghreb and India.[22]

Applying the Girard formula with a coefficient of 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/clothing, 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/clothing, where the resulting average protection does not exceed 20% (except in India and the Maghreb).

The impact of such a 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 less than 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. By contrast, for developing countries directly cutting applied duties delivers far greater liberalisation, thus showing 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 of directly cutting applied tariffs would lower average applied protection in industrial products by 3.5 percentage points (6.1 points in textiles/clothing and 2.7 points in other products), while the cut only reaches 2.4 points (4.7 points in textile/clothing and 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 if the Girard formula is used on bound rates, while it would be cut by 4.2 points if the formula directly cut applied tariffs. The situation is similar for Brazil.

How much difference does choosing a different B coefficient make when applying the Girard formula? The answer is that the higher the initial average protection in a country (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 initially low 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, particularly for countries such as India, those in the Maghreb, 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.

It is worth noting that deepening cuts by lowering the B coefficient from 1 to 0.65 makes a difference of comparable importance for most developing countries, as with the switch from 2 to 1. While a limited liberalisation is largely absorbed by the binding overhang (the cut in

[21] Nevertheless, had SSA and South Asia not been exempted from any commitment, the impact would also be significant (around 3 percentage points) for these two regions.

[22] It is notable that the average tariff duty resulting from the removal of tariff peaks remains greater than 15% in India for textiles and clothing. This result stems from the fact that some of the products included in these GTAP sectors are classified in the WTO nomenclature as agricultural products, and are accordingly excluded from the liberalisation scenario considered here.

applied tariffs is far less than in bound tariffs), this is not true of additional liberalisation. This magnifies the link between the depth of liberalisation and the balance between developed and developing countries.

## 4. Simulation results

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

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

Multilateral liberalisation is generally expected to increase import prices, at least on those products experiencing the greatest liberalisation. Lowered trade barriers increase the world demand for imports, therefore inducing an upward pressure on their prices. Yet this is not the case here as a result of applying the Girard formula with the coefficient B = 1 (Table 3). On the contrary, world import prices decline for most industrial products, and in particular for textiles, clothing 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 the majority of industrial sectors helps to explain this finding. Imported intermediate inputs account for a substantial share of the total cost of many products. For most producers, lowered tariff duties thus mean cheaper intermediate inputs and hence lower production costs.[23] When import prices are only 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[24] incorporated in world imports increases for all the industrial sectors. This price increase is very moderate, however, not exceeding 0.35% except for textiles, clothing and leather, 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 and +0.29% for Hong Kong/Taiwan/Singapore), but leading to a slight deterioration in North America (-0.25% in Canada and -0.24% in the US). In contrast, there is a general if limited (0.10% for intermediate countries) deterioration in the terms of trade for developing countries, with the sole exceptions of China and Russia. As a result of their high initial level of protection, India (-1.61%) and the Maghreb (-0.83%) experience the most significant deterioration.

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[23] 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.

[24] This calculation is 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 the difference in the import ratio between the final and intermediate goods for each sector.

*Table 3. Effects of applying the Girard proposal (using coefficient B = 1) on world import prices, as measured 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 |

*Notes:* The world GDP price is used as the numeral. 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 price indices are computed as Fischer indices.

*Source:* Authors' simulations.

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, the Maghreb and SACU (Table 4). 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 enveloping countries exempted from any requirements, do not experience any significant increase in industrial imports. But nor do they benefit from any increase in industrial exports; on the contrary, their industrial exports decrease slightly. Indeed, these countries initially benefit from widespread preferential schemes in their main markets, either directed towards Africa (by the EU under the Cotonou Agreement or by the US under the AGOA) or directed towards LDCs, as mentioned previously. For these two regions, multilateral liberalisation does not involve much improvement in market access – it is most of all synonymous with 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 for these countries multilateral liberalisation entails an erosion of preferences on their main export markets.

*Table 4. Effects of applying the Girard proposal (using coefficient B = 1) on industrial added value, industrial exports, industrial imports, terms of trade and welfare (% change)*

| | | Industrial added value | industrial exports | industrial imports | Terms of trade | Welfare |
|---|---|---|---|---|---|---|
| **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 |
| **Developing ctries** | | **-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: clothing (+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%. Yet in some cases these rather low aggregate figures hide a significant reshuffling of industrial activity worldwide, in particular for the above-mentioned sectors. In the clothing sector, for instance, Asian countries strongly benefit from the liberalisation, with 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 clothing sector is halved in the Maghreb countries, and it is reduced by more than 10% in Canada and Mexico. Here again, the erosion of preferences is the main reason for this sharp downsizing of the clothing sector, which would require a substantial adjustment from the Maghreb economies in particular. In textiles, the so-called 'Dragons' (Korea, Hong Kong, Taiwan and Singapore) record a substantially increased value added, mainly at the expense 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) 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, worldwide income gains appear to be very limited (+0.04%). Among developed countries, Asian countries are the main gainers, which is unsurprising given their strong competitive positions in the world trade of industrial products. These gains mainly stem from improved access to export markets and entail sizeable gains in terms of trade, 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 rises, thus increasing the variety of goods available to consumers, who in addition also benefit from easier access to foreign goods (although this effect is weak, owing 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 loser among developed countries, because of deteriorated terms of trade stemming from eroded preferences in North American markets.

Among developing countries, the outcome is far more contrasted. The Maghreb countries enjoy a strong income gain (almost +2%), and Russia, SACU, the Tigers and Turkey record slight gains. Yet all the 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, particularly compared with those observed for developed countries.

The results for India and the Maghreb may seem puzzling. While these regions are the two most protectionist and present some similarities in their export structure (strongly oriented towards textiles and clothing), they exhibit opposite outcomes: India features as the greatest loser, whereas the Maghreb is the greatest winner.[25] The explanation for this is mainly twofold. First, liberalisation entails higher consumer gains in the Maghreb because initial protection is very inefficient, with not only a high average level, but also with strong variations across products and partners. Liberalisation thus entails strong allocative efficiency gains for the Maghreb countries (+1.7% of equivalent variation), which is far less the case for India (+0.3%). Second, the adjustment in India entails a large output decrease in several fragmented sectors (chemistry, ferrous and metal 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 owing 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 does not earn any significant gains in terms of trade, because of the tough price competition among developing countries (most of which experience a depreciation of their real exchange rates) that China encounters 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 had

[25] In addition, it should be noted that the Maghreb region is heterogeneous. Algeria and Libya are not WTO members and exhibit high protection levels. Although Morocco and Tunisia account for the bulk of the region's foreign trade, this could blur the analysis.

offered a wide range 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 check for below.

## 4.2 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% (see Appendix 3). This is six times as much as the increase resulting from the elimination of tariff peaks and approximately three times more than under the Girard proposal. The difference in outcomes across the application of the Girard proposal with different B coefficients remains limited at the world level: world trade is increased by 4% with a coefficient of 0.65, by 3% with a coefficient equal to unity and by 2% with a coefficient of 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 range of 20%.

The distribution of industrial import creation across countries closely follows the hierarchy of initial protection: the highest import increases are recorded in the Maghreb and in India (with respectively a 48% and a 45% increase in volumes following complete liberalisation). Argentina and Brazil record a 28% and a 23% trade increase respectively. Logically, these high-protection countries are also those where the choice of a B coefficient in the Girard formula matters most. Indian imports increase by 16% in volume with B = 0.65, compared with only 4% 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, compared with 7% for industrialised countries. Under this benchmark scenario, however, the volume of exports of the poorest countries would decline by 1%. Only 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 effects observed on exports are necessarily closely linked to those on imports (see Appendix 4). Any *ex ante* import surge over and above the export increase would entail real depreciation and hence further (industrial and agricultural) export growth. This explains why strong export growth is recorded in countries such as India and those in the Maghreb, not because liberalisation would *ex ante* create a strong increase in the foreign demand for their products.

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 of 0.65 for the Girard formula this impact is smoothed (respectively +0.1 / -0.3 / -0.2), and even more so with a coefficient of 2 (respectively – 0.0 / +0.0 / - 0.1). Lastly, introducing an SDT (scenario (f)) profoundly modifies the results for intermediate developing countries: their terms of trade are slightly improved in this case, particularly to the benefit of Argentina, China, Russia and the Tigers. Countries that were facing extensive worsening in their terms of trade, such as India, also find their losses are sharply limited.

*Table 5. Effects 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 |
| **Developing ctries** | | **-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.*

The impact on terms of trade is thus detrimental to developing countries when liberalisation is significant, while this is not the case for lesser tariff cuts. This results from an association with high initial protection levels and 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 with developed countries. For developing countries liberalisation thus entails 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 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 them. As a result, the exporters in developing countries are close competitors. This means that the real depreciation of other developing countries substantially reduces the competitive advantage each country draws from its own depreciation, hence the need for further depreciation.

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

*Table 6. Effects 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 |
| **Developing ctries** | | **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** |

*Note*: Initial levels are expressed in tens of $US billions for 2001.

*Source:* Authors' simulations.

As evidenced by a decomposition of welfare gains, this deterioration in terms of trade plays a key role in explaining the welfare losses found for many developing countries as soon as 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, a comparison of scenarios (a) to (e) points out the increasingly uneven impact of more ambitious liberalisation scenarios. India is a good illustration of this: the welfare loss is –0.15% in our central scenario (Table 6). It doubles when we use the parameter 0.65 instead of unity in the Girard formula. It is even four times as large with complete liberalisation, whereas the welfare loss becomes negligible with a coefficient of 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 although almost all of them are exempted from any liberalisation commitment, SSA countries are adversely affected in welfare terms in all the scenarios, with the exception of the elimination of tariff peaks. This loss, of limited amount, is the result of preference erosion (in particular for textiles and clothing in the EU and US markets) 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 (with a coefficient of 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[26] (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, not only in terms of trade but also regarding 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 that have high initial protection: textiles, clothing and 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 and steeper decreases in South America and poor countries. Accordingly, this change in the parameterisation of the model slightly magnifies the uneven nature of the welfare changes across regions, with a more favourable outcome for intermediate countries, but a worsened impact on poor countries.

An alternative departure from our initial set of assumptions 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 those sectors that were initially highly protected, namely textiles, clothing and leather, where the price increase can be twice as large under perfect competition. Another significantly impacted sector is other manufacturing, including light industries mostly exported by developing economies. Regarding welfare, abandoning the imperfect competition mostly 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 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 or south) into two qualities (high or low). One could criticise such assumptions on the grounds of intra-firm trade, international sub-contracting, outsourcing practices, etc. After all, one does not care where his/her sportswear has been produced, if 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

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

producing low quality goods, they are mainly competing among themselves. Insofar as liberalisation results in an *ex ante* negative competitive shock for most of them, the real depreciation required to maintain a balanced current account is higher, because it is shared by close competitors, thus limiting the substitution effect.

*Table 7. Compared effects on world import prices, as measured through value-added prices of the Girard proposal (B = 1) under different model 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.*

So far, we have assumed capital stock to be fixed. If we instead assume that each economy's capital stock is endogenous, while the real return to capital is held constant, the results are significantly altered in relation to the *ex ante* impact on the marginal productivity of capital. This magnifies 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 a change in the 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 trend in the return to capital. The poorest countries 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.

*Table 8. Compared effects of the Girard proposal (B = 1) on terms of trade under different model specifications (% change)*

| | | Mirage | Sigma x 2 | Perfect comp'n | No vertical diff'n | K endog | Mirage, after agric lib'n |
|---|---|---|---|---|---|---|---|
| **Industrialised ctries** | | **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 |
| **Developing ctries** | | **-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.*

Finally, the results could 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 may 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 and export subsidies) are halved in all countries in the pre-experiment. This last change hardly affects the results. Such an outcome does not mean that there are no additional gains from liberalising agriculture; however, these gains are incorporated in the pre-experiment, not in the simulation. But the results do show that separately studying agricultural and non-agricultural products does not introduce any significant bias.

*Table 9. Compared welfare effects of the Girard proposal (B = 1) under different model specifications, per country (equivalent variation, % change)*

| | | Mirage | Sigma x 2 | Perfect comp'n | No vertical diff'n | K endog | Mirage, after agric lib'n |
|---|---|---|---|---|---|---|---|
| **Industrialised ctries** | | **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 |
| **Developing ctries** | | **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 provides the first study of the stakes involved in multilateral liberalisation of non-agricultural market access, which properly takes account of the actual structure of protection at the detailed level, for both bound and preferential duties. As previously emphasised by, for instance, Francois & Martin (2004), lowered bound duties involve a gain in themselves. Yet the actual impact on applied duties is far from proportional, being 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 can matter a lot, particularly with regard to the sharing of welfare gains.

On the one hand, weak liberalisation would hardly modify applied protection in developing countries, because of the large binding overhang in these countries. On the other hand, ambitious liberalisation would spur price competition between developing countries' exporters, who are often specialised in similar products and quality ranges, resulting in terms-of-trade losses for a number of them. And changing coefficient B in Girard's formula from 2 down to 0.65 appears to be enough to switch the results from the first to the second case. Seemingly secondary issues or technicalities may thus significantly impact the outcome.

Additional gains arising from the conclusion of the Doha Round, especially those associated with agriculture and services should be kept in mind. Nevertheless, the sensitivity analysis carried out in this study validates the assumption that market access to non-agricultural products can be assessed independently of agricultural liberalisation without significant bias.

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

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# Appendix 1. Sector aggregation

*Table A.1. Aggregation by sector*

| Sectors (type of competition) | 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 fibres (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) |

*Source:* Authors.

# Appendix 2. Geographical aggregation

*Table A.2. Aggregation by region*

| 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) |
| EU-25 | 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 European Free Trade Area (xef) |
| RoW | Albania (alb), Bulgaria (bgr), Croatia (hrv) |
| EU-25 | Czech Republic (cze), Hungary (hun), Malta (mlt), Poland (pol) |
| RoW | Romania (rom) |
| EU-25 | Slovakia (svk), Slovenia (svn), Estonia (est), Latvia (lva), Lithuania (ltu) |
| Russia | Russian Federation (rus) |
| RoW | Rest of Former Soviet Union (xsu) |
| EU-25 | 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) |

*Source:* Authors.

# Appendix 3. Resulting average protection level for each liberalisation scenario

*Table A.3 Average protection level for liberalisation scenarios by market (AVE tariff duty, %)*

| | | Textiles | | Wearing | | Leather | | Chem | | WoodPap | | FerMetals | | MetalsNec | | MetalProd | | MotorVeh | | TrspEqNec | | Electronic | | Machinery | | OtherManuf | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| **Industrialised ctries** | | **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** | **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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 2.5 | 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 | 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 | 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 | 7.1 | 5.4 | 8.2 | 6.9 | 2.0 | 1.6 | 1.3 | 1.0 | 6.2 | 4.7 | 5.8 | 4.2 |
| **Developing ctries** | | **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** | **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 | 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 | 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 | 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 | 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 | 9.7 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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 | 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** | | **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** | **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 | 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 | 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 | 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 | 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** | | **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** | **4.4** | **3.3** | **8.0** | **3.8** | **2.0** | **1.5** | **1.4** | **1.1** | **3.1** | **2.4** | **3.0** | **1.9** |

*Notes*: (1) = Initial applied duties; (2) = Girard 1.

*Sources:* MAcMap database and authors' calculations.

# Appendix 4. Detailed simulation results

*Table A.4.1. Effects 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 |
| **Developing ctries** | **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** |

*Note*: Initial levels are expressed in tens of $US billions (in 1997).

*Source*: Authors' simulations.

*Table A.4.2. Effects 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 |
| **Developing ctries** | **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** |

*Note:* Initial levels are expressed in tens of $US billions.

*Source:* Authors' simulations.

*Table A.4.3. Compared effects on industrial added value of the Girard proposal (B = 1) under different model specifications, per country (% change in volume)*

| | | Mirage | Sigma x 2 | Perfect comp'n | No vertical diff'n | K endog | Mirage, after agric lib'n |
|---|---|---|---|---|---|---|---|
| **Industrialised ctries** | | **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 |
| **Developing ctries** | | **-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.4.4. Effects 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.4.5. Effects 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.4.6. Effects 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 |
|---|---|---|---|---|---|---|---|---|
| **Industrialised ctries** | | **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 |
| **Developing ctries** | | **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.4.7. Effects 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 |
|---|---|---|---|---|---|---|---|---|
| **Industrialised ctries** | | **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 |
| **Developing ctries** | | **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.4.8. Effects 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 |
|---|---|---|---|---|---|---|---|---|
| **Industrialised ctries** | | **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 |
| **Developing ctries** | | **-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.4.9. Effects on real exchange rates, 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 |
|---|---|---|---|---|---|---|---|---|
| **Industrialised ctries** | | | | | | | | |
| of which: | 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 |
| **Developing ctries** | | | | | | | | |
| of which: | 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** | | | | | | | | |
| of which: | 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.5.1. 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 compn | 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 |

*Source:* Authors' simulations.

*Table A.5.2. 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 compn | No vertical diffn |
| 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 |

*Source:* Authors' simulations.

*Table A.5.3. 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 |

*Source:* Authors' simulations.

# 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 optimisation programmes:

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

s.t.:

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

and

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

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

### 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)

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

$$\text{s.t.:}\quad DEMTOT_{i,r}^{\,1-\frac{1}{\sigma_{GEOi}}} = a_{Ui,r} DEMU_{i,r}^{\,1-\frac{1}{\sigma_{GEOi}}} + a_{Vi,r} DEMV_{i,r}^{\,1-\frac{1}{\sigma_{GEOi}}}$$

Armington (third stage)

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

$$\text{s.t.:}\quad DEMU_{i,r}^{\,1-\frac{1}{\sigma_{ARMi}}} = a_{LOCi,r} DEM_{i,r,r}^{\,1-\frac{1}{\sigma_{ARMi}}} + a_{ETRi,r} DEMETR_{i,r}^{\,1-\frac{1}{\sigma_{ARMi}}}$$

Regions (forth stage)

For foreign regions of the same level of development:

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

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

For foreign regions of different levels of development:

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

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

Varieties (fifth stage, imperfect competition)

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

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

### 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:

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

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

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

### 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:

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

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

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):

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

Tax revenues:

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

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

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

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

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

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

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

Regional equilibrium:

$$REV_r + SOLD_r = \sum_{i} PRN_{i,r} RN_{i,r} + PTE_{i,r} TE_{i,r} + PK_{i,r} K_{i,r} + \sum_{s} rente_{r,s} - rente_{s,r} + PLbar_r\, Lbar_r + PHbar_r\, Hbar_r + RECTAX_r + \sum_{s}$$

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

### Imperfect competition

Definition of market shares:

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

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

Mark-up in domestic markets:

$$NB_{i,r}\left[EP_{i,r,r} + \frac{1}{\sigma_{VAR\,i}}\right] = \left[\frac{1}{\sigma_{VAR\,i}} - \frac{1}{\sigma_{ARM\,i}}\right] + \left[\frac{1}{\sigma_{ARM\,i}} - \frac{1}{\sigma_{GEO\,i}}\right] SU_{i,r,r} + \left[\frac{1}{\sigma_{GEO\,i}} - \frac{1}{\sigma_{C\,i}}\right] ST_{i,r,r}$$

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 different levels of development:

$$NB_{i,r}\left[EP_{i,r,s} + \frac{1}{\sigma_{VAR\,i}}\right] = \left[\frac{1}{\sigma_{VAR\,i}} - \frac{1}{\sigma_{ARM\,i}}\right] + \left[\frac{1}{\sigma_{IMP\,i}} - \frac{1}{\sigma_{GEO\,i}}\right] SV_{i,r,s} + \left[\frac{1}{\sigma_{GEO\,i}} - \frac{1}{\sigma_{C\,i}}\right] ST_{i,r,s}$$