INTERNATIONAL FOOD
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MARKETS, TRADE AND INSTITUTIONS DIVISION

March 2006

MTID Discussion Paper No. 93

What can the Poor Expect from Trade Liberalization?
Opening the "Black Box" of Trade Modeling

Antoine Bouët

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GLOSSARY OF ABBREVIATIONS

AGOA	African Growth Opportunity Act
AMVdM	Anderson, Martin and Van der Mensbrugghe
AVE	Ad Valorem Equivalent
CEPII	Centre d'Etudes Prospectives et d'Informations Internationales
CES	Constant Elasticity of Substitution
CET	Constant Elasticity of Transformation
CGE	Computable General Equilibrium
CGEM	Computable General Equilibrium Model
CRP	Conservation Reserve Program
DDA	Doha Development Agenda
EBA	Everything But Arms
EFTA	European Free Trade Area
EU	European Union
FDI	Foreign Direct Investment
FL	Full Liberalization
GDP	Gross Domestic Product
GEP	Global Economic Prospects
GSP	Generalized System of Preferences
GTAP	Global Trade Analysis Project
HRT	Harrison, Rutherford, Tarr
HS	Harmonized System
IQTR	Inside Quota Tariff Rate
LDC	Least Developed Countries
LES-CES	Liner Expenditure System - Constant Elasticity of Substitution
MENA	Middle East and North Africa
MIRAGE	Modeling International Relations under Applied General Equilibrium
NAFTA	North America Free Trade Agreement
OECD	Organization for Economic Cooperation and Development
OQTR	Outside Quota Tariff Rate
RD	Research and Development
SACU	Southern Africa Custom Union
SDT	Special and Differentiated Treatment
SSA	Sub – Saharan Africa
TRQ	Tariff Rate Quota
TWB	The World Bank
UN	United Nations
USA	United States of America
WTO	World Trade Organization

ABSTRACT

Trade liberalization is expected to act positively on development and poverty alleviation, both of which have become a high priority of international community. This explains why numerous studies have focused on assessing the expected benefits of trade liberalization on poverty. The main empirical tool for these assessments has been the use of multi-country Computable General Equilibrium Models (CGEM). These models, however, have produced divergent results. As demonstrated by recent studies, the associated increase in world welfare from full trade liberalization ranges from 0.2% to 3.1% — results that differ by a factor of 15 to 1! The impact on poverty headcount is also very divergent as the number of people lifted out from poverty ranges from 72 million to 446 million —a ratio of 5.5 to 1! This is a rather contrasting picture of the effects of trade liberalization on poverty. It gives the impression that with global trade modeling, divergent results are the rule. Moreover, as a sophisticated and complex tool of analysis, CGEM often appears as a "Black Box", the results of which are difficult to understand.

The objective of this study is to examine the efficiency of trade modeling in capturing the benefits from trade liberalization. It will provide a survey of methodologies utilized to assess the impact of trade liberalization on poverty and will examine the extent to which such assessments diverge. The survey also demonstrates the benefits of "complementary analysis", which utilizes different methodologies to study a specific topic.

First, the paper examines the advantages and drawbacks of each method, with a particular focus on multi-country general equilibrium models. Second, the paper undertakes a global modeling under general equilibrium — MIRAGE model— the results of which are compared to those obtained in recent studies.

Using the MIRAGE model [1] full trade liberalization is estimated to increase world real income by $100bln (+0.33%) after ten years of implementation. This trade reform would be development-friendly, as it entails a larger growth rate for developing countries, and especially for Least Developed Countries (LDC). It would also contribute to poverty alleviation, as unskilled labor would gain in numerous developing zones, especially in Latin America and most of Sub – Saharan Africa. Finally, full trade liberalization would reduce world income inequality as the Gini coefficient of world income distribution (taking into account population distribution) would be reduced marginally. Nevertheless, certain developing countries might lose by this world trade reform, such as Argentina, Mexico, and South Africa.

Trade liberalization implies allocative efficiency gains, which are positive in any case. But liberalizing trade may cause deterioration of terms of trade either because rising world prices of agricultural commodities have adverse effects on net food importing countries (Middle East North Africa countries, Mexico, Tunisia, Bangladesh, China) or because preferential access is eroded (SubSaharan Africa – SACU[2] not included – Mexico, Tunisia, Bangladesh.) Furthermore, assuming imperfect competition and product differentiation in industry and services, agricultural specialization has a cost; trade reform gives agricultural countries incentives to reallocate productive factors in the primary sector. In so doing, economies of such countries benefit less from economies of scale and varieties. This mechanism mainly explains why in the simulation presented here Argentina loses from full trade liberalization. Other countries, such as Australia, New Zealand, and Brazil, are negatively affected by this mechanism, but to a lesser extent.

Finally, conclusions that have been unanimously adopted by the literature are confirmed:

[1] The MIRAGE model was developed at the Centre d'Etudes Prospectives et d'Informations Internationales (CEPII) in Paris. Full description of the model is available at the CEPII Web site (www.cepii.fr).
[2] South Africa Custom Union.

- Agriculture liberalization plays a major role in the benefits that can be drawn from liberalization.
- Tariffs are by far the main source of distortions.
- Liberalization in developing countries is a key element of the trade reform.
- The paper also offers four explanations on divergent results of multi-country general equilibrium models, including the MIRAGE model undertaken here:

  1) Experiments are not the same

  2) Data are not the same

  3) Behavioral parameters are not the same

  4) Theoretical features are not the same

Each explanation is examined in detail. The simulation in this paper is also utilized to check explanations of divergent results in the literature. In order to quantify the importance of the four factors, a sensitivity analysis is carried out. This method provides a quantitative assessment of expected benefits from liberalization when one hypothesis is modified and it confirms that:

- Direct trade barriers like tariffs, tariff quotas, and anti-dumping duties are smaller than previously expected. Furthermore, the worldwide structure of protection is less penalizing for developing countries than it was frequently stated few years ago. This is due to the multiplication of preferential schemes, which were not taken into account previously. Consequently, the expected benefits from full trade liberalization are not as large as they were assessed in recent literature.
- In multi-country trade models the size of the expected benefits depends crucially on the value of Armington trade elasticities. The simulation that has been carried out in this study is founded on GTAP elasticities which are small compared to

others used in the literature. These values have been validated by a recent econometric research carried out by Hertel, Ivanic, Preckel, and Cranfield (2000.)

- The size of expected benefits from trade liberalization also depends crucially on the potential positive impact of trade openness on factor productivity. Several multi – country trade models utilize *ad hoc* methodologies to capture this element, like an equation relating positively total factor productivity to trade openness. This relation makes sense; openness may accelerate transmission of technologies. This is broadly confirmed by empirical works, but this kind of econometric study meets a significant number of conceptual and empirical difficulties. Furthermore, the previous direct relation between total factor productivity and trade openness is not founded on microeconomic basis and the parameters of the relationship are not measured with sufficient precision. As a result, integrating this relation automatically amplifies expected benefits, but the size of benefits has to be gauged with extreme care; this, however, does not highlight the channels through which trade integration raises factor productivity.

While this work is primarily focused on the issue of poverty, it does not provide an estimation of the extent to which full trade liberalization could alleviate poverty. Such an assessment would require utilization of numerous household surveys in developing countries, which goes beyond the technical feasibilities of this survey.

Another method of assessment would be possible: using poverty elasticities as in the Global Economic Prospects (2002 and 2004) or as in Cline (2004). An examination of this method, however, reveals that it is founded on weak assumptions. Furthermore, it presents the relation between trade liberalization and poverty alleviation as a mechanical one. According to this method, it would be sufficient to liberalize trade for increasing remuneration of unskilled labor in developing countries and reducing automatically (and proportionally) the stock of poor people in the world. This presentation is not realistic. Trade liberalization has frequently contrasting effects on poverty (poor people engaged in agricultural activities vs. poor working in industry or services, urban poor vs. rural poor,

level of education, etc.) Studies on poverty alleviation have to focus on these contrasting effects and on (international and domestic) policies that have to be simultaneously put in place in order to accompany liberalization. Finally, poverty alleviation is a concept with a high qualitative content while in these studies people can be lifted out from poverty simply because they earn few cents more.

Benefits from eliminating tariff barriers, domestic support, and export subsidies have been recently revised downwards, first, because liberalization has progressed in recent years (end of implementation of the Uruguay Round, China' accession to WTO, etc.), and second, because regional agreements and preferential schemes were not taken into account in previous works. When these elements are accounted for, two points explain divergent results across studies: trade elasticities and dynamic relations. Thus, it remains that trade liberalization is beneficial and contributes to poverty alleviation. It is all the more plausible for two reasons: first, trade reform could also concern non tariff barriers, trade facilitation, and obstacles to trade in services, and second, appropriate domestic reform accompanies trade reform. These two areas have not been enough investigated by economic research. They could constitute priorities in research agenda in order to understand fully the potential benefits that developing countries could draw from trade liberalization.

WHAT CAN THE POOR EXPECT FROM TRADE LIBERALIZATION? OPENING THE "BLACK BOX" OF TRADE MODELING

Antoine Bouët[3]

1. INTRODUCTION

Development and poverty alleviation have become a high priority of the international community. One of the key objectives—the Millennium Development Goals— set forth by the United Nations for 2015 is a reduction by half of the number of people living on less than a dollar a day. But, the world poverty headcount was stagnant in absolute terms during the 1990's. In 2003 nearly one quarter of the world population was living with less than 1$ per day, and one half with less than 2$ per day. To combat these high poverty levels, the current global trade negotiations conducted by the World Trade Organization (WTO) have been placed under the title of the Doha Development Agenda (DDA).

While recent literature confirms the positive relationship between liberalization and poverty alleviation, it also emphasizes that this relationship is not a mechanical one. Winters et al (2004) and Reimer (2002) identify several key linkages such as the price and availability of goods, the factor prices, the government transfers, the incentives for investment and innovation, the evolution of terms of trade, and the short-run risk.

The traditional argument in favor of a positive relationship between liberalization and poverty focuses on the first two linkages. A large proportion of poor people are working in the agricultural sector where trade distortions are particularly high. Liberalization could imply higher world agricultural prices and raise activity and remunerations in this sector in the Third World. The same beneficial outcome could occur in the textile and apparel sectors where protection remains high and developing countries have a comparative advantage.

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Nevertheless, openness might lead to negative outcomes. First, the decrease in import duties might reduce custom revenues so that the government's public receipts may be cut and the government transfers can shrink. Second, terms of trade can be negatively affected either because import prices increase or exports prices decrease due to more severe competition in export markets. Third, cutting trade barriers in a country increases import competition; this implies reallocation of productive factors which entails adjustment costs and short-run risk.

Furthermore, the previous economic mechanism emphasizes the predominance of agricultural activities in developing countries and the relationship between poverty and agriculture. But not all developing countries have a comparative advantage in agriculture, and not all poor people are engaged in agricultural activities. In fact, benefits for poor are expected from trade liberalization, but adverse effects can also occur in the short and the long run, which explains why numerous studies have focused on this issue. Some of the analytical instruments used to address this issue are: spatial and non-spatial partial equilibrium models, gravity equations, and single and multi country computable general equilibrium models.

The objective of this study is to provide a survey of methodologies utilized to assess the impact of trade liberalization on poverty, and examine the diverging results of such assessments. The paper is divided into five sections. Section 1 consists of this introduction. Section 2 looks at the advantages and drawbacks of each model, with a particular focus on multi-country general equilibrium models. Section 3 undertakes a global trade modeling under general equilibrium – MIRAGE model. Section 4 provides a literature review, which is followed by a conclusion provided in section 5.

Section 2 suggests that while no single method is better than others in all methodological aspects, the multi country computable general equilibrium models are an attractive analytical instrument thanks to the availability of complete database (GTAP) and the increasingly calculation capability of computers. While offering a consistent picture of

world economy, this analytical instrument can be utilized today to evaluate the impact of trade reform on a large number of productive sectors, trading zones, and productive factors.

Section 3 undertakes a global trade modeling to asses the impact of liberalization on poverty. Using the MIRAGE model[4] full trade liberalization is expected to increase world real income by $100bln (+0.33%) after ten years of implementation. This trade reform would be development-friendly as it would entail a larger growth rate for developing countries, and especially for Least Developed Countries (LDC.) It could also contribute to poverty alleviation and reduce world income inequality. Nevertheless, certain developing countries might lose from this world reform due to adverse evolution of their terms of trade or excessive specialization in agriculture. Finally, the section highlights the major role played by agriculture and tariffs in expected benefits from liberalization.

Is the MIRAGE assessment comparable to conclusions of recent studies on the same topic? In order to respond to this question, section 4 provides a literature review. Recent assessments using CGEM clearly highlight major divergences. From full trade liberalization, the associated increase in world welfare ranges from 0.2% to 3.1% (Dessus, Fukasaku and Safadi, 1999), results that differ by a factor of more than 15 to 1![5] The impact on the poverty headcount is also divergent as the number of people lifted out from poverty ranges from 72 million (Anderson, Martin and Van der Mensbrugghe, 2005) to 440 million (Cline, 2004), a ratio of 6 to 1[6]. This is a rather contrasting picture of the effects of trade liberalization on poverty. Moreover, as a sophisticated and complex tool of analysis, CGEM often appears as a "Black Box", results of which are difficult to understand.

Section 4 provides four different explanations for divergent results of trade modeling:

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[4] The MIRAGE model was developed ate the *Centre d'Etudes Prospectives et d'Informations Internationales* (CEPII) in PARIS. Full description of the model is available at the CEPII web site (www.cepii.fr).
[5] Comparisons must be done in % terms as welfare might be defined either in $1997 or $2001.
[6] In 2003, the number of people in poverty (2$ per day definition) is estimated at 2.8 bln (World Development Indicators, 2004). Full trade liberalization is estimated to decrease world poverty by a percentage ranging from 2.5 to 15.1.

1) **Experiments are not the same**. Assessing the impact of a DDA is a difficult task because of insufficient information on the contents of the final agreement and on the way countries will implement it. Even if the experiment is based on full trade liberalization, divergences could arise: does the experiment concern all distortions or only border measures? Is a pre-experiment conducted in order to account for the trade shocks that occur between the database period and the implementation date of the liberalization[7]? Finally, some modeling analyses envisage fiscal policy implemented simultaneously in order to offset the loss of tariff receipts, while others do not.

2) **Data are not the same**. At this level, potential sources of divergent assessments are manifold: social accounting matrix and data on economic policies. Amongst different assessments, the main source of divergence comes from data on market access. The data may or may not take into account all regional agreements and all preferential schemes. Tariff reduction may be imposed on bound or applied duties.. Furthermore, data on the bound level of domestic support may or may not be included. Finally, sector and product decomposition can differ.

3) **Behavioral parameters are not the same**. A CGEM needs an estimation of several parameters. A key parameter of this modeling exercise is trade elasticity. There is a disagreement on the level of these parameters within the scientific community. The impact of liberalization on trade flows, and thus on activity, is highly sensitive to these figures.

4) **Theoretical assumptions are not the same**. Models can differ by their theoretical assumptions. Labor and capital may be sector-specific or they can be re-allocated to other sectors. Land supply may be fixed or may be positively related to real remuneration. Competition may be perfect or imperfect. Openness may or may not have a positive effect on factor productivity. Divergence may also concern functional forms:

[7] For example, recent assessments study the effects of implementing liberalization in 2005, whilst the most recent available database is for 2001. A pre-experiment can be realized to account for different trade agreements that took place between 2001 and 2005, like the end of the Uruguay Round, Everything But Arms, African Growth Opportunity Act, the accession of China to WTO… If not, the effects of trade liberalization would be overstated.

utility function, complementarity vs. substitutability of productive factors and intermediate consumption or between intermediate goods.

Each explanation is examined in detail. In order to quantify the importance of these factors, a sensitivity analysis is carried out, which includes several specifications. This method provides a quantitative assessment of hypothetical modifications and confirms that:

- Direct trade barriers like tariffs, tariff quotas and anti-dumping duties are smaller than previously expected.
- In multi-country trade models the size of the expected benefits depends crucially on the value of Armington trade elasticities.
- The size of expected benefits from trade liberalization also depends on the potential positive impact of trade openness on factor productivity or capital accumulation.

In addition to providing explanation on divergent results of trade modeling, the paper also sums up convergent conclusions of these studies, which affirm that:

(i) Liberalizing agriculture is the main source of expected gains, accounting for about two thirds of global gains.

(ii) Tariffs are by far the main source of distortions.

(iii) Developing countries could be great beneficiaries of these reforms.

(iv) Liberalizing trade policies of developing countries could contribute to about half of the expected benefits.

(v) Full trade liberalization could be beneficial for nearly all countries throughout the world, while it is quite plausible that the incomplete liberalization envisaged by DDA could be negative for numerous developing countries, especially if it leads to special and differentiated treatment (SDT). This policy option could mean less liberalization for middle income countries, no liberalization for Least Developed Countries

(LDC), and numerous exemptions in the way in which agriculture is liberalized in rich countries.

This work does not provide any estimation of how full trade liberalization could alleviate poverty. Such an assessment would require the utilization of numerous household surveys in developing countries, which goes beyond the technical feasibilities of this survey. But, another method would be feasible: using poverty elasticities as in the Global Economic Prospects (2002 and 2004) or as in Cline (2004.) An examination of this method, however, reveals that it is founded on weak assumptions: normal or lognormal internal distribution of income and constant dispersion of this distribution after the trade reform.

Furthermore, this method presents the relation between trade liberalization and poverty alleviation as a simplistic one: it would be sufficient to liberalize trade for increasing unskilled labor's remuneration in developing countries, which would automatically (and proportionally) reduce the stock of poor people in the world. This presentation is not realistic. Trade liberalization has frequently contrasting effects on poverty (poor people engaged in agricultural activities vs poor working in industry or services, urban poor vs. rural poor, level of education, etc.) Studies on poverty alleviation have to focus on these contrasting effects and on (international and domestic) policies that have to be put in place simultaneously in order to accompany liberalization. Finally, poverty alleviation is a concept with a high qualitative content while in these studies people can be lifted out from poverty simply because they earn few cents more.

The objective of this study is to examine the efficiency of trade modeling in capturing the benefits from trade liberalization. It is aimed at evaluating the advantages and drawbacks of different methodologies but it is focused on multi-country computable general equilibrium models, which have received great attention in the last years from academics, development institutions, and public opinion. This methodological evaluation will be founded on our own modeling of expected benefits from full trade liberalization, the results of which will be carefully compared to those obtained in recent studies. The ultimate aim of this work is threefold:

(i) Assessing realistically the consequences of trade liberalization on development.

(ii) Understanding the divergences that come out of recent studies.

(iii) Defining the role that can be played by the International Food Policy Research Institute (IFPRI) in this area.

As a matter of conclusion, section 5 responds to these three questions.

2. ASSESSING THE IMPACT OF TRADE LIBERALIZATION: HOW?

Several methodologies are available for evaluating economic consequences of trade liberalization: (i) spatial and (ii) non spatial partial equilibrium analysis; (iii) single country and (iv) multi country general equilibrium model. This section provides an overview of these methodologies and identifies their main advantages and drawbacks. For a better understanding of the structural differences, in each case, a very simple model illustrates the methodology. Two possible applications are developed for multi-country general equilibrium trade models, as the most sophisticated method of assessment in spite of its major drawbacks.

2.1 NON SPATIAL PARTIAL EQUILIBRIUM MODELING

Consider a certain sector in a country. In the simplest theoretical framework, domestic and foreign goods are perfect substitutes.

Let Q^D be the demanded quantity, Q^S the supplied quantity, M^D the imports demand, M^S the imports supply, P the domestic price of the good studied, P* its world price, t is the tariff applied domestically on imports of this good.

A non spatial partial equilibrium model can be expressed as a model of five equations. Equations (1) and (2) are expressing, respectively, the quantities demanded and supplied by domestic agents as a function of domestic price (P).

$$Q^D = Q^D(P) \quad (1)$$

$$Q^S = Q^S(P) \quad (2)$$

The level of domestic price is such that the demanded quantity is greater than the supplied quantity; the difference is imported from the rest of the world.

$$M^D = Q^D(P) - Q^S(P) \quad (3)$$

The foreign supply depends on the level of the world price (P*).

$$M^S = M^S(P^*) \quad (4)$$

The domestic tariff t creates a difference between the world and the domestic prices:

$$P = P^*.(1+t) \quad (5)$$

This model can be even simpler as the inclusion of equation (4) reflects that the importing country is large. In case of a small country, one would consider that whatever its import demand, world price remains constant: equation (4) vanishes.

The obvious advantage of this kind of model is its simplicity and its tractability. Quantity of this good can be normalized so that the world price is equal to 1. If the importing country is small, the economic consequences of a tariff can be derived immediately from this system of equations; calculating the distortion resulting from protection (variation in consumer surplus, producer surplus, and public receipt) only requires information on the level of the tariff, the levels of domestic consumption and production, and the price-elasticity of demand and supply.

Even in the case of a less simplistic formulation (it is possible to suppose that domestic and foreign goods are not perfect substitutes[8], or to consider a multi-product partial equilibrium model where, for example, one product is used as the input of a second

[8] See for example Hufbauer and Elliot, 1994 in an assessment of US trade policy or Messerlin, 2001, for the European Union.

one[9]) several immediate (and strong) criticisms can be addressed to this method. It supposes that commodities originating from several exporting countries are perfectly homogenous: it accounts for neither an imperfect substitutability between foreign products, nor the differentiated transportation costs. Therefore, it is unable to measure bilateral trade flows. This metric issue will be addressed in the next subsection on spatial partial equilibrium models.

The previous system of equations does not include general equilibrium effect. It is only sustainable in cases of small sectors of domestic economies. If, on the contrary, the sector under consideration is large, the imposition or elimination of a tariff might have non marginal effects on the demand of productive factors and intermediate consumptions, consumers' income, etc. The construction a general equilibrium model allows for taking into account these effects (see subsection 2.3.)

2.2 SPATIAL PARTIAL EQUILIBRIUM MODELING

Suppose now n countries (i=1, 2, …n) with 1 being the domestic country, j = 2, …, and n is the index for foreign countries. In the sector studied, imports and domestic goods are imperfect substitutes: the Armington[10] hypothesis precisely means that products are differentiated by their country of origin. Equation (6) is the demand function for domestically produced goods, while equation (7) is the demand function for imports from country j. Substitutability between products implies that demand for one product depends on all prices.

$$Q_1^D = Q_1^D(P_1; P_2; ...; P_n) \qquad (6)$$

$$Q_j^D = Q_j^D(P_1; P_2; ...; P_n) \qquad (7)$$

The supply of domestic good is:

[9] See Roningen, 1997.
[10] See Armington, 1969.

$$Q_1^S = Q_1^S(P_1) \qquad (8)$$

The supply of foreign goods depends on foreign prices:

$$Q_j^S = Q_j^S(P^*_j) \qquad (9)$$

Partial equilibrium model supposes that the consumers' income and the cost of productive factors are constant, so that they do not exert any impact on demand and supply.

Finally, the gap between domestic and foreign prices reflects the domestic tariff and the cost of transportation from country j to country 1 (τ_j - in %). The domestic tariff is indexed by j (the exporting country) as preferential schemes, regional agreements or certain features of the protective instrument[11] can result in trade discrimination.

$$P_j = P^*_j.\left(1 + t_j + \tau_j\right) \qquad (10)$$

This model is easily tractable (see the COMPAS model –Francois and Hall, 1993- for a log-linear version or Francois and Hall, 1997, for a CES version).More information on discriminatory trade regimes is available (see Bouët, Decreux, Fontagne, Jean and Laborde, 2005a). The estimation of bilateral transportation costs is a much more difficult issue, but the great advantage of this method is that it allows for measuring bilateral trade flows.

2.3 SINGLE COUNTRY TRADE MODELING

As a complex methodology, general equilibrium modeling can be time-consuming, but it allows for taking into account fundamental effects of economic reforms—like income effects and interdependence between sectors of production. The expansion of activity in a sector may have economy-wide effects which can be captured by this framework, but which are not accounted for by partial equilibrium model. This expansion increases demand for primary factors and their remuneration; it therefore raises the cost of production for other sectors, and the demand of intermediate goods addressed to other

[11] The tariff may be specific and not ad valorem, or it can be an anti-dumping duty.

sectors. Further, it affects the level of net public receipts/expenses if the production or the utilization of some factors is either taxed or subsidized; the variation of remuneration modifies the income level of households, which in turn, change their levels of consumptions.

As a result of this full integration of income and interdependence effects, general equilibrium accounts for the complete budget closure of a model. If the behavior of n agents is modeled and that (n-1) agents are globally in budget deficit (they consume more than they produce), it ensures that the n^{th} agent is in surplus: s/he produces more than s/he consumes; and her/his surplus exactly matches the global deficit of the (n-1) other agents. In doing so, a general equilibrium model is fully consistent.

The most direct way to account for general equilibrium effects is to construct a single country trade model. Of course this kind of model is unable to measure bilateral trade flows, but it takes into consideration general equilibrium effects. To illustrate this method, consider one country and N sectors (k=1, 2…N). In the following simplistic structure, imported and domestic goods are perfect substitutes; there is no intermediate consumption in production, no government, and labor is the sole productive factor (its remuneration is w). These are uncommon features of single country trade models used in the literature, but they allow for a concise presentation of the model in only 8 equations – from (11) to (18) -. Furthermore, there is perfect competition in all markets and perfect mobility of labor across sectors. Demand function of good k depends on all prices (allowing for substitutability or complementarities between goods) and national income, supposedly distributed to a single household whose demand is representative:

$$Q_k^D = Q_k^D(P_1; P_2 \ldots P_N; Y) = Q_k^D(P; Y) \qquad (11)$$

P is a vector of N prices. The country's supply of good k is function of domestic price of good k and of the remuneration of labor:

$$Q_k^S = Q_k^S(P_k; w) \qquad (12)$$

Let ED_k be the domestic Excess Demand for good k. If it is positive (respectively negative), it represents imports (respectively exports).

$$ED_k = Q_k^D(P;Y) - Q_k^S(P_k;w) \quad (13)$$

Let ES^*_k be the rest of the world's Excess Supply of good k. If it is positive (respectively negative), it represents exports (respectively imports) of the rest of the world.

$$ES^*_k = ES^*_k(P^*) \quad (14)$$

The government is applying import duties t_k on good k.

$$P_k = P^*_k.(1+t_k) \quad (15)$$

P_k might be sufficiently low for ED_k to be positive: the country imports good k which is in excess supply in the rest of the world ($ES^*_k>0$). Exports occur in the case of P_k high (the case of positive exports and positive t_k is possible; then t_k represents an export subsidy). Then ED_k and ES^*_k are negative.

Let L^D_k be the demand of labor by sector k and $\overline{L}$ the total endowment of labor. The labor market equilibrium requires:

$$L_k^D(w;P_k) = \overline{L} \quad (16)$$

National income comes from labor and import taxes:

$$Y = w\overline{L} + \sum_k t_k P^*_k ED_k \quad (17)$$

It is important to note that in case of exports, either t_k is zero or exports are subsidized (t_k positive and ED_k is negative).

There are several ways to operate a closure of this model. One is to consider that the current account is constant – or in other words, the country is unable to borrow from, or to lend to, the rest of the world:

$$-\sum_k P^*_k \, ED_k = \overline{CA} \qquad (18)$$

When comparing this very simple single country trade model to the partial equilibrium model presented in subsection 2.1, it is possible to point out the four main features that distinguish partial from general equilibrium analysis. First, demand depends on all prices and income, thus, making possible real income effect on consumption. Second, supply also depends on the remuneration of productive factors. Third, from equation (17) the national income is affected by factor remuneration and tariff receipts; equilibrium on factor market determines the level of remuneration; it affects product demand and thus the formation of equilibrium on the product market. This mechanism might be inversed as economic activity determines factor demand[12]. Fourth, equation (16) constitutes a linkage between sectors, through the equilibrium on factor market[13]. The economic expansion of one sector raises its demand of productive factors and thus their cost; it affects the marginal cost of production in other sectors.

As a matter of conclusion, general equilibrium model is much richer than partial equilibrium model as it adds interdependence effects between sectors (through real income effects or factor remuneration effects) and between types of markets (products / productive factors). Finally, one of the major drawbacks of general equilibrium model is the fact that it requires more information on economic variables which greatly reduces its tractability.

2.4 MULTI COUNTRY TRADE MODELING

The previous framework is now extended to n countries (i=1,2…n); there are still N sectors (k=1,2…N). Products are differentiated by their country of origin (Armington). To simplify the presentation, suppose that there is no government, no intermediate consumption in production and labor is the sole productive factor.

[12] In fact there is no anteriority in this sequence as one of the main conclusions of the general equilibrium theory is that equilibrium occurs simultaneously on all markets.
[13] Another one is intermediate consumption: expansion in activity in sector i raises demand for intermediate consumption, whose prices are increased. It penalizes activity in other sectors.

Let $CP_{k,i,j}$ be the price paid by country j's consumers when they buy good k produced in i (consumer price)[14]. Demand in country j of good k produced in country i $Q^D_{k,i,j}$ depends on all consumer prices and of country j's income:

$$Q^D_{k,i,j} = Q^D_{k,i,j}(CP_{.,.,.}; Y_j) \tag{19}$$

If i is different from j, $Q^D_{k,i,j}$ represents trade flows of good k from i to j.

Let $PP_{k,i,j}$ be the price received by country i's producers when they sell good k in country j (producer price). The supply of good k produced in i to country j $Q^S_{k,i,j}$ depends on the producer price in j of good k produced in i $PP_{k,i,j}$ and the cost of labor in i.

$$Q^S_{k,i,j} = Q^S_{k,i,j}(PP_{k,i,j}; w_i) \tag{20}$$

Let $t_{k,i,j}$ be the tariff imposed by country j on good k coming from country i. The gap between producer price and consumer price is defined by[15]:

$$CP_{k,i,j} = PP_{k,i,j}\left(1 + t_{k,i,j}\right) \tag{21}$$

If $L_{k,i}$ is the demand of labor in sector k in country i and $\overline{L}_i$ is the total supply of labor in country i, factor market equilibrium requires:

$$\sum_k L_{k,i}\left(w_i; PP_{k,i,.}\right) = \overline{L}_i \tag{22}$$

Country j's national income is defined by:

$$Y_j = w_j \overline{L}_j + \sum_k \sum_{i \neq j} t_{k,i,j} PP_{k,i,j} Q^D_{k,i,j} \tag{23}$$

Finally all countries' current balances are constant:

[14] In case of double country index (i,j), the first index i refers to supply; the second one j refers to demand.

[15] We could also add a transportation cost $\tau_{k,i,j}$ of good k from i to j but it would require the modeling of a transportation sector.

$$\sum_{k}\sum_{j\neq i} PP_{k,i,j}Q^{S}_{k,i,j} - \sum_{k}\sum_{j\neq i} PP_{k,j,i}Q^{D}_{k,j,i} = \overline{CA}_{i} \qquad (24)$$

As compared to a single - country model, the immediate advantage of a multi-country trade model is its ability to calculate bilateral trade flows. It is all the more important in a world where trade discrimination is extensive. Single-country trade models can not really capture discriminatory effects of trade, like regional agreements or preferential schemes.

Nonetheless the complexity is significantly increased as it adds a new dimension to trade. Equations can now be four-dimensional (intermediate consumption: two sectors; two countries) and their number is increasing exponentially with the number of geographic zones and sectors[16]. All theoretical assumptions (households' disaggregations, imperfect competition, imperfect mobility of productive factors, unemployment, etc.) which can be applied in a single-country trade model can also be adopted in a multi-country trade model, but these extensions are constrained by computational capacity. This is the reason why these models are complementary analytical instruments of trade liberalization: for example, multi-country trade models can evaluate the impact of regional agreements at a macroeconomic level, while a single country trade model with extended disaggregation of households can use this macroeconomic shock (variation in world prices) to evaluate its distributional impact.

An illustration of this would be to undertake a computable general equilibrium model. This is the focus of the next subsection. Another analytical tool founded on multi-country general equilibrium model is the gravity equation (see 2.4.1.2), which is based on econometrics.

[16] That is to say: intermediate consumption of good k originated in country i by sector k' in country j. Thus decomposing in 10 sectors and 10 geographic zones leads to 10*10*10*10=10,000 equations for intermediate consumption.

2.4.1 Multi country CGEM

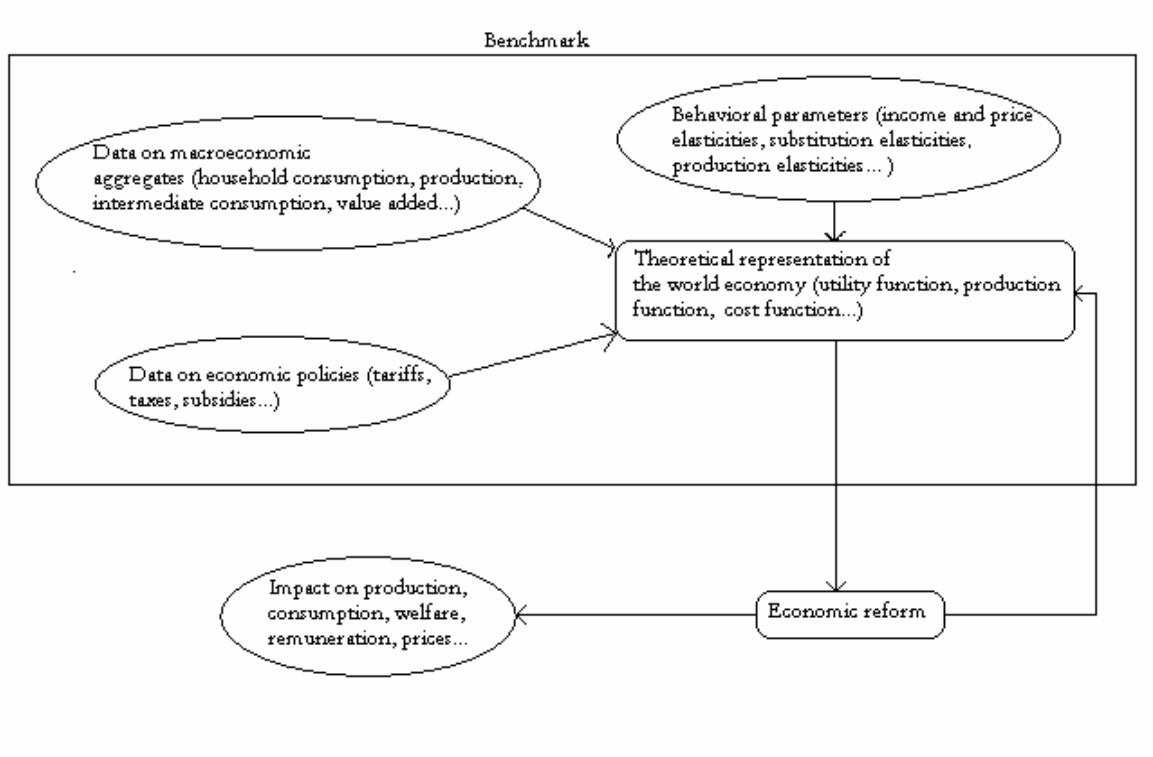
A Computable General Equilibrium Model (CGEM) is founded on a theoretical representation of the world economy; this theoretical representation is a multi-country general equilibrium model. Computable means that the model is calibrated so that it represents the world economy at the initial period of time.

The modeler must choose behavioral representations of consumers, producers, governments, and so forth. These choices are made based on the objective of the study. When studying trade reform, modeling the economy's real sector is prioritized while the financial one is disregarded. When the objective is the impact on poverty, numerous households are included in order to account for the diversity of income sources and consumption shares.

In order to represent the world economy, it is necessary to have data on household consumption, on sector production, added value, intermediate consumption, exports and imports, data on economic policies, and so forth.

Figure 1 is a close representation of a CGEM. The core of the model is composed of a theoretical representation of the economy. It is fed, on one side, with data on macroeconomic aggregates and economic policies, and on the other side, with behavioral parameters identified through econometric investigation. This information represents a benchmark on which economic reform is applied. The experiment generates new values of economic variables and compares them to initial values.

Figure 1—Structure of a computable general equilibrium model



Thus, a CGEM is an attractive way of modeling the consequences of trade reform as it is a fully consistent representation of the world economy, and it takes into account income effects and the interconnections between sectors. When considering the impact of trade reform at the world level, a multi-country trade model can be employed even if it lacks a great in-depth view of the functioning of national economies. On the contrary, a single country trade model can be employed when the modeler prioritizes the impact on domestic variables: it is, for example, of great usefulness for the study of redistributive effects of trade reform.

2.4.2 Gravity Equation

The gravity equation has been an attractive analytical tool for researchers in the international trade area as its utilization has been manifold. Gravity equation can be utilized

to evaluate market access, border effects, trading potentials, impact of regional agreements, and so forth.

Yet, the first generation of gravity equations had no solid theoretical foundation; intuitively, it sounded appealing to explain international trade through attractive forces (activity in the exporting zone, demand in the importing one) and resistive forces (transportation costs, trade barriers, etc). Fortunately, gravity equation has received a specific theoretical attention with the works of Anderson (1979), Bergstrand (1989, 1990), Deardorff (1998), Anderson and Van Wincoop (2003) and is now well-founded.

Consider a gravity equation following Fontagne, Pajot, and Pasteels' theoretical model (2001): all goods are differentiated by place of origin and each region is producing only one good. The supply of each good is fixed. Consumers have identical and homothetic preferences represented by a CES utility function. Let c_{ij} be the consumption of good produced in country i by agents in country j. The latter are maximizing utility U_j:

$$U_j = \left(\sum_i \beta_i^{1/\sigma} c_{ij}^{(\sigma-1)/\sigma} \right)^{\frac{\sigma}{\sigma-1}} \qquad (25)$$

subject to the budget constraint:

$$\sum_i p_{ij} c_{ij} = y_j \qquad (26)\,.$$

σ is the elasticity of substitution between all goods, β_i is a distribution parameter and p_{ij} is the price in j of the good produced in i. If p_i is the exporter's supply price then:

$$p_{ij} = p_i \tau_{ij} \qquad (27)$$

τ_{ij} is greater or equal to 1 and includes trade costs. Trade costs might be seen only as direct costs resulting from transportation and taxation at the border. They might also include information costs on quality, technical features, and availability of the product.

Trade costs are of iceberg-type: (τ_{ij}-1) % of origin production is lost in trade such that, if Q_i is production of i:

$$p_i Q_i = \sum_j p_{ij} c_{ij} = \sum_j p_i \tau_{ij} c_{ij} \tag{28}$$

Value of exports from i to j is defined by:

$$x_{ij} = p_i \tau_{ij} c_{ij} \tag{29}$$

Finally country i's total income is:

$$y_i = p_i Q_i \tag{30}$$

If all quantities are normalized such that $p_i = 1$, the following expression can be drawn from this model:

$$x_{ij} = \frac{1}{\tau_{ij}} \frac{y_i y_j}{y^W} \frac{\left(\frac{\tau_{ij}}{\widetilde{\Pi}_j} \right)^{1-\sigma}}{\sum_k s_k \left(\frac{\tau_{ik}}{\widetilde{\Pi}_k} \right)^{1-\sigma}} \tag{31}$$

where

$$\widetilde{\Pi}_j = \left[\sum_i \alpha_i \tau_{ij}^{1-\sigma} \right]^{\frac{1}{1-\sigma}} \tag{32}$$

is a CES index of the rate of trade costs when acceding to country j

The meaning of the gravity equation (31) is intuitive and straightforward. Exports from i to j are positively related to the supply capacity of i (i's income), the demand capacity of j (j's income) — these are the attractive forces —and negatively related to trade costs.

Compared to the initially designed gravity equation expressed in McCallum (1995) and Wall (1999), a new insight is the inclusion of not only absolute trade costs (τ_{ij}), but

also of relative trade costs — see the numerator of the third fraction in (31). Consider the case of trade flows from New Zealand to Australia: they are larger because the absolute geographic distance between the two countries is smaller, but also because the importing country is remote from all countries in the world. Considering that the level of bilateral protection is fixed, increased protection of Australia on products coming from the rest of the world strengthens trade flows from New Zealand.

The advantage of the gravity equation is its extreme tractability. Furthermore, it gives very positive econometric results. Nevertheless, it explains only exports; even though in a tentative yet not convincing effort, Wall (1999) tried to draw welfare costs associated with protection from gravity equation[17].

In conclusion of this methodological review, it is important to note that these analytical instruments are complementary, not substitute. Multi-country general equilibrium models are the most comprehensive and consistent analytical tool for evaluating the consequences of trade liberalization: they account for income effects, interdependence between factor and product markets, discriminatory aspects of international trade, and so forth. Nevertheless, they are complex and demanding in terms of statistical information. Furthermore, they cannot fully reflect the complexity of national economies because the modeler is bound to simplify theoretical representation to simultaneously account for international trade relations with other geographic zones. On the other hand, partial equilibrium models offer less consistency and are less extensive, but they give the modeler more freedom to study a specific aspect of trade liberalization. Nevertheless, it is questionable to use a partial equilibrium model in the case of a large economic sector.

The rest of this study focuses on multi-country general equilibrium models. First, they constitute the most ambitious way for studying the potential impact of trade liberalization on developing countries. Second, they have been extensively used in recent

[17] Wall (1999) tests econometrically a non microeconomically-founded equation, utilizes a weakly-founded index of trade policy and derives welfare effects by applying a proportion rule to the trade effect.

years in order to study the potential impact of full trade liberalization or a potential Doha agreement[18]. Third, these studies have drawn a very contrasting picture of these consequences so that their credibility has been questioned. Fourth, these models often appear as a "black box" the results of which are difficult to understand.

The next section focuses on an evaluation of full trade liberalization with the MIRAGE model. It tries to put in better perspective the stakes of trade reform for developing countries while highlighting the advantages and the drawbacks of the analytical instrument.

3. A NEW ASSESSMENT OF THE IMPACT OF TRADE LIBERALIZATION ON DEVELOPMENT AND POVERTY

The objective of this section is to carry out an experiment under a multi-country computable general equilibrium model which analyzes the impact of full trade liberalization on developing countries. World poverty is mainly found in the agricultural sector, which also constitutes major trade distortions worldwide. Thus, full trade liberalization would entail a positive impact on poverty alleviation. Liberalization of textile and clothing industry —which is labor intensive—could bolster economic activity and contribute to poverty reduction in developing countries. Moreover, elimination of domestic distortions could enhance welfare and economic growth.

Nevertheless, some questions remain. Some developing countries are highly specialized in products on which distortions are very low worldwide (coffee, cocoa, copper, etc.). Is there any potential positive impact of full trade liberalization on these economies?

Exports of other developing countries, especially Least Developed Countries and Sub - Saharan countries, have been granted large trade preferences by rich countries,

[18] See for example the development of the GTAP network, but also the works of the World Bank (Global Economic Prospects, 2002 and 2004), and of Cline (2004).

especially the European Union (the "Cotonou" regime, the EBA – Everything But Arms) and the US (AGOA – African Growth Opportunity Act, the US Caribbean Initiative). Naturally, they will gain no improvement in market access; instead, they will be negatively affected by tougher competition from large agricultural exporters, like Cairns group. Eroded trade preferences have been at the heart of contention since the beginning of the Doha Agenda. This issue requires special attention.

Today, most of the intervention in agriculture contributes to augmented world production and diminished demand, pushing down world prices of agricultural commodities. Therefore, elimination of these distortions should raise world prices. It could have negative effects on net food importing countries, however, even if the increase in prices contributes to augmented domestic agricultural production.

From a theoretical point of view these questions are appealing. When liberalizing an economy, welfare gains are stemming from two major sources: allocative efficiency gains and terms of trade gains. A country's own trade reform explains the former: by eliminating import tariffs, consumption surplus is increased and productive factors are allocated to more efficient utilizations. These gains are obtained regardless of what trade partners are carrying out. They are called WYDIWYG gains ('What You Do Is What You Get' – Winters, 1999). Terms of trade gains can be achieved through raising export prices and/or lowering import prices. Improved access to foreign markets contributes to the former. From a mercantilist point of view, the main goal of trade liberalization is achieved through opening foreign markets and raising exports. Contrary to that, neoclassical theory puts an emphasis on allocative efficiency gains (WYDIWYG gains).

The inspiration of CGEM is neo – classical. In this sense, allocative efficiency gains are fundamental in these studies: WYDIWYG gains have even been considered as the major source of gains for developing countries in the Uruguay Round. From a policy perspective, it means that every country will gain from its own trade reform.

But CGEMs capture other sources of gain through the evolution of terms of trade (under constant trade volumes, increased export prices or decreased import prices mean improvement in terms of trade, while decreased export prices or increased import prices mean deterioration in terms of trade). Terms of trade effects might be negative so that multilateral liberalization can imply welfare losses for a country. From a policy perspective, this could be a result of tougher competition on export markets (eroded preferences imply that exports are more competed) —which entails reduced export prices — or rising import prices.

Thus, in this kind of modeling exercise, methodological choices are fundamental. Aggregating all developing countries in one zone, for example, would mislead policy conclusions: a global zone composed of South America and Sub Saharan Africa would be a net food exporting zone, while some Sub Saharan African countries are net food importing countries. In order to tackle the issues previously mentioned, special attention has to be given to the geographic decomposition of the model. Also, the importance of the way in which competition is modeled and dynamic gains are captured can be emphasized. A sensitivity analysis has to be specifically devoted to these issues.

Subsections 3.1 to 3.3 describe technical features of the MIRAGE model and the geographical and sector decomposition adopted. Subsection 3.4 presents the pre-experiment and draws a picture of the world just before implementing full trade liberalization: level of GDP and trade, and level of distortions. Subsection 3.5 describes the impact of full trade liberalization both, at the world and country levels. It finally decomposes the shock in order to tackle the main economic policy issues: which countries are the main beneficiaries? Which are the most distorting measures?

3.1 A TECHNICAL PRESENTATION OF THE MIRAGE MODEL

The MIRAGE (Modeling International Relationships in Applied General Equilibrium) model is a multi-sector, multi-region CGEM devoted to trade policy analysis.

The model is done in a sequential dynamic recursive set-up: it is solved for one period and all variable values, determined at the end of a period, are initial values of the next one.

Macroeconomic data and social accounting matrixes, in particular, come from the GTAP6 database (see Dimaranan and McDougall, 2006) which describes the world economy in 2001. Tariff averages have been re-calculated using the MacMap methodology (see Bouët, Decreux, Fontagne, Jean and Laborde, 2005a and 2005b).

From the supply side in each sector the production function is a Leontieff function of Added Value and intermediate consumption: one output unit needs for its production x% of an aggregate of productive factors (labor, unskilled and skilled; capital; land and natural resources) and (1-x) % of intermediate consumption. These proportions are fixed.

The intermediate consumption is an aggregate CES function of all goods: it means that substitutability exists between two intermediate goods, depending on the relative prices of these goods. This substitutability is constant and at the same level for any pair of intermediate goods. Similarly, added value is a CES function of unskilled labor, land, natural resources, and of a CES bundle of skilled labor and capital. This nesting allows introducing less substitutability between capital and skilled labor than between these two and other factors. In other words, when the relative price of unskilled labor is increased this factor is replaced by a combination of capital and skilled labor, which are more complementary.

Factor endowments are fully employed. The only factor the supply of which is constant is natural resources. Capital supply is modified each year due to depreciation and investment. Growth rates of labor supply are fixed exogenously. Land supply is endogenous; it depends on the real remuneration of land. In some countries land is a scarce factor (Japan, European Union, etc.) such that elasticity of supply is low. In others (Australia, Brazil, Argentina, etc.) land is abundant and elasticity is high.

Skilled labor is the only factor perfectly mobile. Installed capital and natural resources are sector – specific. New capital is allocated amongst sectors according to an

investment function described later on. Unskilled labor is imperfectly mobile between agricultural sectors and non agricultural sectors according to a CET function: the unskilled labor's remuneration in agricultural activities is different from non agricultural activities. This factor chooses its distribution between these two series of sectors according to the ratio of remunerations. Land is also imperfectly mobile, but of course, between agricultural sectors.

Therefore, in MIRAGE there is full employment of labor, or more precisely there is a constant aggregate employment in all countries: labor markets adjust by wage. It is quite possible to suppose that total aggregate employment is variable and that there is unemployment; but of course, this greatly increases the complexity of the model so that simplifying assumptions have to be made in other areas (the number of countries or sectors). This could amplify the expected benefits of trade liberalization for developing countries (see Diao, Diaz-Bonilla, Orden and Robinson, 2005).

Capital in a given region, whatever its origin, domestic or foreign, is assumed to be obtained by assembling intermediate inputs according to a specific combination. The capital good is the same whatever the sector. The MIRAGE model describes imperfect as well as perfect competition. In sectors under perfect competition there is no fixed cost and price equals marginal cost. Imperfect competition is modeled according to a monopolistic competition framework. It accounts for horizontal product differentiation linked to varieties. Each firm in sectors under imperfect competition produces its own and unique variety with a fixed cost expressed as a fixed quantity of output. According to Cournot hypothesis, each firm supposes that its decision of production will not affect production of other firms. Furthermore, the firms do not expect that their decision of production will affect the level of domestic demand (which would be what modelers call a Ford effect.)

The monopolistic competition framework implies that each year firms exert their market power by applying a mark-up to their marginal cost. This mark-up depends negatively on the price-elasticity of demand according to the Lerner formula. This price-elasticity, as perceived by firms, depends positively on the elasticity of substitution

between the goods produced domestically and abroad, and negatively with the number of competitors and the market share of the firm in the demand region[19]. In the long term the number of firms is endogenous as it increases when profits are positive. An implication of this hypothetical structure is that international trade has pro-competitive effects and reduces marks-up and prices.

The number of firms may adjust progressively, either quickly (2 years in "*fragmented"* sectors) or slowly (5 years in "segmented" sectors). This distinction is based on the seminal work of Sutton (1991). Empirically, the pertinence of this classification has been confirmed by Oliveira-Martins (1994) and Oliveira-Martins, Scarpetta and Pilat (1996). These works are the basis of the taxonomy used by MIRAGE to distinguish fragmented and segmented sectors.

Thus, the last version of MIRAGE includes new assumptions:

- imperfect mobility of labor between agricultural and non agricultural sectors;
- endogenous land supply;
- the European land set-aside program is modeled; it decreases the quantity of land available for production in the wheat sector.

The demand side is modeled in each region through a representative agent whose propensity to save is constant. The rest of the national income is used to purchase final consumption. Preferences across sectors are represented by a LES-CES function: this specification means that for consumers there is constant substitutability depending on relative consumer prices, not between total consumptions, but between the excess of total consumption relatively to a minimal level. It implies that consumption has a non – unitary income elasticity; when the consumer's income is augmented by x% the consumption of each good is not raised by x% systematically.

[19] This specification is very close to the one used by Harrison, Rutherford and Tarr (1997).

When competition is imperfect the product is horizontally differentiated (varieties) and consumers have increased utility with more varieties; this is a traditional hypothesis (called Spence-Dixit-Stiglitz function). But the MIRAGE model introduces here two specific features. First, products coming from developed countries and those from developing countries are supposed to belong to different quality ranges. Their substitutability, therefore, is assumed to be lower than the substitutability between products coming from the same quality range. Second, domestic products benefit from a specific status of consumers; they are less substitutable to foreign products than foreign products between each other, within a given quality range.

The macroeconomic closure is obtained by assuming that the sum of the balance of goods and services and FDIs is constant and equal to its initial value.

3.2 THE GEOGRAPHIC DECOMPOSITION

Table 1 indicates the geographical decomposition which has been designed for this study. Given that the study is an assessment of trade liberalization on developing countries, 14 of the 20 selected zones are developing countries[20].

The MIRAGE model has two features that influence geographical decomposition. First, land supply is endogenous and a distinction is made between countries with abundant land supply and countries with scarcity of land. Second, a vertical differentiation is introduced considering that products coming from the North (rich countries) are of high quality and products from the South are of low quality. These two features are given in the last two columns of table 1. The country classification according to the scarcity of land is based on a calculation of arable land per person (rural population). Data come from the 2003 World Development Indicators and are available in Annex 1.

[20] Annex 2 gives the geographic and sector correspondence table between these decompositions and the GTAP classification.

Table 1— Geographical decomposition

#	Abbrev	Zone	North/South	Land = scarce facto.
1	AUNZ	*Australia/New Zealand*	North	No
2	Cana	*Canada*	North	No
3	DvdA	*Developed Asia*	North	Yes
4	EU25	*European Union - 25*	North	Yes
5	USAm	*USA*	North	No
6	Roec	*Rest of OECD*	North	Yes
7	Arge	*Argentina*	South	No
8	Bgld	*Bangladesh*	South	Yes
9	Braz	*Brazil*	South	No
10	Chin	*China*	South	Yes
11	DvgA	*Developing Asia*	South	Yes
12	Indi	*India*	South	Yes
13	Mexi	*Mexico*	South	Yes
14	SACU	*Southern Africa Custom Union*	South	Yes
15	Tuni	*Tunisia*	South	Yes
16	Zamb	*Zambia*	South	Yes
17	Rame	*Rest of America*	South	Yes
18	Rmen	*Rest of Middle East and North Africa*	South	Yes
19	RSSA	*Rest of SubSaharan Africa*	South	Yes
20	RofW	*Rest of the World*	South	Yes

The geographical decomposition presented in Table 1 reflects specific characteristics of various countries and regions. The reason why, for example, the European Union and the USA are presented as separate zones is because they have the richest markets in the world and they have granted large trade preferences. Australia and New Zealand are powerful agricultural exporting countries, which could be among the main beneficiaries of this trade shock. The zone 'Developed Asia' gathers countries with extremely high protection in agriculture (Japan, South Korea, and Taiwan). In other rich countries, Canada has a very low density of rural population per arable land. The zone entitled 'Rest of OECD' is composed by rich countries (Mexico is not included) with land

as a scarce factor and with a very high protectionism in agriculture: Switzerland, Norway, and Iceland.

As far as developing countries are concerned, India and China have been isolated as they concentrate 37% of the world population and 50% of the world poverty (2$ per day definition[21]). Moreover these countries could be winners of worldwide full trade liberalization for different reasons:

(i) it would entail an elimination of large domestic distortions as today they are highly protected countries, especially India[22];

(ii) They have been granted only small trade preferences, such that liberalization should imply a significant improvement of their market access to the rest of the world.

Brazil and Argentina are powerful agricultural exporting countries, with very large productive capacity, and they have only been conceded a small preference in their access to Europe and USA, as compared to other developing countries.

On the contrary, Tunisia and Bangladesh could be penalized for two reasons: they are net food importing countries and their export performance has been bolstered by large trade preferences (the Euromed partnership in the case of Tunisia, the EBA in the case of Bangladesh). Zambia mostly exports copper which is only marginally taxed by import duties throughout the world. Moreover, Zambia is a beneficiary of all main preferential schemes: EBA, AGOA, and GSP. The Southern Africa Custom Union (SACU) must be distinguished from the rest of Sub-Saharan Africa: its members are not Least Developed Countries, except Lesotho. Mexico has a relatively low income average per capita and free access to USA. It may be also concerned by an erosion of trade preferences.

[21] This data on population and poverty are coming from the World Development Indicators – 2003.
[22] According to the MacMap-HS6 database, the average protection of India was 33.5% in 2001. China is less protected with 14.1% at the same year.

Finally, four developing zones have been distinguished due to the specificity of their geographic trade composition: the rest of the developing Asia, the rest of Middle East and North Africa (MENA), the rest of America (excluding OECD countries) and the rest of Sub – Saharan African countries. The MENA zone is a large net-food importing country and it exports mainly primary, non agricultural, and oil commodities. This product structure of exports is also a feature of the 'Rest of South America' zone (Bolivia, Chile, and Venezuela). The rest of Sub – Saharan countries have extended preferences on their exports towards Europe and USA.

Thus, the geographical decomposition of this study emphasizes the heterogeneity of developing countries according to forces that **could** contribute to successful stories for some countries (Brazil, China, India), but also to great loses for others (Bangladesh, Mexico, Tunisia, Zambia). Of course, a global welfare impact is needed in all these cases as the elimination of domestic distortions can offset increased prices of imported goods and/or eroded preferential margins.

Since the launching of the Doha Agenda, several negotiating blocks have appeared, adding complexity in this process, as compared to the negotiation between USA and the European Union which has characterized the last trade rounds. This geographical decomposition illustrates the new partition: USA, the European Union, the rich countries of the Cairns group (Australia, Canada, New-Zealand), the G-10 (with the Developed Asia zone and the Rest of OECD zone), the G-20 (Argentina, Brazil, China, India, South Africa), the G-90 (Zambia, Tunisia, Rest of Sub-Saharan Africa). Thus, this model could also be utilized to explain the positions of these negotiating blocks.

3.3 PRODUCT DECOMPOSITION

The sector decomposition emphasizes the existence of key sectors where distortions are high and numerous. Of course agriculture must be the main focus of study. This is the reason why out of the 17 sectors considered, 9 are agricultural.

Amongst these agricultural activities, some are of key concern as distortions are especially high: tariffs for wheat, sugar, meat, rice, milk; domestic support for cotton (plant-based fibers). In the case of sugar, rice and milk, the processed goods have been isolated, as paddy rice, raw milk, sugar cane and sugar beet are only marginally traded. Finally, vegetables and fruits constitute a key agricultural activity for numerous developing countries.

Textile and clothing sectors are still highly protected as compared to the rest of industrial activity throughout developed countries.

In Table 2, the last three columns give valuable information for the MIRAGE model. In each sector, competition may be perfect or imperfect. According to the traditional point of view, agricultural sectors and transportation are characterized by perfect competition, whereas other sectors are characterized by imperfect competition. According to Oliveira-Martins and Scarpetta (1999) textile and clothing/apparel are assumed to be fragmented; other sectors under imperfect competition are assumed to be segmented.

Table 2—Sector decomposition

Number	Abbrev.	Sector	*Type of competition*	*Segm./Fragm.*	*Agr./Non agric.*
1	Whet	Wheat	Perfect	-	Agricultural
2	VgFr	Vegetables and Fruit	Perfect	-	Agricultural
3	Plfb	Plant-based fibers	Perfect	-	Agricultural
4	Meat	Meat: cattle, sheep, goats, horse	Perfect	-	Agricultural
5	Milk	Milk (processed)	Perfect	-	Agricultural
6	Rice	Rice (processed)	Perfect	-	Agricultural
7	Sugr	Sugar (processed)	Perfect	-	Agricultural
8	OtFP	Other Food Products	Perfect	-	Agricultural
9	Otag	Other Agricultural Products	Perfect	-	Agricultural
10	Oprm	Other Primary products	Perfect	-	Non agric.
11	Text	Textile	Imperfect	Fragm.	Non agric.
12	Weap	Wearing and Apparel	Imperfect	Fragm.	Non agric.
13	Mich	Metal mineral petroleum and chemical products	Imperfect	Segm.	Non agric.
14	Veeq	Vehicles and equipment	Imperfect	Segm.	Non agric.
15	Omnf	Other manufacturing products	Imperfect	Segm.	Non agric.
16	OtSr	Other services	Imperfect	Segm.	Non agric.
17	TrT	Transport and Trade	Perfect	-	Non agric.

In the version of MIRAGE utilized for this central experiment, unskilled labor is imperfectly mobile between agricultural activities and non agricultural activities. The last column indicates this distinction: the food sector is considered as agricultural, here.

3.4 THE INITIAL WORLD

3.4.1 The pre-experiment

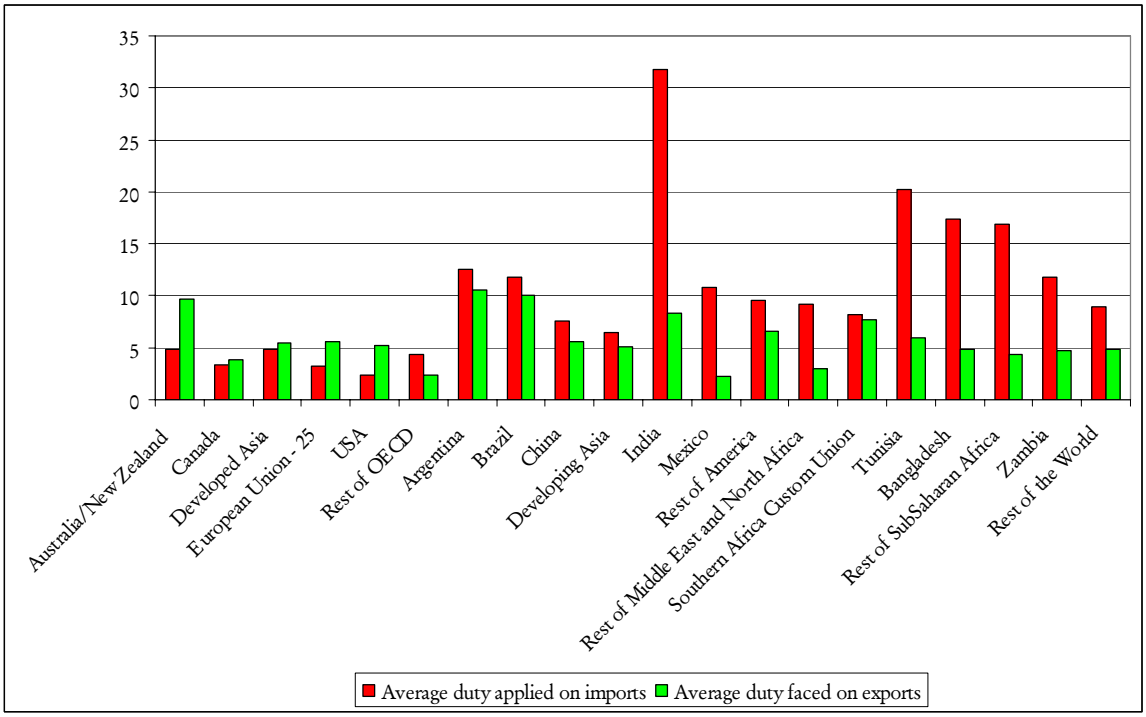
Initial data (Social Accounting Matrix and tariffs) are from 2001. As substantial liberalization occurs between 2001 and 2005, a pre-experiment is conducted: data on market access are changed in order to include the last implementation of the Uruguay Round, the elimination of the Multi - Fibre Arrangement, enlargement of the European Union, implementation of the "Everything But Arms" initiative and of the African Growth Opportunity Act, and finally, the accession of China to WTO. These reforms should result in welfare benefits but are not part of a current deal on trade liberalization.

3.4.2 Main features of the initial trading system

The initial world is characterized by a few statistics**:** level of tariffs, export structure by destination, export structure by product, and net trade balance in agricultural and food products. This choice is justified by the arguments mentioned previously: domestic support and export subsidies are only minor distortions as compared to tariffs; preferential access to a large market is a common feature such that its erosion is a central concern; agricultural world prices are expected to rise such that being a net importer/exporter is a key issue.

Annex 3 gives bilateral levels of protection for each zone in 2005. Each row defines the average tariff charged by an importing country while each column indicates the average duty faced by a country on its exports to a specific destination. The last column indicates the average protection in each zone, while the last row expresses the average duty faced on exports. This information is summarized in Figure 2.

Figure 2—Protection applied and faced by zone - 2005



Source: author's calculation.

India is by far the most protectionist country, but trade barriers are also high in Bangladesh, Sub – Saharan Africa, and Tunisia, marginally less in Brazil, Argentina, and Zambia. Global protection in rich countries is lower.

Due to preferential schemes (EBA, AGOA, Cotonou, Caricom) or specialization in products little taxed across the world (coffee, coca, cotton, mining), numerous developing countries are facing low average tariff on their exports: Tunisia, Rest of Sub-Saharan Africa, Bangladesh, Zambia, and especially Mexico and Rest of Middle East and North Africa. For Mexico, the North American Free Trade Agreement (NAFTA) provides free access to a major market, while for the other zone this is a combination of two elements — Euromed partnership and exportation of raw commodities—which explains the very low average duty faced on exports. In the case of Australia, New Zealand, Brazil, and Argentina, specialization in agriculture implies that their exports are penalized more than

those of other countries. Conversely, specialization in industry gives a relatively good access to foreign markets: Canada, Developed Asia, EU, USA, and China.

The necessity of taking fully into account preferential schemes and regional agreements is now widely admitted by the international community of researchers. It has changed the global picture of the world protection, not only because average world protection is now considered lower than previously thought (see above), but also because trade policies from industrial countries appear less anti-development.

For example, in 2004 the Global Economic Prospects from the World Bank put an emphasis on the regressive aspect of trade policies.

> '*Tariffs imposed by the industrial countries on imports from developing countries are typically much higher than those they levy on other industrial countries. In agriculture, the industrial countries impose an average 15 percent tariff on imports from other industrial countries, whereas the rates on imports from developing countries range from 20 percent (Latin America) to 35 percent (Europe and Central Asia). Outside of agriculture, the discrepancy is even more striking. Tariffs on imports from other industrial average 1 percent, while those from developing countries face tariff averages ranging from 2.1 percent (Latin America) to 8.1 percent (south Asia).'* (Global Economic Prospects 2004, The World Bank, p. 81)

From Jean, Laborde and Martin (2005) it appears now that:

> "*…developing countries' exporters of agricultural products faced an average tariff of 16 percent in 2001, a rate that is expected to fall to 15 percent once current commitments, particularly by China and other developing countries, are phased in. The average tariff facing industrial countries was 17 percent in 2001, and will fall to 16 percent with full implementation of current commitments. The LDCs as a group face lower,*

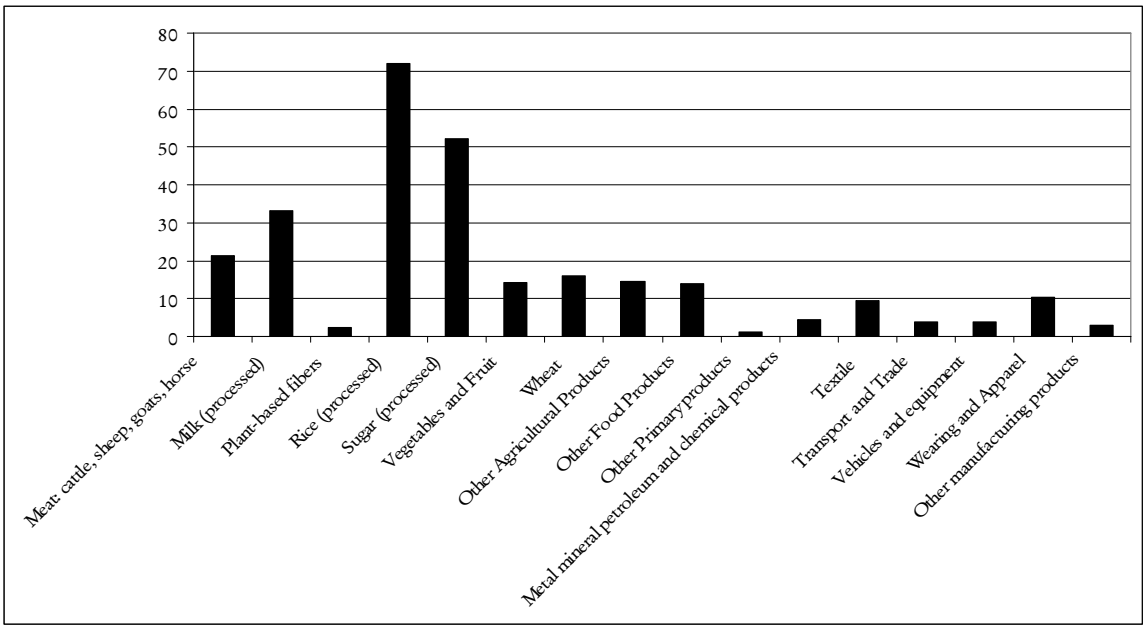
but still significant barriers, with an average tariff of 12 percent even after preferences are taken into account" (Jean, Laborde and Martin, 2005.)

In agriculture the imposition of specific duties by numerous rich countries (Switzerland, European Union, Norway) has a very negative impact on protection faced by developing countries: as they export products of lower unit value on average, thus, the rate of protection associated with the same duty is higher. Nevertheless, the impact of preferential schemes is substantial. This means that, globally, trade policies are *progressive*, in the sense that poorest countries are facing lower average duty on their exports than richer countries, and not *regressive*, as previously thought. Of course, these two new qualifications (lower world protection and 'progressive' trade policies) are key elements to keep in mind in explaining trade pessimism.

In Europe, preferences have been given to Bangladesh and Sub – Saharan Africa (EBA), Middle East and North Africa (the Euro – Mediterranean partnership), the rest of OECD (the EU – EFTA agreement – European Free Trade Agreement-); in USA, to Canada and Mexico (NAFTA), Sub – Saharan Africa (AGOA). Annex 3 shows that these schemes imply systematically lower rates of protection.

Annex 4 gives the level of protection by importing country/zone and product, while Figure 3 provides a graphical snapshot of the world average protection by product. Protection is very high in the case of rice (with a record duty of 615% in Developed Asia), sugar, and milk, substantial for meat and wheat. In industry, only textile and clothing /apparel are significantly taxed.

Figure 3—Protection by product - 2005



Source: author's calculation.

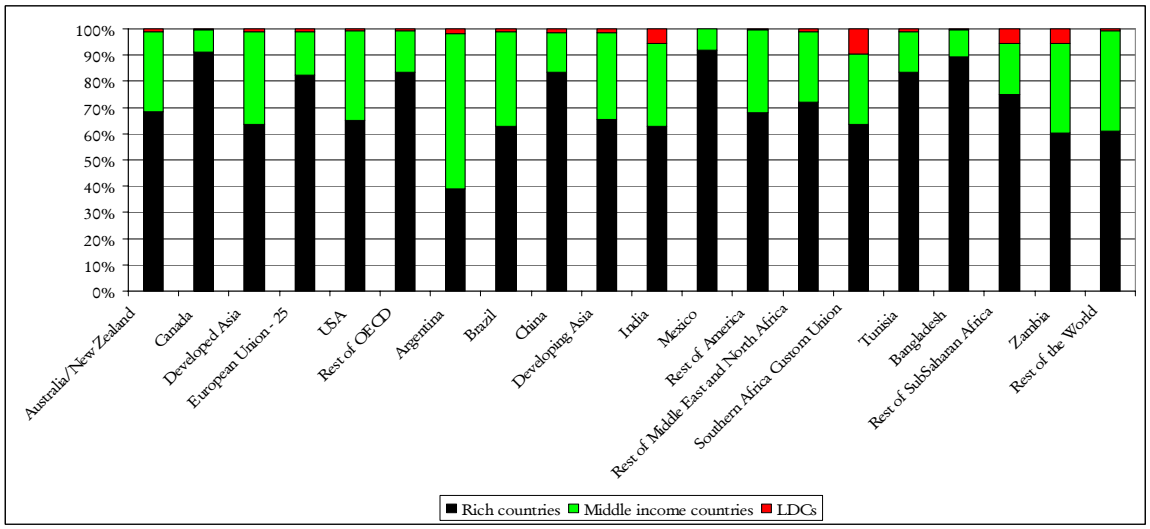
Even if it is not systematic, there is evidence of tariff escalation as protection on sugar cane and sugar beet, raw milk and paddy rice (these products are contained in the 'Other agricultural products') is much lower than average import duty on processed sugar, processed milk and processed rice. On average, cotton (plant-based fibers) is also less taxed than textile which is less taxed than clothing and apparel.

While Annex 5 provides detailed information, Figure 4 gives a synthetic representation of the initial geographical structure of exports: Europe, USA and Developed Asia are the main destinations of world exports. It also highlights the impact of regional agreements or preferential schemes; trade is highly concentrated in North America (from Canada and Mexico to USA) and in Europe (inside the European Union and from the EFTA –Rest of OECD - to the EU). The European Union is by far the first destination for exports from Tunisia and to a lesser extent Sub-Saharan Africa.

Figure 4 illustrates the global heterogeneity in destinations of exports from developing countries. While Bangladesh, Tunisia, Mexico, and China concentrate their

exports towards market of rich countries, Argentinean exports clearly prioritize middle income countries.

Figure 4—Geographical structure of exports - 2005

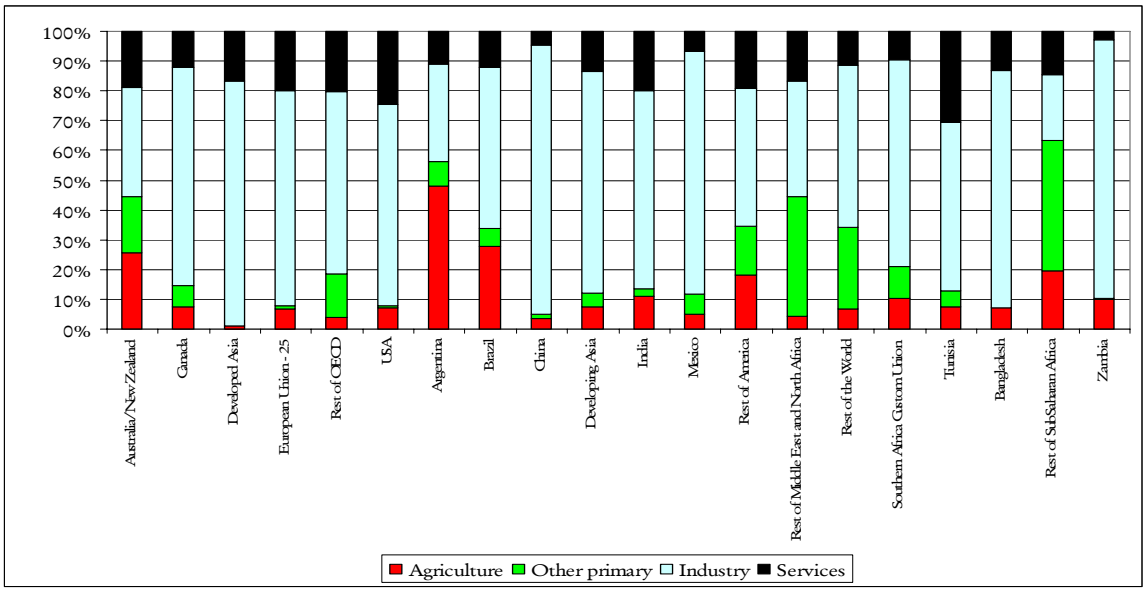


Source: author's calculation.

Figure 5 illustrates the product composition of exports (detailed information is in Annex 6.) On one side, some countries are specialized in industry (Zambia of which 70% of exports are metal, mineral, petroleum, and chemical products, Bangladesh of which 70% of exports are textile and apparel, Mexico, China, Developed Asia); others in agriculture (Australia-New Zealand, Brazil, and especially Argentina.)

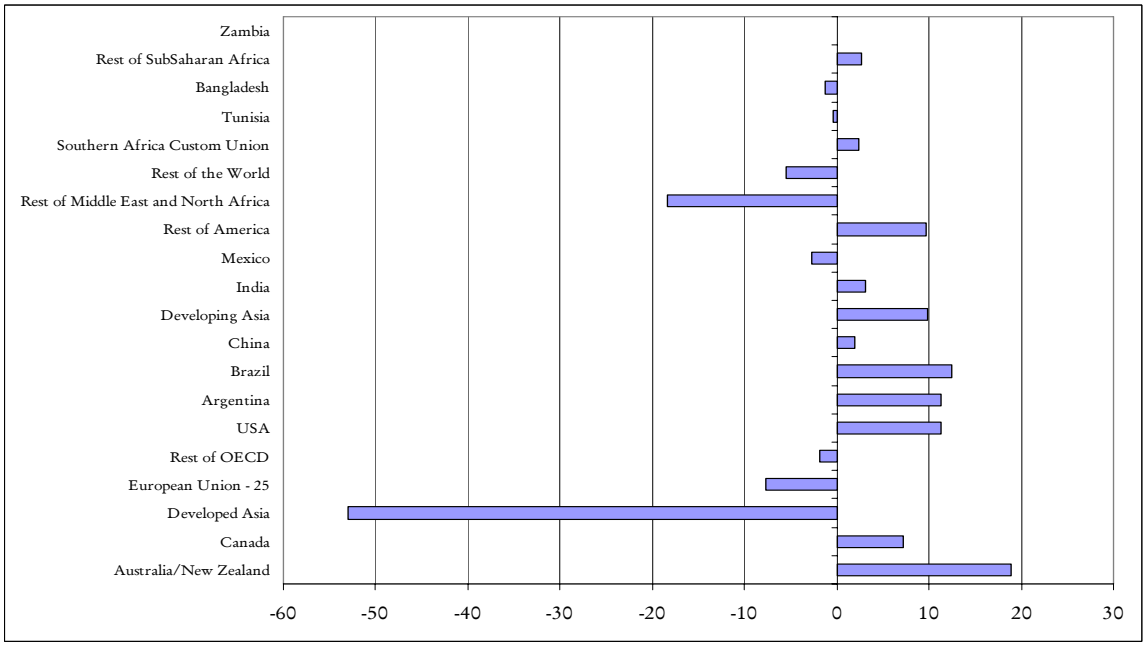
Figure 6 shows the net trade balance of the 20 zones in agricultural and food products. North Africa and Middle East countries, the EFTA, the European Union, Mexico, the Developed Asia, and China are net food importers and could lose from an increase in agricultural world prices. Australia, New Zealand, Brazil, and Argentina are conversely large net food exporters.

Figure 5—Product composition of exports - 2005



Source: author's calculation.

Figure 6—Net exports of agricultural and food products – 2005 - $ bln



Source: author's calculation.

It is noteworthy that no simple categorization, of developing countries as net food exporters and developed countries as net food importers can be made: Australia-New Zealand is the first net food exporter while some developing zones do not have comparative advantage in this activity. On the same line, it is not relevant to consider all developing countries as preference-receiving and developed countries as preference-giving countries: Canada, Mexico, the European Free Trade Area (EFTA) countries have an excellent preferential access like LDCs, while middle income countries have only a minor one. Some rich countries like Japan do not concede large preference.

3.5 EXPECTED BENEFITS FROM TRADE LIBERALIZATION

Before providing results of the impact at the country level, the impact of full trade liberalization at the world level is analyzed.

3.5.1 Impact of full liberalization at the world level

As compared to the baseline situation, full trade liberalization increases world welfare (real income) by 0.33%, or USD 99.6 bln[23] (see Table 3). When focusing on the rate of increase in real income, if the reference is the last group of assessments based on recent data on market access and domestic support, this result is close to Hertel and Keeney (2005), and Francois, Von Meijl and Tongeren (2005). But it is smaller than the figure pointed out by Anderson, Martin and Van der Mensbrugghe (2005). The difference is large with Cline's results (2003) or with the Global Economic Prospects' assessment (2002 and 2004).

Table 3—Impact of full trade liberalization- World indicators.-2015- Rate of change (%)

World agricultural trade	33.67
World Merchandise Trade	5.25
World Welfare	0.33

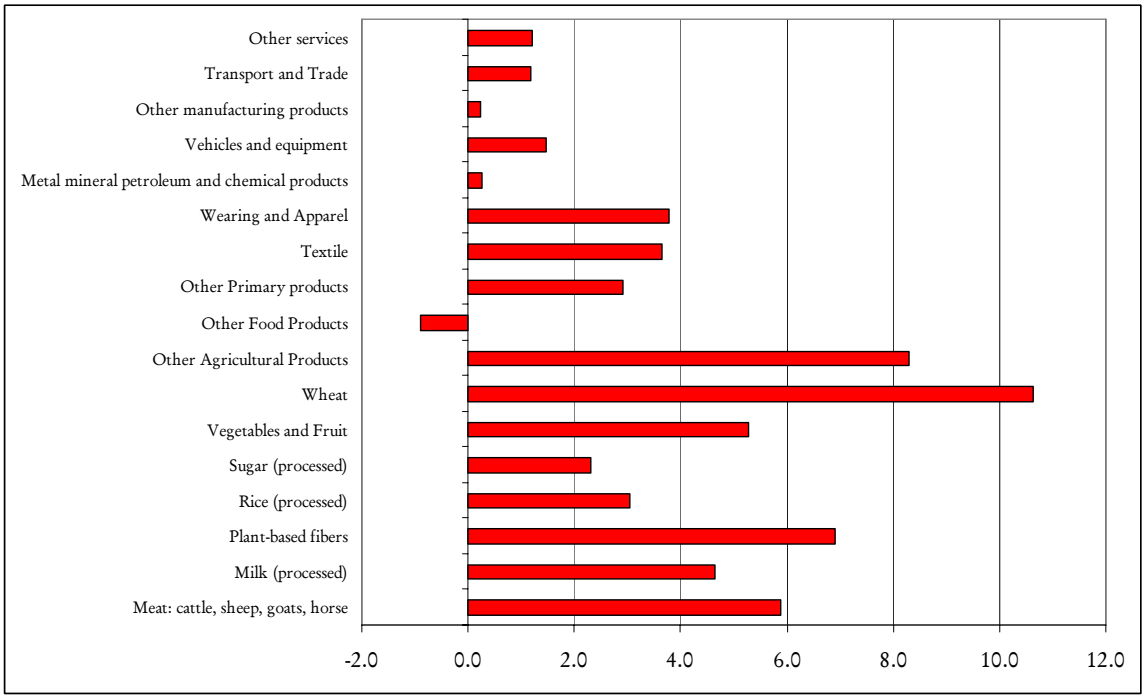
Source: author's calculation.

[23] This version of MIRAGE does not include exogenous change in factor productivity. As a consequence it is better to adopt a reasoning in relative terms.

This welfare increase is associated with an augmentation of world trade by 5.25%. As trade barriers are numerous in the agricultural sector, world agricultural trade increases by 6.5 times more.

Trade liberalization consists of eliminating import tariffs, and production and export subsidies. Thus it increases world demand and decreases world supply, contributing to an augmentation of world prices. This point is confirmed by Figure 7, which indicates the evolution of world prices after trade liberalization (see first column of Annex 7), for three sectors (primary, industry, services). But price augmentations are uneven: while they are only minor in industry and services, they are large in agriculture, especially for wheat, plant – based fibers, and other agricultural products. These increases in agricultural world prices are quite similar to those obtained by other studies (see for example Diao, Somwaru and Roe, 2001).

Figure 7—Impact of full trade liberalization: World prices for 2015 - rate of change (%)



Source: author's calculation.

Annex 7 indicates the evolution of world prices by exporting countries. In a model like MIRAGE, there is not a single world price for a specific commodity: according to Armington hypothesis, every country produces a specific product; the world price indicated in Figure 7 is an average of export prices. It is particularly contrasting for meat, plant-based fibers, (processed) rice, (processed) sugar, and wheat.

3.5.2 Impact of full liberalization at the country level

What is the country impact of this trade reform? It is *progressive*: the increase in welfare is proportionally higher for developing countries, and especially for LDCs (see Table 4), although their share of the overall world welfare increase might be smaller. The rate of change in welfare is 2 times greater for LDCs than for middle income countries and more than 2 times greater than for rich countries. In this sense, full liberalization is development – friendly.

This does not mean, however, that each developing country profits evenly from this higher rate of change in welfare. Table 5 shows that welfare gains are unequally distributed among developing countries. In this table, countries are ranked by income levels: first, the rich countries, then the middle income countries, finally the LDCs. This information is completed by macroeconomic indicators on production and exports in Table 6.

There are several sources of welfare variations. First, distortions are reduced and productive factors are re-allocated in sectors where they are more efficient. Table 5 indicates these allocation efficiency gains which are systematically positive, as numerous distortions are eliminated[24].

[24] As some distortions like (final, intermediate) consumption taxes remain after the shock, and as the economic variable on which these taxes are levied can be modified by trade reform, allocation efficiency losses could occur.

Table 4—Distribution of welfare gains among beneficiary zones and the rate of change in welfare

	Share of total welfare gain	Increase in welfare
Rich countries	73.8%	+0.3%
Middle income countries	24.1%	+0.4%
LDCs	2.2%	+0.8%

Source: author's calculation.

Table 5— Impact of full trade liberalization: Macroeconomic indicators for 2015- rate of change (%)

	Welfare	Allocation efficiency gains	Terms of trade gains
Australia/New Zealand	0.9	0.1	1.4
Canada	-0.1	0.6	0.2
Developed Asia	1.4	2.3	0.1
European Union - 25	-0.1	0.2	-0.1
Rest of OECD	1.0	1.0	0.1
USA	0.1	0.0	0.1
Argentina	-0.1	0.3	0.3
Brazil	0.2	0.1	0.4
China	0.6	0.8	0.1
Developing Asia	0.4	0.7	-0.1
India	0.7	1.5	-0.9
Mexico	-0.3	1.3	-0.5
Rest of America	0.0	0.8	-0.2
Rest of Middle East and North Africa	0.9	1.2	-0.5
Rest of the World	0.1	0.9	0.0
Southern Africa Custom Union	-0.2	0.3	0.6
Tunisia	0.4	0.4	-0.4
Bangladesh	1.5	1.8	-1.1
Rest of SubSaharan Africa	0.6	1.3	-0.6
Zambia	0.3	1.6	-2.4

Source: author's calculation.

Table 6—Full trade liberalization: Macroeconomic indicators on production and exports (rate of change in %)

	Agro-food production (vol)	Non agro-food production (vol.)	Exports (volume)
Australia/New Zealand	18.3	-1.5	10.1
Canada	-2.8	-0.1	-3.7
Developed Asia	-6.4	-0.2	6.8
European Union - 25	-2.5	-0.2	-4.4
Rest of OECD	-10.8	0.2	0.8
USA	0.5	-0.2	-0.5
Argentina	7.5	-2.5	12.5
Brazil	12.2	-1.3	21.7
China	-0.2	0.8	9.0
Developing Asia	7.1	0.3	8.8
India	-4.0	2.8	52.2
Mexico	-4.9	-1.8	4.4
Rest of America	4.4	-1.2	20.0
Rest of Middle East and North Africa	-6.1	1.6	11.9
Rest of the World	-3.4	-1.4	14.3
Southern Africa Custom Union	7.6	-1.4	6.4
Tunisia	0.8	1.1	-4.2
Bangladesh	0.7	2.7	55.5
Rest of SubSaharan Africa	-4.0	-0.4	19.2
Zambia	-4.4	3.2	21.2

Source: author's calculation.

Second, terms of trade are modified. A better access to foreign markets increases export prices while, on the contrary, erosion of preferences implies more competition on export markets and lower export prices. Furthermore, as distortions are numerous in agricultural sectors, full trade liberalization entails an increase in the relative world price of these commodities. Agricultural exporters are generally benefiting from an improvement in their terms of trade while net food importing countries are penalized.

Nevertheless, consideration of only the initial agro-food balance (see Figure 6) can be misleading: trade of wheat, sugar, rice, and meat is severely distorted, while other agricultural products are much less distorted. Specialization of each country is not evenly distributed in all agricultural sectors. For example, agricultural exports of India, the 'Rest of America' zone and the 'Developing Asia' zone are highly concentrated in the 'Other food products' (respectively at a level of 46%, 45% and 61%). This is the only agro – food commodity the world price of which decreases after trade reform (see Figure 7). Conversely, these three zones are also net exporters of industrial products the world price of which remains almost constant (metal, mineral, petroleum and chemical products). As a result, these three zones lose from a deterioration of their terms of trade even if they were initially net food exporting countries (Table 5).

But like other models of its generation, MIRAGE captures other effects of welfare changes (otherwise the first column in Table 5 would be equal to the sum of the two other columns). It accounts for imperfect competition activities so that expansion of these sectors implies new welfare effects. As production increases, average costs and prices are cut, bringing efficiency. Moreover, as horizontal differentiation is modeled, selling on a larger scale allows for an increased number of varieties to be produced: it implies accrued utility for variety-lover consumers.

But conversely, as already noted by Francois, Von Meijl and Tongeren (2005), this feature has negative consequences on countries where specialization in perfect competition activities (agriculture) increases due to liberalization. As compared to the baseline, it might entail a smaller economic activity in industry, less economies of scale and fewer varieties.

Finally, in MIRAGE like in the World Bank's LINKAGE model, land supply is endogenous and is determined by its real remuneration. This effect is particularly strong in countries with large endowments of land.

In rich countries, the impact of full liberalization is positive, except in the case of Europe and Canada where it is negative, even if this welfare loss is marginal. The welfare

gain is quite marginal for USA, but it is significant for others as distortions are very high in the case of Developed Asia (Japan, South Korea, Taiwan), and the rest of OECD (Switzerland, Norway, Iceland). For Australia/New Zealand full liberalization implies a significant increase in real exports and activity, and a substantial improvement in terms of trade as it raises prices of exported goods and provides a better access to large markets like USA and Europe. Agro-food production increases by nearly 20% in this zone while it decreases in other rich countries (except USA for which the augmentation is insignificant – see Table 6).

Agricultural specialization has a mixed effect in the case of Australia/New Zealand, Argentina and Brazil as it entails augmented real remuneration and supply of land, but less activity in industry and fewer welfare effects associated to this sector.

Agro – food production decreased significantly for Canada, although initially, it was a net food exporter. For Canada, multilateral liberalization implies a much more severe competition on its first exports' destination: USA (initially 75% of its exports). Its export of meat to USA decreases by 10%, vegetables and fruits by 4%, rice by 18%, clothing and apparel by 28%, metal, mineral and chemical products, vehicles, and equipment by 9%. Globally, this full trade liberalization entails a cut in its total exports of merchandise by nearly 4%, resulting from the loss of preferential access to its rich neighbor and a reduced activity in both industry and agriculture. This evolution has two negative consequences for Canada: first, industrial activity is reduced as compared to the baseline situation; it decreases welfare gains coming from economies of scale and varieties. Second, as agricultural production is negatively affected, real remuneration of land decreases, such that land supply is reduced.

In developing countries, efficiency gains are large where distortions are initially high: India, Bangladesh, and Sub – Saharan Africa. As Brazil, Argentina, and SACU are large net food exporters, the rise in agricultural world prices implies an improvement in their terms of trade. The zone Rest of Sub –Saharan Africa is initially a net food exporter (see Figure 6). Nevertheless, its terms of trade are worsened as it faces more competition

on large markets like the European Union where its preferential access is eroded: its export prices decrease. Furthermore, in the cases of Bangladesh and 'Rest of MENA', preferences are eroded and prices of imported goods are raised: these two negative effects are cumulative.

The adverse effect of agricultural specialization on welfare gains which comes from economies of scale and product differentiation, explains global welfare losses of Argentina, Canada and SACU[25]. Allocating more productive factors in sectors under perfect competition reduces the gain from multilateral liberalization in the case of Australia/New Zealand, Brazil, and "Rest of America". Conversely, full trade liberalization expands the industrial sector and increases associated welfare gains in Bangladesh, Tunisia, and Zambia.

The case of Bangladesh is fascinating as full trade liberalization entails a 55% increase in total merchandise exports (in volume). Bangladesh is a very specialized country with two sectors (textile and clothing/apparel) representing 70% of its exports (see Annex 6). Furthermore, it has a duty-free access to Europe, but its exports towards USA, Canada, Australia/New Zealand, Argentina, Brazil, and Mexico are still highly taxed. This structure of protection and specialization explain such an increase in export performance, but at the same time, trade reform has two negative consequences for this country: first, it faces an increased competition on its exports towards Europe (44% of total exports), which in turn, decreases the prices of these exports; second, it is a net food importing country and its import prices are raised.

Table 7 indicates the impact of full trade liberalization on factor remunerations in real terms. As demonstrated by the international trade theory, trade openness affects more the real remuneration of less mobile factors. Moreover, as distortions are initially concentrated in the agricultural sector, full trade liberalization has a prominent impact on world prices and activities in this sector. This explains why on one side the remuneration of

[25] This point will be confirmed later on, through a sensitivity analysis. If the same model is conducted under perfect competition in all sectors, Argentina, for example, gets a large increase in welfare.

land and natural resources is significantly modified by full trade liberalization, while on the other side, capital and skilled labor are much less affected. The real remuneration of land is much reduced by liberalization in the EFTA, the European Union and Developed Asia[26]. It results from this table that gains from liberalization have to be shared between several productive factors while losses are concentrated on one or two factors. This may imply strong resistance and weak support for liberalization

Table 7—Impact of full trade liberalization: Remuneration of production factors for 2015 – rate of change (%) – real terms

	Agr Unskilled real wages	Ind Unskilled real wages	Real return to capital	Real return to land	Real return to natural resources	Skilled real wages
Australia/New Zealand	10.3	2.1	-0.7	3.9	-4.4	1.2
Canada	-0.3	-0.3	-0.4	-24.2	4.0	-0.2
Developed Asia	-2.7	1.9	1.4	-30.9	-6.0	2.3
European Union - 25	0.1	0.3	-0.8	-41.6	-3.8	-0.1
Rest of OECD	-4.9	0.9	1.0	-50.1	5.5	1.2
USA	0.8	0.1	-0.3	-17.0	2.3	0.0
Argentina	5.8	1.5	-1.4	3.0	-6.1	-1.4
Brazil	7.1	1.6	-0.8	4.8	-6.9	0.3
China	-0.7	2.3	-1.7	-7.3	-18.7	4.3
Developing Asia	0.8	1.2	-0.4	-5.3	-16.2	0.9
India	-1.6	1.8	0.1	-4.7	-25.5	4.2
Mexico	-4.4	0.3	0.4	-23.1	-23.1	-2.0
Rest of America	4.2	1.4	-1.1	7.3	-14.2	0.0
Rest of Middle East and North Africa	-2.3	1.0	1.2	-7.4	-11.2	1.3
Rest of the World	-1.1	2.1	-2.3	-5.7	12.4	0.0
Southern Africa Custom Union	4.8	0.8	-1.7	12.7	8.8	-0.3
Tunisia	1.0	1.1	0.6	-1.0	-7.5	0.3
Bangladesh	1.5	1.3	1.0	1.9	-6.5	0.6
Rest of SubSaharan Africa	0.3	1.6	-0.8	-0.4	-4.5	1.5
Zambia	-4.1	-1.0	1.8	-9.0	-22.7	0.6

Source: author's calculation.

What is the potential impact of trade liberalization on poverty? It cannot be measured under this version of the MIRAGE model[27]. Nevertheless, Table 7 can give some insights into this potential effect. In developing countries, poor people are mostly endowed

[26] These three zones were the main contenders of agricultural liberalization during the negotiation of the Doha Agenda.

[27] It cannot be measured as far as we do not utilize poverty elasticities. We will explain why later.

with unskilled labor. Thus, Table 7 points out that full trade liberalization could have a very positive impact on poverty in South America, SACU, Bangladesh, Developing Asia, Tunisia and Rest of Sub-Saharan Africa. It has clearly a contrasting effect on urban/rural poverty in China, India, Mexico, Rest of Middle East and North Africa, where it increases remuneration of urban households and decreases that of rural households. Finally, it has an unambiguously negative effect in the case of Zambia.

3.5.3 Trade liberalization and world income distribution

The potential impact of full trade liberalization on world inequality can also be measured. Recent studies (Bourguignon, Levin and Rosenblatt, 2004; Milanovic, 2005) focus on comparison of GDP per capita concluding on decreasing world inequality during the nineties due to rapid growth in China and India[28]. A similar assessment might be done here, but in a prospective way. Although some countries are aggregated in a single set, this calculation gives some insights on the size and the direction of the redistribution associated with trade reform.

Does full trade liberalization reduce world inequality? The answer is yes (although it may not be clear-cut), but the resulting redistribution is of limited extent. This is shown in Table 8[29]. Using results on real income from the above modeling exercise, it is possible to calculate real income per capita, with and without full trade liberalization: in Table 8, countries are ranked in increasing order according to their real income per capita. Lorenz curves can be constructed using cumulated population (in %) and cumulated real income (in %). Full trade liberalization implies only a slight move of Lorenz curve so that only one curve for the two income distributions appears in Figure 8.

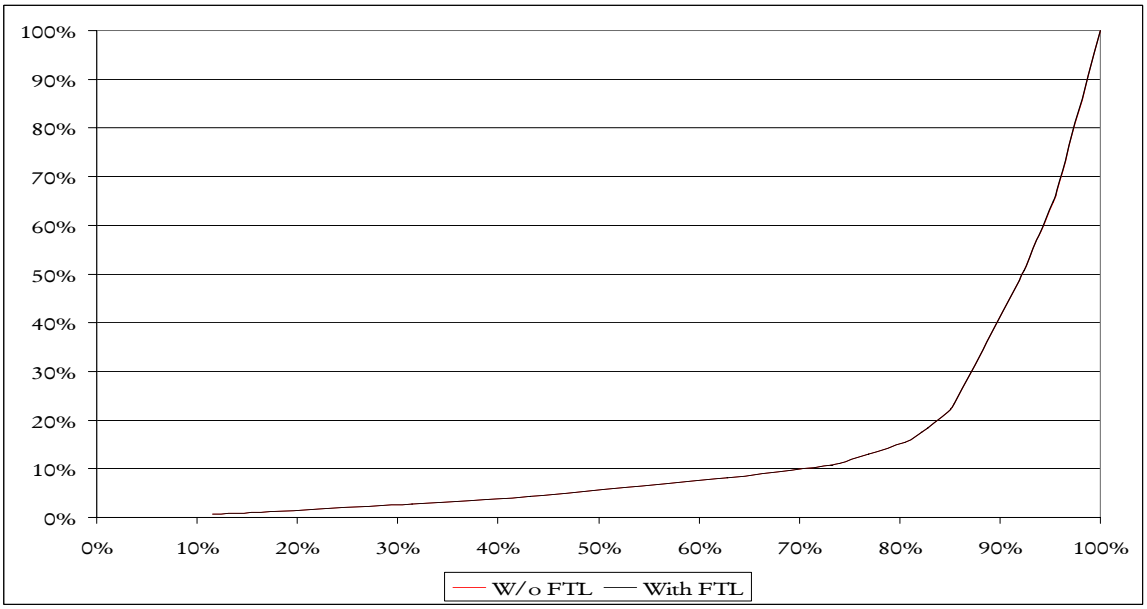
[28] Let us notice the exceptional work by Milanovic (2005) who takes into account domestic distribution of income with the use of households' survey; his conclusions are less clear-cut.
[29] Data on expected population in 2015 come from the World Development Indicators 2004.

Table 8—World redistribution associated with full trade liberalization

	Population (Mios)	Share in world population %	Population % Cumulated	Real income ($ bln)	Real income head (1,000$)	Real Income %	Real Income Cumulated	Real income ($ bln)	Real income head (1,000$)	Real Income %	Real Income Cu-
				Without Full trade Liberalization				With Full trade Liberalization			
Rest of SubSaharan Africa	815.8	11.5%	11.5%	220.05	0.26973523	0.72%	0.72%	221.413	0.27140598	0.72%	0.72%
Zambia	11.9	0.2%	11.7%	3.731	0.31352941	0.01%	0.73%	3.743	0.31453782	0.01%	0.74%
Bangladesh	166	2.3%	14.0%	53.432	0.32187952	0.18%	0.91%	54.242	0.32675904	0.18%	0.91%
India	1231.6	17.4%	31.4%	563.647	0.45765427	1.85%	2.76%	567.328	0.46064307	1.86%	2.77%
Rest of the World	840.65	11.9%	43.2%	494.929	0.58874561	1.62%	4.38%	495.592	0.58953429	1.62%	4.39%
China	1389.5	19.6%	62.8%	1145.103	0.82411155	3.76%	8.14%	1152.263	0.82926448	3.77%	8.16%
Developing Asia	728.9	10.3%	73.1%	787.877	1.08091233	2.59%	10.73%	791.194	1.08546303	2.59%	10.75%
Tunisia	11.5	0.2%	73.3%	19.391	1.68617391	0.06%	10.79%	19.46	1.69217391	0.06%	10.81%
Southern Africa Custom Union	54.4	0.8%	74.0%	111.224	2.04455882	0.36%	11.15%	110.997	2.04038603	0.36%	11.17%
Brazil	201	2.8%	76.9%	559.103	2.78160697	1.83%	12.99%	560.388	2.788	1.83%	13.01%
Rest of America	254.9	3.6%	80.5%	721.627	2.83102001	2.37%	15.36%	721.97	2.83236563	2.36%	15.37%
Mexico	120.6	1.7%	82.2%	653	5.4145937	2.14%	17.500%	650.889	5.39708955	2.13%	17.497%
Argentina	42.9	0.6%	82.8%	290.751	6.77741259	0.95%	18.454%	290.374	6.76862471	0.95%	18.446%
Rest of Middle East and North Africa	162.2	2.3%	85.1%	1116.153	6.88133785	3.66%	22.12%	1126.301	6.94390259	3.68%	22.13%
Australia/New Zealand	26.1	0.4%	85.4%	383.195	14.6818008	1.26%	23.37%	386.78	14.8191571	1.27%	23.40%
European Union - 25	463.2	6.5%	92.0%	7724.054	16.6754188	25.35%	48.72%	7713.922	16.6535449	25.23%	48.62%
Canada	33.5	0.5%	92.4%	644.39	19.2355224	2.11%	50.83%	643.991	19.2236119	2.11%	50.73%
Developed Asia	203.6	2.9%	95.3%	4278.685	21.0151523	14.04%	64.87%	4340.462	21.3185756	14.20%	64.93%
Rest of OECD	12.55	0.2%	95.5%	367.598	29.2906773	1.21%	66.08%	371.353	29.5898805	1.21%	66.14%
USA	319.9	4.5%	100.0%	10337.052	32.3133854	33.92%	100.00%	10351.896	32.3597874	33.86%	100.00%

Source: author's calculation.

Figure 8—Lorenz curve on world inequality

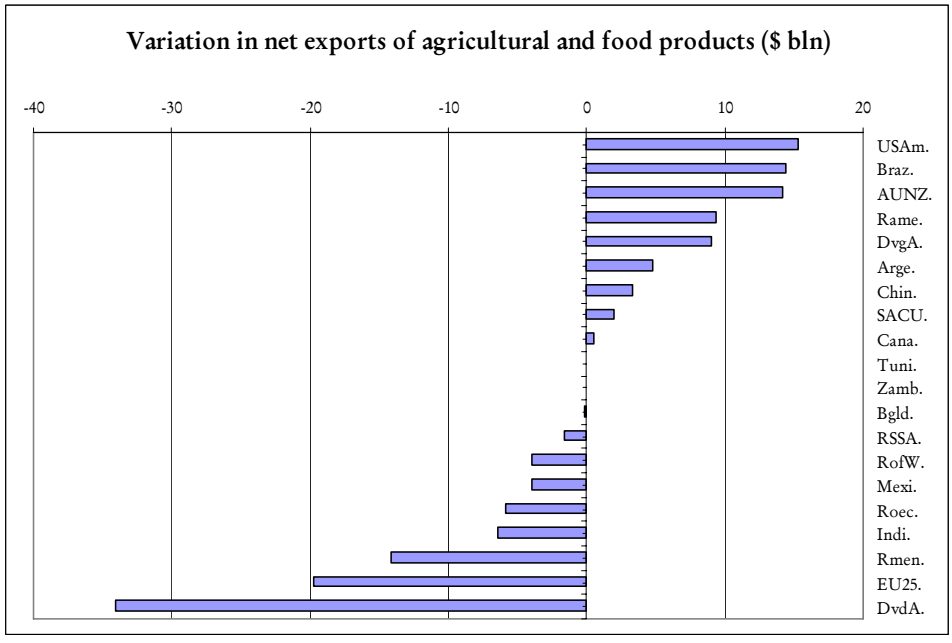


Source: author's calculation.

Full trade liberalization entails an upward move of the Lorenz curve except on four points: Mexico, Argentina, Canada, and the European Union. The Gini coefficient is reduced from 0.73993 down to 0.73981. Globally, free trade means less inequality in the world (with the above limitations) but the impact is minor: this trade reform does not change the fact that 63% of world population gets only 8% of world income.

This trade reform implies a redistribution of the world agricultural production. The USA, Brazil, Australia, New Zealand, Developing Asia, Argentina, and SACU increase their net trade balance in these commodities (see Figure 9) while the trade deficit in agricultural and food products of Developed Asia, the European Union, North Africa and Middle East, India and the EFTA worsens.

Figure 9—Impact of full trade liberalization on net agricultural exports



Source: author's calculation.

3.5.4 Decomposing trade reform

Decomposing trade reform by sources allows for a better understanding of the underlying mechanisms. The decomposition technique which is usually adopted (see Harrison, Horridge and Pearson, 2000) is not used here, however, as trade shocks are not considered to be additive. Therefore, only one part of the shock is simulated:

- full trade liberalization in the North, then in the South;
- Agricultural liberalization, then industrial liberalization;
- Elimination of import tariffs, then domestic support, then export subsidies.

Doing so, conclusions that emerge from the literature are confirmed. First, developing countries' own trade reform matters a lot; second, agriculture provides the greatest welfare gains; third, tariffs, by far, are the main source of distortions.

In the next subsections full trade reform is decomposed successively by liberalizing region (North/South), then by liberalized activities (agriculture/industry), finally by instruments (tariffs/domestic support/export subsidies.) Detailed results are provided in Annex 8, Annex 9, and Annex 10.

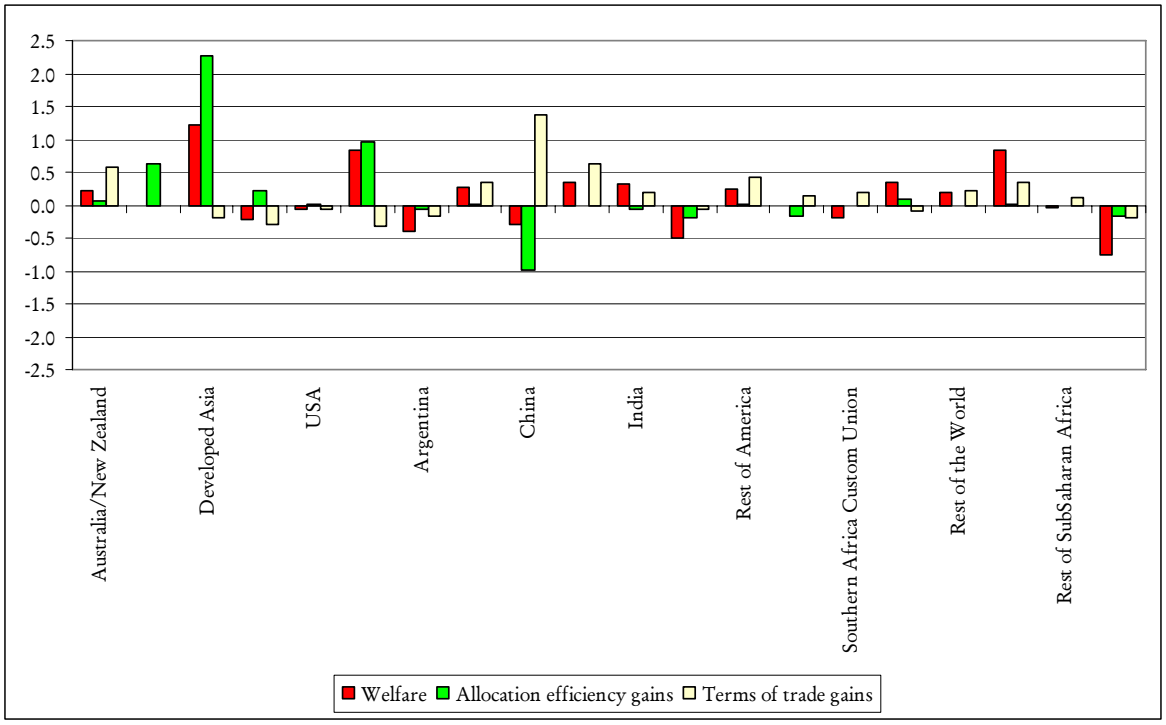
Decomposition by liberalizing region

Figure 10 represents welfare gains by country coming from full trade liberalization in the North and it decomposes such gains between efficiency gains and terms of trade gains[30]. Figure 11 provides the same data in the case of full trade liberalization in the South. Liberalization in the North implies the greatest welfare gain (+0.11%), but trade reform in developing countries also matters (+0.06%). Although the average protection is higher in the South, it is more dispersed across sectors in rich countries and thus more distorting. Furthermore, liberalizing access in developed countries creates more trade as they are richer.

[30] In this section all figures have been drawn using the same scale in order to allow visual comparisons.

The origins of these welfare gains are quite different. Efficiency gains are high for the countries which carry out the reform. In the case of Northern liberalization (see Figure 10) efficiency gains are large for developed countries, small for developing countries, while the opposite is true when liberalization takes place in the South[31].

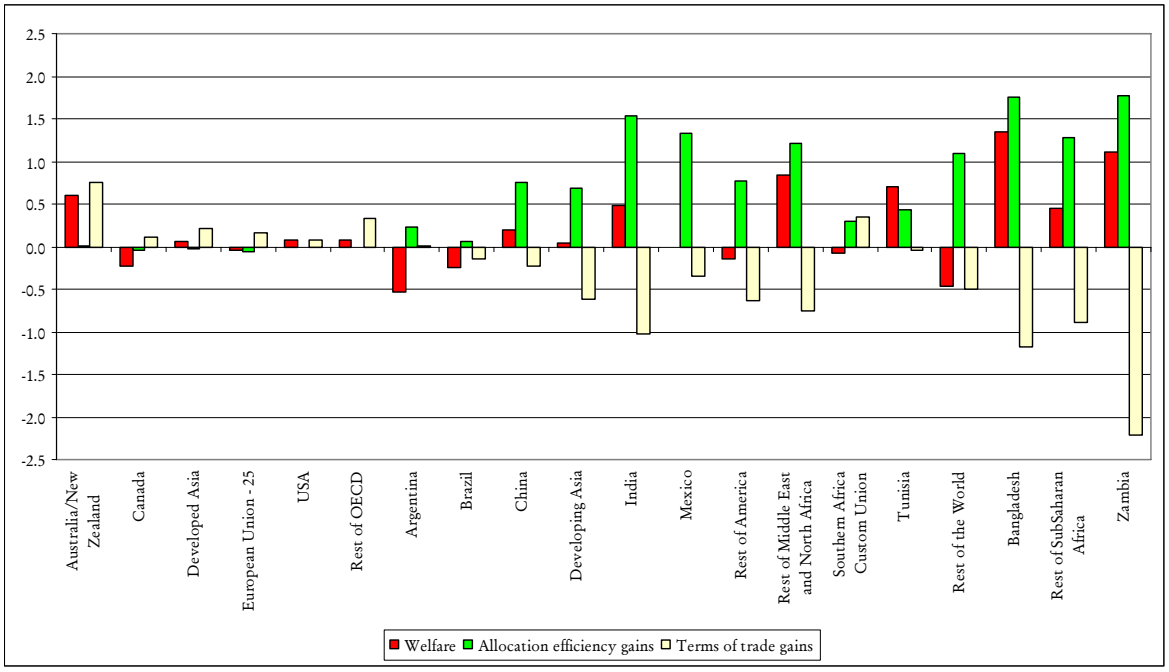
Figure 10—Welfare gains by region (%) – Northern full trade liberalization



Source: author's calculation.

[31] Exceptions are coming from variations in fiscal base while tax/subsidy rate is unchanged. For example if import duties are unchanged but imports increased, efficiency loss are augmented. In Figure 10 China is affected by a substantial efficiency loss while liberalization only takes place in the North. It comes from high taxes, especially on production, implemented in China. As Northern trades liberalization entails variation in Chinese production, it causes efficiency losses even if Chinese policies is not modified.

Figure 11—Welfare gains by region (%) – Southern full trade liberalization



Source: author's calculation.

Terms of trade gains are generally positive for developing countries when developed countries carry out trade liberalization. It stems from the positive impact that the Northern trade reform has on improved market access and on world prices of agricultural goods and textile/clothing goods in which developing countries have a comparative advantage.

Exceptions to this scheme are Tunisia and Mexico whose preferential access to the European Union and USA, respectively, is eroded by multilateral liberalization: more competition in the destination of their exports means reduced export prices. The benefits from Northern liberalization for Argentinean exports are mitigated by an initial geographic concentration on middle income countries (see Figure 4).

The cases of Zambia and 'Rest of MENA' are of great interest as Northern liberalization for these two zones is negative in terms of real income. Concerning their exports they do not profit from improvement of terms of trade or market access. This is the

case as they either export mainly untaxed products (oil, petroleum, copper) or their preferential access is eroded. Furthermore, they lose from raising world agricultural prices. On the contrary, reforming their own trade policies brings these two countries significant allocative efficiency gains (see Figure 11) and reinforces South-South trade.

On average, terms of trade of developing countries are worsened when carrying out their own trade reform even if this deterioration is marginal in most cases. For specific countries the extent to which their terms of trade are worsening might be large (see India, Bangladesh, and Zambia).

In a nutshell, in general trade reforms in both North and South matter for developing countries, but while on average Northern trade reform implies improvement of foreign markets access and increased export prices, Southern trade reform is beneficial as it entails a reallocation of productive factors to competitive sectors. Nevertheless, Northern trade liberalization can generate welfare losses for developing countries due to deterioration of terms of trade.

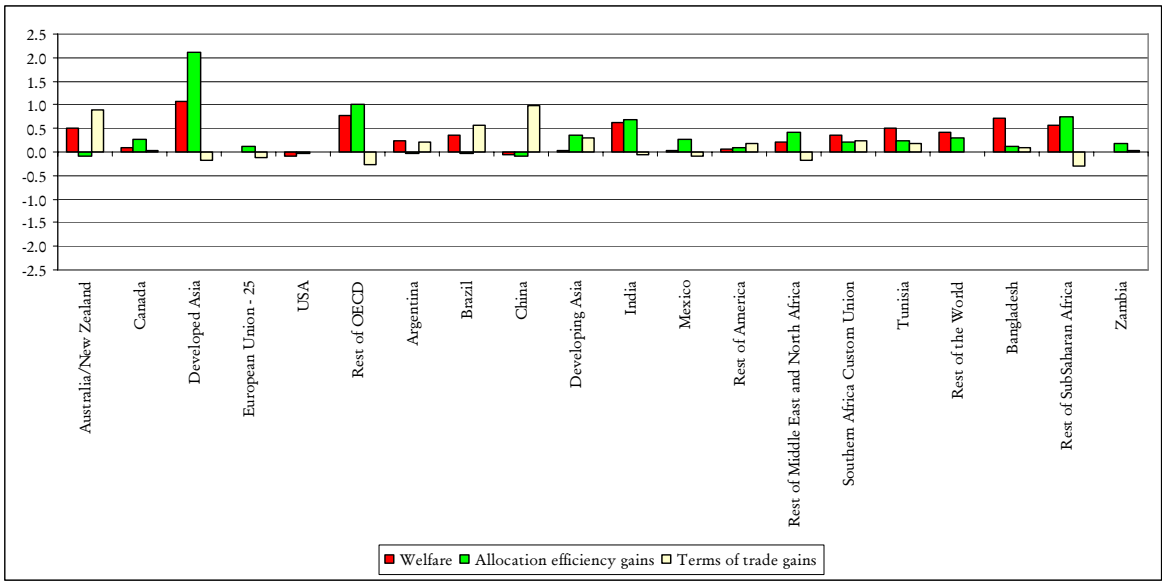
Decomposition by liberalized activity

Consider two case scenarios: one where only agriculture is fully liberalized (see Figure 12) and the other where only trade in industry is freed (see Figure 13). Agriculture is by far the main source of welfare gains: +0.18% while industrial liberalization entails a minor increase in world welfare. This reflects the concentration of distortions in agriculture. While on average world protection is 19.1%, in this activity it is only 4.2% in industry (but 10.5% in textile and apparel – see Bouët, Decreux, Fontagne, Jean and Laborde; 2005a). Furthermore, domestic support and export subsidies are concentrated in the agricultural sector while they are very rare in industry.

In the same line, from Figure 12 and Figure 13, it clearly appears that the level of efficiency gains reflects the initial pattern of protection. In the case of full agricultural liberalization, they are high in Developed Asia, Rest of OECD, India, Rest of Middle East and North Africa, and Rest of Sub – Saharan Africa. On the industrial side, efficiency gains

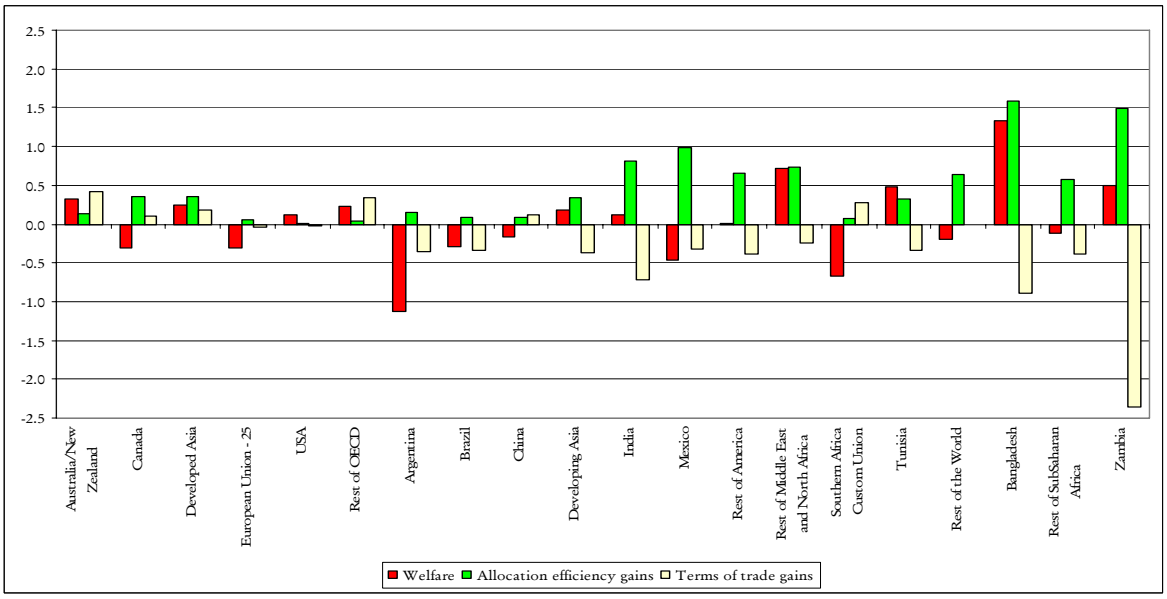
are large in India, Mexico, Bangladesh, Zambia, Rest of Middle East and North Africa, Rest of Sub – Saharan Africa, that is to say where protection is initially high.

Figure 12—Welfare gains by region (%) – Full trade liberalization in agriculture



Source: author's calculation.

Figure 13—Welfare gains by region (%) – Full trade liberalization in industry



Source: author's calculation.

As far as terms of trade gains are concerned, as already mentioned and explained, agricultural liberalization entails a substantial rise in world prices of agricultural commodities. It is beneficial for countries which were initially net exporters of agricultural and food products. Others lose from augmented world agricultural prices, while Mexico and Rest of Sub-Saharan Africa cope with more competition on their main export destination on which they lose preferential access.

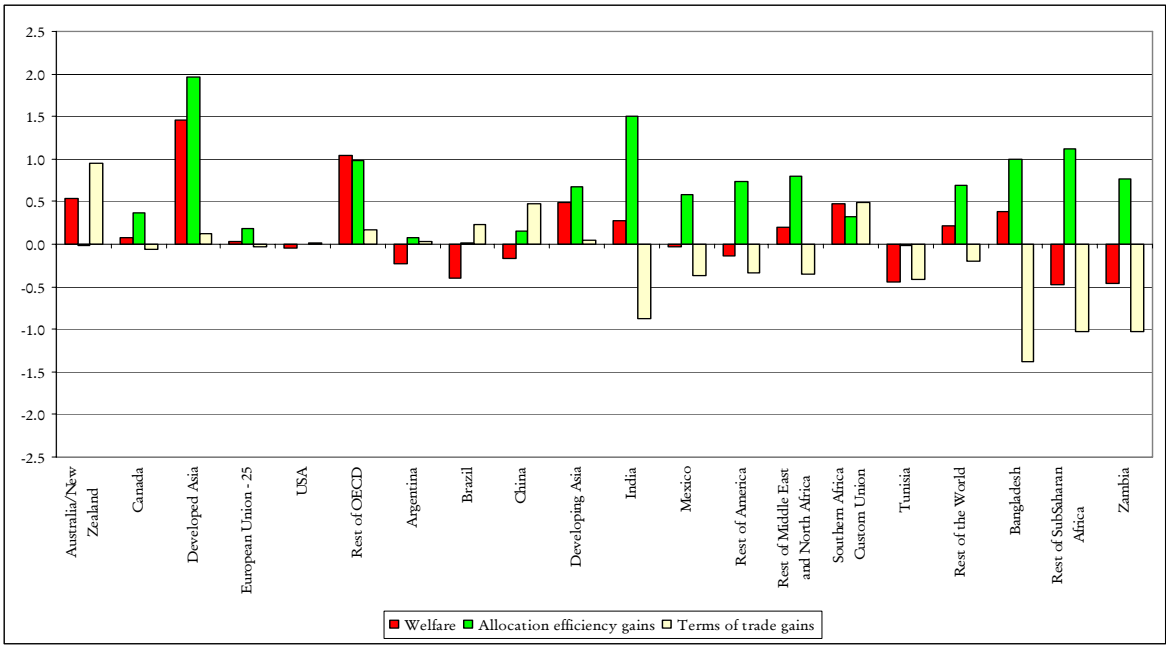
Argentina, Brazil, Mexico, and Rest of Sub – Saharan Africa have contrasting interests in full trade liberalization as they are winners from agricultural liberalization, but are loosing from industrial liberalization. In the case of Argentina, liberalization of only industrial sector increases the relative price of industrial goods. This implies deterioration of terms of trade. Furthermore, industrial sectors attract productive factors and the remuneration of land is reduced. The land supply decreases affecting negatively the agro-food sector and domestic activity, as a prominent sector in the economy. This means that agricultural reform is a key issue for Argentina.

Except China and Zambia which are negatively affected — though marginally— welfare of developing countries increases with agricultural full trade liberalization, whereas liberalized trade in industry has much more contrasting effects.

Decomposition by instrument of intervention

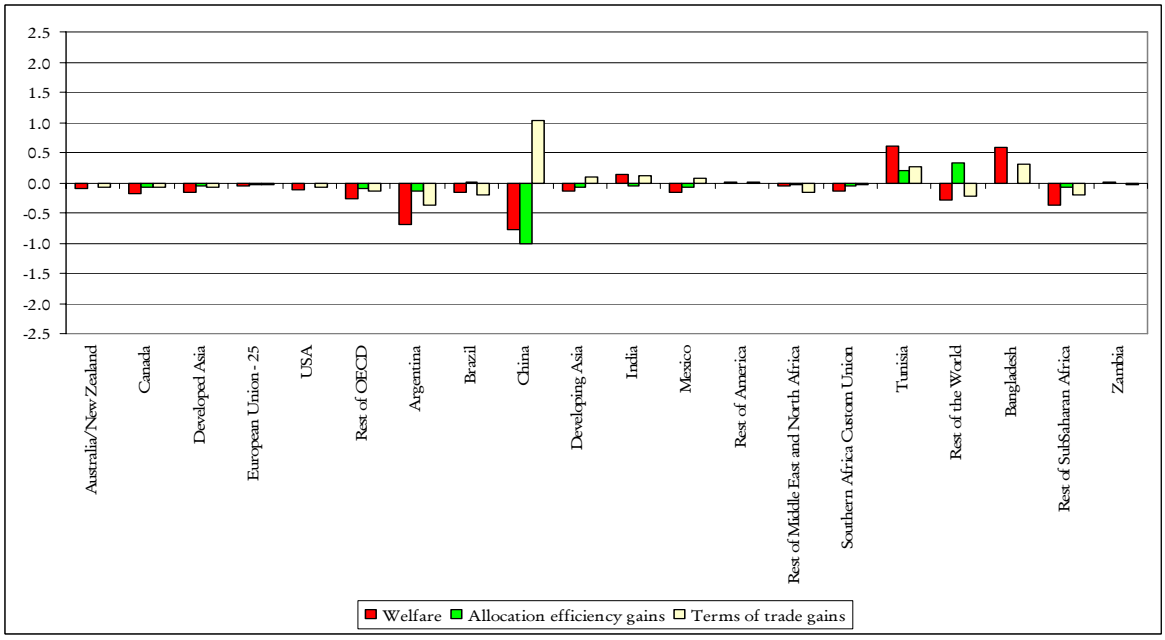
It is important to note the impact of each distorting instrument. Figure 14, Figure 15, and Figure 16 indicate the impact of fully eliminating border protection, export subsidies, and domestic support respectively.

Figure 14—Welfare gains by region (%) – Full elimination of border protection



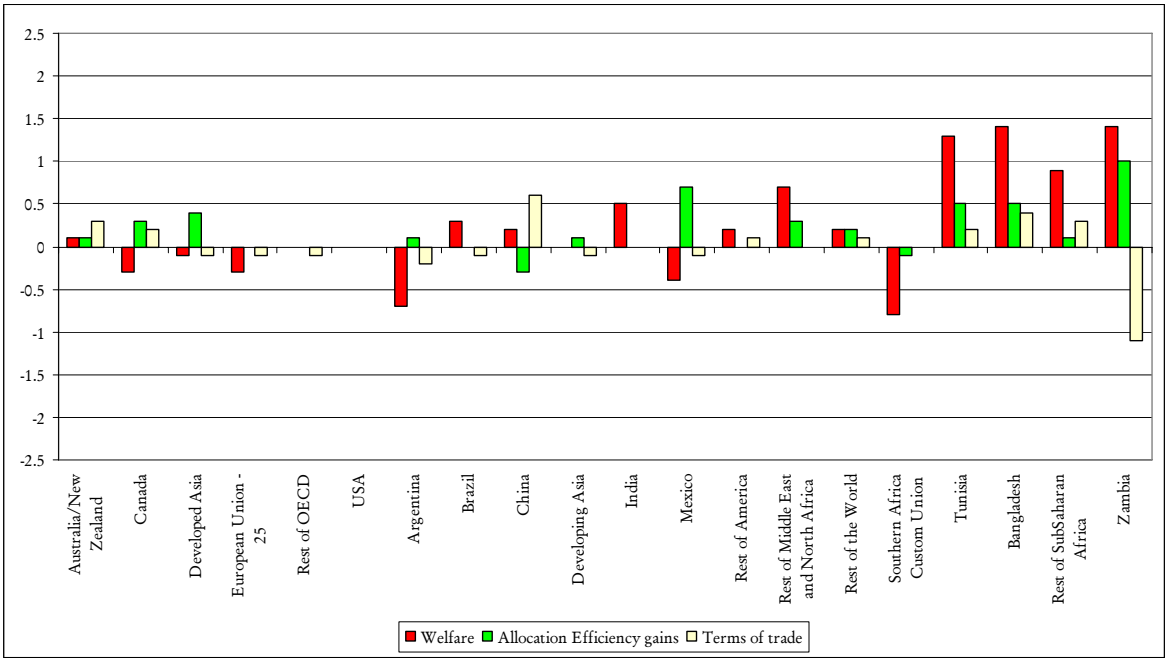
Source: author's calculation.

Figure 15—Welfare gains by region (%) – Full elimination of export subsidies



Source: author's calculation.

Figure 16—Welfare gains by region (%) – Full elimination of domestic support



Source: author's calculation.

Tariff is by far the main source of distortions. Complete elimination of this instrument increases world welfare by 0.23%. Elimination of domestic support and export subsidies has a small negative effect on world welfare[32].

Exports subsidies are initially substantial for milk in the European Union, USA and Rest of OECD, for rice, sugar, and meat in the European Union, and for Vegetable and Fruit in Rest of OECD. In industry, export subsidies are only significant in the rest of Latin America zone, whereas for textile and for apparel industries they are significant in the Southern African Custom Union..

Eliminating tariffs creates positive efficiency gains in countries where protection is initially high (India, Bangladesh, Rest of Sub-Saharan Africa) or exhibits peaks (Developed Asia, rest of OECD). Tariff is a discriminatory instrument: its elimination has positive

[32] This conclusion is quite conform to the issue raised by Panagarya (2005).

terms of trade effects on Australia/New Zealand, SACU, Argentina, and Brazil, while it entails loss of preferential access for Zambia, Rest of Sub-Saharan Africa, and Mexico.

In rich countries, domestic support is great in plant-based fibers, wheat and 'Other agricultural products' activities. The elimination of this program causes a large increase in world prices of these commodities. It is quite beneficial to their main exporters (Rest of Sub-Saharan Africa)

As a matter of conclusion, full trade liberalization is welfare–improving and development–friendly as welfare augmentations are greater for developing countries and especially for Least Developed Countries. Nevertheless, some topics require further consideration:

- Full liberalization can have adverse effects on individual countries because of terms of trade losses; either they are net food importing countries and increased agricultural prices cut their real income, or they have a preferential access which is eroded by multilateral liberalization. Furthermore trade liberalization does not significantly improve access to foreign markets in the case of countries which mainly export oil, petroleum, and mineral products.
- Results from the simulation imply a supplementary question: is specialization in agricultural activities a good strategy for development? The simulation points out that stimulating agricultural specialization entails a smaller expansion of industrial activity, that is to say less economies of scale and fewer varieties. This conclusion has already been emphasized in the literature (Francois, Von Meijl and Tongeren, 2005) and has not been discussed at the political level. After all, economic history does not provide many experiences of countries extremely specialized in agriculture and having supported a high and lasting economic growth.

This study might have led to a slight underestimation of expected benefits. At least three reasons justify this statement. First, they are founded on a database on market access that fully includes regional agreements and preferential schemes. Implicitly, it means that

full utilization of this preferential access is supposed. Even if this methodology is better than no inclusion of preferences, it has been demonstrated that these preferences are not fully utilized. This implies that expected benefits for countries receiving – preferences, which are mostly developing countries, are underestimated. Second, simulation is based on low trade elasticities. This choice can be justified. Recent econometric work by Hertel, Ivanic, Preckel, and Cranfield, 2000, gives a scientific basis for using these behavioral parameters. But this element must be kept in mind.

Third, our estimation is founded on a 17 sectors * in 20 geographic zones. This is a quite representative choice as compared to the literature and is also justified by the theoretical features. The model accounts for imperfect competition, horizontal and vertical differentiation, imperfect mobility of unskilled labor between agricultural and non – agricultural activities, and it is dynamic. Thus, increasing the number of products and regions would have also augmented the number of equations and the calculation time. But this disaggregation inevitably underestimates the distortions created by protection as tariffs are unevenly distributed across products and regions.

Obviously, it is necessary to have an idea of the extent to which expected benefits from trade liberalization can be underestimated. Simultaneously, a review of the literature has to be undertaken to verify if the results provided here are not ‘outliers’.

4. MODELING TRADE LIBERALIZATION AND DEVELOPMENT UNDER CGEM: A SURVEY

CGEM assessments of trade liberalization have multiplied. There are several explanations for that such as, increased access to economic data, increased efficiency in calculation time, development of the GTAP network, and so forth. What is most surprising, however, CGEM's quantitative conclusions diverge.

4.1 DIVERGENCES AMONG ASSESSMENTS OF TRADE LIBERALIZATION UNDER CGEM

Without being exhaustive, our survey has recorded nineteen CGEM assessments of the impact of full trade liberalization on the world during the last 6 years[33], and nine assessments of the impact of a potential Doha agreement. Annex 11 provides a synoptic table on the assessments of full trade liberalization on world welfare and poverty[34]. Annex 13 gives the same information for the Doha Development Agenda.

4.1.1 Trade pessimism?

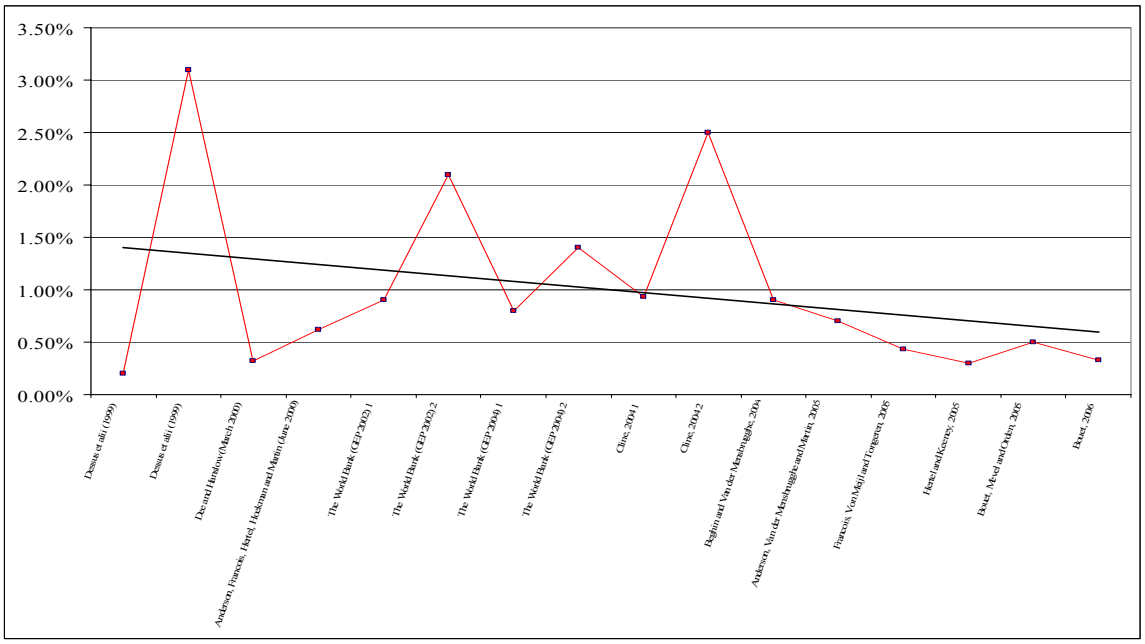
These two tables reveal a major divergence in CGEM assessments. As far as full trade liberalization is concerned, the increase in world welfare ranges from 0.2 to 3.1% (that is to say a range from 1 to more than 15!). The impact on poverty headcount is also divergent as the number of people lifted out from poverty ranges from 72 mln to 440 mln (a

[33] The assessment carried out in the previous section is included.
[34] In the case of the GEP 2004 (see Annex 12), it is a pro-poor scenario which would imply elimination of export subsidies, decoupling all domestic support and a significant cut in tariffs: rich countries would be subject to a maximum tariff of 10% in agriculture (5% in industry), with an average target of 5% (1%). For developing countries, the caps would be 15 and 10% with average of 10 and 5%.

ratio of 1 to 6.1!) with an average of 219 mln[35]. This is a rather contrasting picture of the effects of trade liberalization ([36]).

Figure 17 ranks the estimations of world benefits from full trade liberalization in chronological order[37]: on average the expected world welfare gain experiences continuous decrease[38]. For example, from an average world welfare increase of 1.7% in 1999, the average estimate is 1.5% in 2002, 1.3% in 2004, and 0.5% in 2005. Is the trade pessimism amongst trade economists getting ever stronger? If yes, is this conclusion justified?

Figure 17—Trade pessimism? - Impact of full trade liberalization on world welfare ($ bln)



Source: author's calculation.

[35] In 2003, the number of people in poverty (2$ per day definition) is estimated at 2.8 bln (World Development Indicators, 2004). It means that full trade liberalization could decrease world poverty by a percentage of 2.9% to 19.1%, with an average of 9.4%.

[36] In this survey we do not include assessments of expected benefits from trade liberalization in services or from trade facilitation. These studies are rare and while shedding light on a fundamental topic the methodology needs further refinements. On the contrary we included trade liberalization only in agriculture, as studied by the USDA – ERS (2001), but we did not give the results from Diao, Diaz- Bonilla, Robinson and Orden (2005) as they only account for consequences on developing countries.

[37] We excluded from this graphic the USDA-ERS which only focused on agricultural liberalization.

[38] More precisely the trend, calculated according to a linear regression, exhibits a decreasing slope.

Obviously, these results are not totally comparable. Real incomes can be defined either in the dollar value of 1997 or in the dollar value of 2001. Furthermore, models can be static or dynamic. In case of a dynamic model, the increase in supplies of productive factors are (endogenously or exogenously) taken into account, and in some simulations even technical progress and related changes in factor productivity are included. Thus, the same rate of increase in real income, entailed by trade reform and applied to different bases, gives birth to different levels of assessments: comparing studies by rate of change in real income is more appropriate. It is even more reliable to compare results coming from the same model: Hertel and Keeney (2005) to Hertel (2000) or Anderson, Martin and Van der Mensbrugghe (2005a) to the World Bank's GEP in 2002 and 2004. It brings a more accurate picture, but the main conclusion is the same: results are divergent and the general trend is less trade optimism.

Figure 18 shows the impact of trade reform on poverty headcount. In 2004 Cline carried out two estimations, the second one being especially optimistic. Putting aside this second estimation, trade pessimism is rather confirmed.

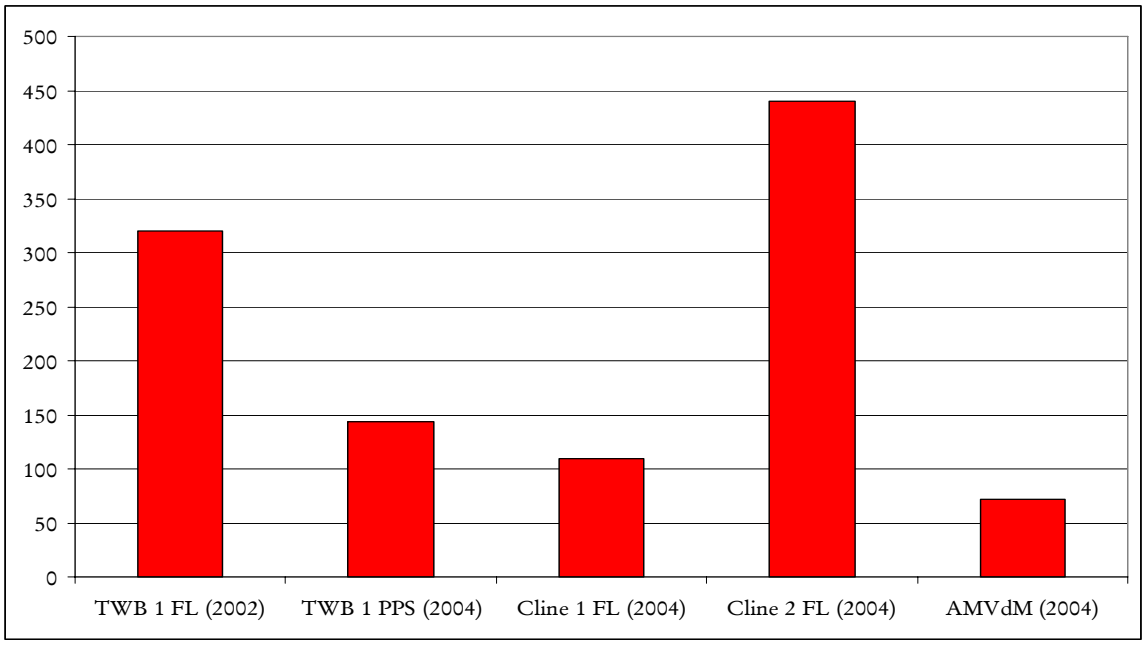
Finally, Table 9 indicates if the assessments conclude on welfare losses for some regions or countries. Until 2000 most studies have concluded on the absence of losers from trade liberalization at the national level, highlighting a kind of "*Mondialisation heureuse*"[39]. From Dee and Hanslow (2000) more and more studies are concluding on welfare losses for countries. It is noteworthy that these are nearly all developing countries (with the exception of Canada based on an assessment conducted in 2000).

The potential implications of Doha Development Agenda have been also scrutinized. This is laid out in Annex 13. A comparison of Annex 11 and Annex 13 leads to the conclusion that the potential impact of the Doha Agenda is much smaller than the

[39] French expression for "fortunate globalization"; this qualification is famous in France since an article from Alain Minc in the daily newspaper *Le Monde* in August 2001. It was a tentative description of globalization as a wonderful process giving benefits to everybody in all countries throughout the world.

one resulting from full trade liberalization. This is one of the main conclusions of all these studies.

Figure 18—Trade pessimism? Impact of full trade liberalization on poverty headcount (mln - 2$ per day definition)[40]



Source: author's calculation.

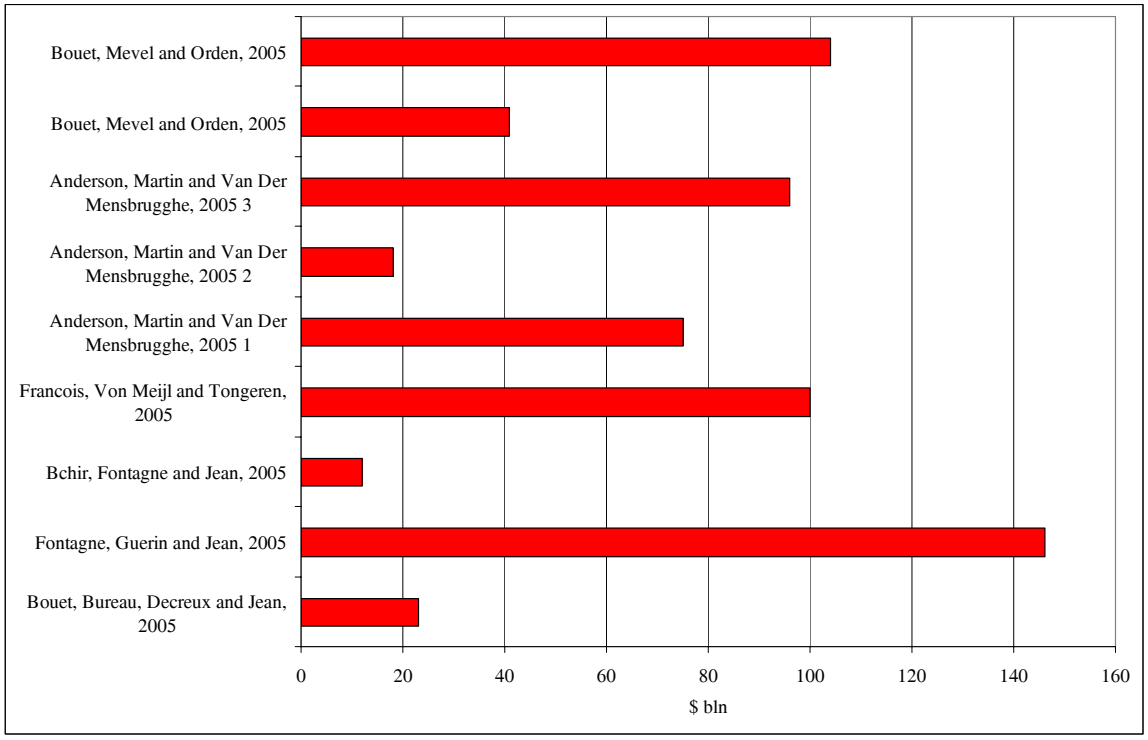
[40] TWB: The World Bank; FL: Full liberalization; PPS: pro-poor scenario; AMVdM: Anderson, Martin and Van der Mensbrugghe.

Table 9—Trade pessimism? Potential losers from full trade liberalization

	Dessus et alii (1999)	*Dee and Hanslow (March 2000)*	*Hertel (July-August 2000)*	*USDA - ERS (2001) 1*	*USDA - ERS (2001) 2*	*The World Bank (GEP 2002) 1*	*The World Bank (GEP 2002) 2*	*The World Bank (GEP 2004) 1*	*The World Bank (GEP 2004) 2*	*Cline, 2004 1*	*Cline, 2004 2*	*Beghin and Van der Mensbrugghe, 2004*	*Anderson, Van der Mensbrugghe and Martin, 20(*	*Francois, Von Meijl and Tongeren, 2005*	*Hertel and Keeney, 2005*	*Bouet, Mevel and Orden (2005)*	*Bouet, 2006*
Losers ?	no losers	Mexico, Canada	Other MENA countries	Mexico, RoW	no losers	no losers	no losers	no losers	no losers	Malaysia, Mexico	Malaysia, China	no losers	no losers	South America, China, India	Philipp., Banglad., R.o. Lat. Amer., Mozamb., R.o. SubSah. Afr.	China, Venezuela, Banglad., Mozamb., Zambia	Canada, EU, Argentina, Mexico, SACU

Assessing the impact of a Doha Agenda under CGEM gives also birth to divergences (see Figure 19) The range of welfare variations for an Agricultural Doha Round is from 0.08% (Bouet, Bureau, Decreux and Jean, 2005) to 0.18% (Anderson, Martin and Van der Mensbrugghe, 2005, 1) and from 0.17% (Bouet, Mevel and Orden, 2005) to 0.51% for a complete Round (Fontagne, Guerin and Jean, 2005).

Figure 19—Trade uncertainty: Assessments of the Doha Agenda in 2005 ($ bln)



Source: author's calculation

4.1.2 Convergent conclusions

Before explaining the source of divergences, and the fading optimism, it is worthwhile to put an emphasis on convergent conclusions of all these studies (see Table 10):

(i) Full liberalization is beneficial. At the world level it increases welfare. This does not mean that all countries or all economic agents are better off.

Liberalizing trade gives birth to a "larger cake" but some can get smaller parts than others; if efficient redistribution mechanisms are put in place all agents could get increased welfare.

(ii) Liberalizing agriculture is the main source of expected gains, accounting for about two thirds of global gains. It stems from the fact that this sector contains a major part of current trade barriers. Furthermore, nearly all export subsidies and domestic support goes to agriculture[41].

(iii) Tariffs are by far the main source of distortions. They account for more than 90% of expected benefits in case of full liberalization. This major political issue is confirmed by the assessment of the Doha Agenda. It prioritizes the elimination of export subsidies and a cut in domestic support, while pursuing modest objectives in terms of market access. This is obviously the reason why Annex 13 indicates only small welfare increases.

(iv) Developing countries could be large beneficiaries of these reforms. As their GDP is lower, it would even imply a higher rate of increase in their real income. In this sense, trade reform is a progressive reform as far as it increases real income of poor countries.

(v) Liberalizing trade policies of developing countries is a major stake. It contributes for about half of expected benefits. This is of course one supplementary criticism addressed to the Doha Agenda as a Special and Differentiated Treatment could allow developing countries to liberalize less and Least Developed countries to keep their trade policies unchanged.

These convergent conclusions are extremely important. Even if the picture drawn by these models is not as favorable as the one that emerged a few years ago, it remains

[41] Large gains in world welfare are expected from liberalization in services but these estimates are subject to a great caution.

that the global net expected effect is positive: trade liberalization has to be done even if parallel policies have to be implemented simultaneously. The other points detail the contents of positive world trade reform: it has to focus on agriculture and market access, and developing countries have to reform their own economies too.

Nevertheless, divergences between these assessments and stronger trade pessimism require further examination. From the short representation of a CGEM in Figure 1, it is easy to identify the potential sources of these divergences. Studies can differ by:

i. economic data
ii. behavioral parameters
iii. theoretical features of the model
iv. experiment which is conducted

The following subsection examines each of these explanations.

Table 10—CGEM assessments of full trade liberalization: Convergent conclusions

	Dessus et alii (1999)	Dessus et alii (1999)	Anderson, Francois, Hertel, Hoekman and Martin (200	USDA - ERS (2001) 1	USDA - ERS (2001) 2	The World Bank (GEP 2002) 1	The World Bank (GEP 2002) 2	The World Bank (GEP 2004) 1	The World Bank (GEP 2004) 2	Cline, 2004 1	Cline, 2004 2	Beghin and Van der Mensbrugghe, 2004	Anderson, Van der Mensbrugghe and Martin, 2005	Francois, Von Meijl and Tongeren, 2005	Hertel and Keeney, 2005
Role of agric;	na	na	65%	na	na	69%	71%	66%	69%	57%	na	69%	63%	65%	66%
Role of tariffs	na	na	na	na	na	na	na	na	na	na	na	99%	93%	91%	95%
Share of Dvg countries in benefits	22%	38%	43%	8%	38%	52%	65%	55%	67%	38%	47%	56%	30%	8%	26%
Role of Dvg countries policies	na	na	45%	na	na	55%	66%	62%	62%	44%	na	na	45%	58%	na

4.2 WHY DO CGEM ASSESSMENTS DIVERGE SO MUCH?

There are four explanations for these divergences which concern experiments, data, theoretical assumptions, and elasticities.

4.2.1 Experiments are not the same

The first explanation concerns the experiments. It does not only consider designed scenario, but also the conduct of a pre-experiment and the offsetting of fiscal policies.

Full liberalization vs. Doha Development Agenda (DDA)

Annex 12 considers only assessments of complete (in agriculture and in industry) and full liberalization, with the exception of the study done by the USDA – ERS which assesses implications of liberalizing only agriculture. Experiments in Annex 13 are tentative representations of a Doha Development Agenda only in industry as examined by Bchir, Fontagne and Jean (2005), or in agriculture as examined by Bouet, Bureau, Decreux and Jean (2005), or by Anderson, Martin and Van der Mensbrugghe (2005 - scenarios 1 and 2).

Obviously, DDA experiments might diverge as at the time when they were done, no study had complete and definitive information on the conclusion of this agenda. Most of these studies utilize the "Harbinson" proposal of May 2003 in agriculture; some use the Girard formula in industry. The reason is that for more than two years they were the only quantitative proposals put forward by an official negotiator.

The Harbinson proposal is explained in Table 11. It defines several tiers with increased reduction rates when applied to initial tariffs[42]. As far as developed countrie

[42] Let us recall that these reduction rates are applied to bound duties.

are concerned[43], for example, tariffs higher than 90% must be reduced by a rate of 60%.

Table 11—The "Harbinson" proposal

Developed countries		Developing countries	
Initial tariffs	Reduction rate	Initial tariffs	Reduction rate
t>90%	60%	t>120%	40%
t=<90% and t>15%	50%	t=<120% and t>60%	35%
t=<15%	40%	t=<60% and t>20%	30%
		t=<20%	25%

Nevertheless, the usage of this formula is subject to criticism. As noted by Jean, Laborde and Martin (2005), it contains discontinuities: while a 91% bound tariff initially adopted by a developed country is going to be reduced at 36.4%, a 90% duty will be set at 45%. Although it may be easy to come up with corrections of these discontinuities (Jean, Laborde and Martin apply marginally reduction rates, like in an income tax schedule) this formula continues to be a source of divergence in assessments.

In trade negotiations, it often appears that "*devils are in the details*". In other words, an ambitious package can be announced, but as it includes detailed and complicated clauses its final impact on market access might be far from the one proclaimed. Three examples can illustrate this point.

i) Tariff rate quotas (TRQs) have been implemented during the Uruguay Round in order to guarantee minimum access and to safeguard exports of some developing countries. There have been 1371 TRQs implemented (see de Gorter and Sheldon, 2000 and Matthews and Laroche, 2001, for a complete presentation).

A TRQ is composed of two tariffs (the Inside Quota Tariff Rate – IQTR- and the Outside Quota Tariff Rate – OQTR) and a quota. It is already difficult to ascertain the protective impact of a TRQ, but it is even more hazardous to anticipate the way TRQs

[43] Let us recall that this is a WTO definition of developing/developed countries, that is to say "there are no WTO definitions of "developed" and "developing" countries. Members announce for themselves whether they are "developed" or "developing" countries"(http://www.wto.org/english/tratop_e/devel_e/d1who_e.htm).

will be liberalized and the method in which countries will implement this reform. Trade negotiators could indeed decide to decrease Tariff Quota Rates, to expand quotas or a combination of the two. At the national level, a government could modify the way quotas are administered[44] and this could have significant consequences on some developing countries.

ii) The Geneva framework agreement, concluded on July 2004, includes a sensitive products clause:

> "*Without undermining the overall objective of the tiered approach, members may designate an appropriate number, to be negotiated, of tariff lines to be treated as sensitive, taking account of existing commitments for these products*" (see http://www.wto.org/english/tratop_e/dda_e /draft_text_gc_dg_31july04_e.htm).

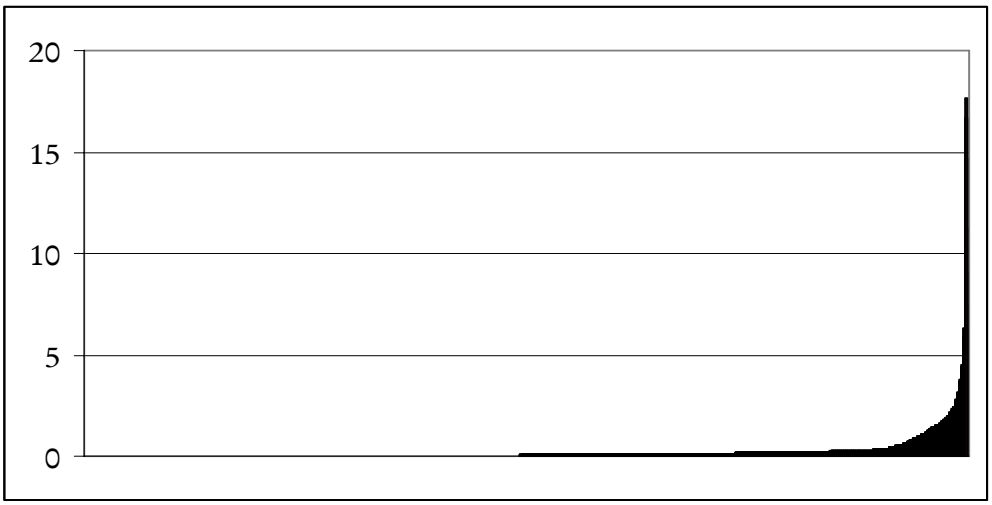
This clause is so ambiguous that it is difficult to ascertain its consequences. Self–selection of tariff lines may imply that more protected products will be exempted from liberalization. Anderson, Martin and van der Mensbrugghe (2005a) demonstrated that even in the case of a low percentage of tariff lines admitted as sensitive products, it could considerably reduce the effects of liberalization. In Annex 13 the only difference between scenarios 1 and 2 carried out by Anderson, Martin, and van der Mensbrugghe (2005) is the inclusion of the sensitive and special products clause on 2% of tariff lines. The associated world welfare gain is cut from $75bln to $17bln.

The importance of such a clause comes from the convex form of tariff distributions in OECD countries. Graph 20 illustrates this point, showing an increasingly ranked distribution of bound tariffs in Switzerland. In Switzerland, like in Norway, Iceland, Japan and European Union, protection is highly concentrated on a few products. Exempting a few lines of liberalization may have significant consequences. In 2001, the

[44] Quotas can be administered according to several ways: on an historical basis, on a "first arrived, first served" basis…

average Swiss bound duty in agriculture is 81.6%[45]. When applying the "Harbinson proposal" without sensitive products clause, this average falls down to 34.1%. If, on the contrary, a sensitive products clause is applied exempting 2% of tariff lines from liberalization, and if in Switzerland, this room for maneuver is utilized on the highest duties in agriculture, the new bound duty average is 64.8%!

Figure 20—Bound duties – Switzerland – 2001 – HS6



Source: MacMap-HS6 and author's calculation

iii) Specific tariffs are numerous in rich countries' agricultural sector. According to the MacMap-HS6 database, this trade barrier represents the totality of agricultural protection in Switzerland, and about three quarters in the European Union and Japan (see Bouët, Decreux, Fontagne, Jean and Laborde, 2005b).

If a proportional formula were to be applied, the existence of specific tariffs would not be a source of divergence. But it is all the more plausible that a progressive formula will be applied: larger cuts for higher initial tariffs, either by the previously exposed Harbinson proposal or by a Swiss formula. It is, therefore, necessary to evaluate

[45] This average duty is here especially high as *ad valorem* equivalents of specific tariffs, by far the most prominent instrument of protection in Switzerland, is calculated by dividing duties by world unit values, that is to say relatively low unit values as compared to national unit values of imports.

the Ad Valorem Equivalent (AVE) of a specific tariff. In the case of a tiered approach, this assessment is aimed at finding out which coefficient has to be applied. The transformation is also necessary in the case of a Swiss formula, as this approach only makes sense when applied to ad valorem duties.

Calculating AVE of specific tariffs could seem straightforward as it is only necessary to divide the specific duty by a unit value. The question remains, however, about which unit value has to be utilized. For one product defined at the HS6 level, unit values of trade flows may greatly diverge depending whether they are taken at the national or the world level. The European Commission (see MAP – Brief, 2005) gives the example of fresh sausages, of which the unit value of European imports is 8 euros by kg, while the world unit value is 2 euros. The tariff applied by the European Union is 1.5 euros per kg; the AVE is either 19% (from the European unit value) or 75% (from the world unit value). As developed countries mostly import products of high quality, using a world unit value to calculate AVE systematically inflates the rate of liberalization. The construction of the MacMap-HS6 database has clearly highlighted that this is a major issue (see Bouët, Decreux, Fontagné, Jean and Laborde, 2005). This has even been the main source of contention for trade negotiators during the first part of 2005.

From the above discussion it clearly appears that a good assessment of the impact of DDA must include consideration of not only the final agreement, but the detailed way in which the agreement is implemented by each WTO member. Of course, it could be stated that in case of full liberalization, this source of divergence disappears. Nevertheless, the need to define what full liberalization is and which distortions have to be eliminated remains. It may concern border measures (import duties, export subsidies) or domestic distortions; in the latter case the definition is less obvious. One can choose measures to be eliminated on an institutional criterion, for example those forbidden by the WTO. But it is also possible to include other programs which could have sensible effects, contrary to what is expected from trade liberalization: for example the elimination of the European land-set aside program and the US CRP (Conservation

Reserve Program) could contribute to a major expansion of land supply in these two countries and a substantial increase in their agricultural production.

There are other issues that may explain why experiments are not the same among different assessments of the effects of full trade liberalization.

The "pre-experiment" issue

Almost all studies use the GTAP database. The last available version (GTAP-6) is for 2001 and provides social accounting matrixes and trade flows for up to 87 countries (or geographic zones) and 57 activities. Previous assessments used the GTAP database-5, for 1997.

When studying trade liberalization the reviewed studies usually suppose that it takes place in 2005 or 2006, implying an 8/9-years delay under GTAP-5 version and a 4/5-years delay in GTAP-6. Whatever the effective date of liberalization , trade barriers have been reduced since 1997 or since 2001: the Uruguay Round has been definitively implemented with the phasing out of the Multi – Fiber Arrangement, some countries have entered the WTO and consequently reduced their tariff barriers (China), some preferences have been granted to developing countries (Everything But Arms, African Growth Opportunity Act, etc.), and new regional agreements have been negotiated (USA – Morocco, Chile-Mexico, etc.) or modified (enlargement of the European Union to 25 countries).

Applying a trade shock on a dataset which does not include all this information overstates the impact of full trade liberalization on trade flows, economic activity, and welfare. This is the reason why in most studies (Beghin and Van der Mensbrugghe, 2004; Bchir, Fontagne and Jean, 2005; Anderson, Martin and Van der Mensbrugghe, 2005; Hertel and Keeney, 2005, for example) a pre-experiment is conducted. Several trade agreements, enforced during this transition, are simulated and applied to the initial database: this is called a "pre-experiment". Then the designed experiment involves simulating either full trade liberalization or Doha Agenda on this modified database.

While concluding that full trade liberalization would imply a world welfare gain of $287bln, Anderson, Martin and Van der Mensbrugghe (2005) demonstrate that the liberalization process that took place between 2001 and 2005 (the last implementation of the Uruguay Round, the end of the MFA, the access of China to WTO, the enlargement of the European Union to 10 countries from Eastern and Central Europe, the setting up of EBA and AGOA, etc.) has increased world welfare by $54bln —that is to say an increased gain of about 19%.

When modeling is done under recursive dynamics a benchmark is constituted: if the trade shock is applied over a period of ten years for example, the evolution of the world economy is simulated without any trade reform during these ten consecutive years, but with investment increasing the stock of capital, and increase in labor supplies either exogenous (given a projected rate for that period) or endogenous (labor supply depending on its real remuneration)[46]. Under different benchmarks, however, the same trade reform will lead to different welfare gains. This is why comparing studies by rate of change (in %) is more appropriate.

Compensatory fiscal policies

Alongside the elimination of trade distortions, fiscal policies are frequently implemented in these assessments which could lead to divergent conclusions. Two reasons may be invoked for including fiscal reforms simultaneously to trade reforms in liberalization assessments.

(i) The fiscal issue is a major concern in developing countries, where corruption and tax evasion are prominent. As income and sale taxes do not yield sufficient public receipts, taxing imports has become a key source of revenue for the public sector. Annex 14 indicates the importance of import taxes in proportion of GDP in the 85 countries/zones of the GTAP-6 database. In developing countries these taxes represent

[46] Land supply can also be modified as its real remuneration is changed.

from 0.4% of the domestic GDP in Botswana up to 4.3% in Tunisia. When implementing full trade liberalization, it may be unrealistic not to consider offsetting fiscal instrument (which can be more or less distorting). Even the implementation of a DDA could reduce fiscal receipts.

(ii) For more than 60 years (the Stolper-Samuelson theorem has been published in 1941) liberalizing trade has been considered to affect the income distribution inside a country. Thus, it can be argued that reducing trade barriers increases economic efficiency (it increases the size of the cake) but it also modifies the way in which income is distributed (the way the cake is split). As a matter of fact, it could be argued that the effects of free trade have to be corrected by a fiscal policy. This issue is all the more important now as the current round of negotiation has been placed under the objective of poverty alleviation. Poverty comes from low factor remuneration and/or high consumer prices. If prices of commodities, the production of which requires an intensive utilization of unskilled labor, are increased, the activity in this sector is enhanced and the demand for and remuneration of this factor is elevated; this finally contributes to poverty alleviation. On the other hand, augmented consumer prices have adverse effects on poor people who buy these commodities. A way of tackling this issue is using the fiscal instrument.

The idea that trade liberalization has to be accompanied by a fiscal policy is consistent. But it represents yet another source of divergence amongst assessments of expected benefits.

4.2.2 Data are not the same

The utilization of different data leads logically to different assessments. Nearly all assessments are using the GTAP database on consumption, production, and international trade. But divergences may stem from the utilization of different databases on market access and domestic support even if today modelers are progressively using the same information.

Data on market access

Data on market access have greatly evolved within a few years. It might be one of the major sources of reduced optimism about the expected benefits from trade liberalization. Three improvements are significant:

- The main databases take into account trade preferences and regional agreements;
- *Ad* v*alorem* equivalents of specific tariffs and tariff rate quotas are calculated;
- Simulation of multilateral trade negotiation accounts for the interaction of bound and applied duties.

MacMap is a 4-dimensional database on market access (importing country, products, exporting country, and instrument of protection). It includes all preferential schemes and regional agreements between different countries[47]. The base period for MacMap is 2001 and the commodity coverage includes 5,111 products (Harmonized System at the 6 digit level, HS6). It includes *ad valorem* duties, specific duties, compound duties, TRQs and anti-dumping duties, and calculates *ad valorem* equivalent of all these protective instruments. It measures market access to 163 countries by 208 partners.

The objective of global trade negotiations are the reduction of bound duties. Thus, an accurate assessment of the impact of a multilateral trade reform must take into account the interplay between bound, MFN applied, and preferential duties. To complement MacMap, the CEPII has recently constructed a dataset on bound duties, for 2001

[47] For a complete presentation of the MacMap-HS6 database, see Bouet, Decreux, Fontagne, Jean and Laborde (2005a and 2005b).

The data on market access from MacMap have been included in the GTAP database[48].

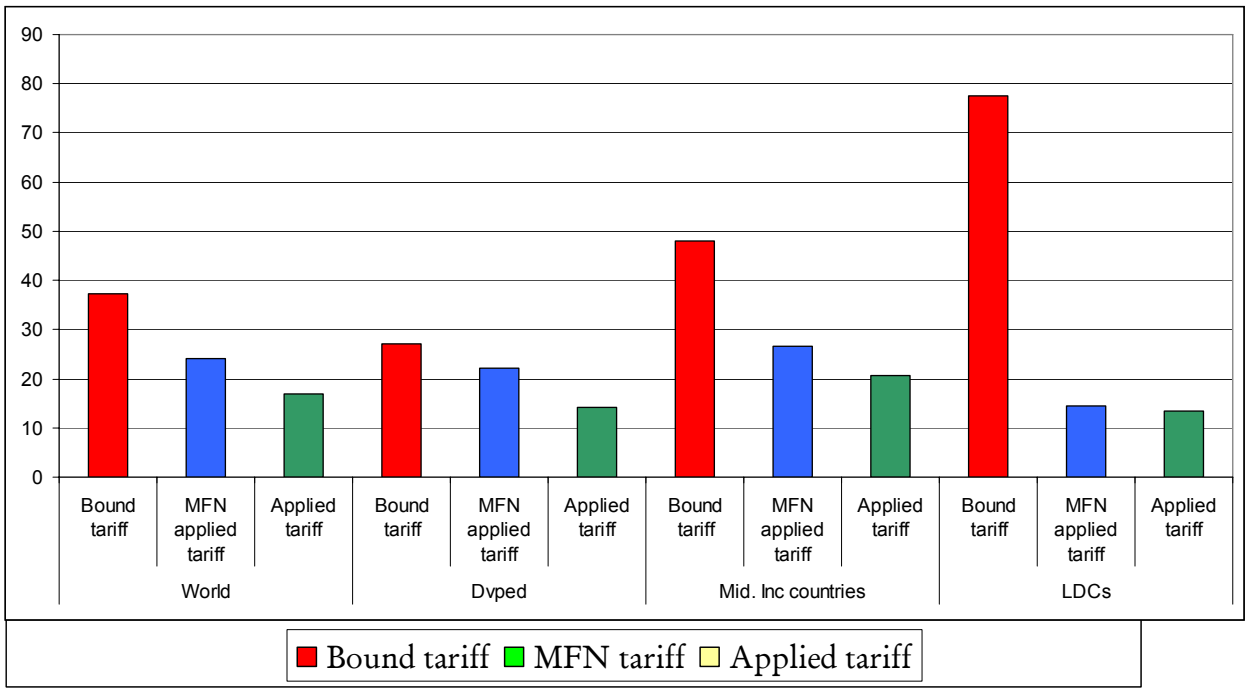
The MacMap_HS6 database is now the main reference for measuring market access in general equilibrium analysis; it has resulted in a downwards assessment of the level of protection throughout the world as it includes all preferential schemes and regional agreements, instead of basing border protection uniquely on MFN tariffs. Obviously, this methodology implies that trade preferences are fully utilized, while clearly, such preferential schemes (and in a lesser extent, free trade agreements) have been frequently criticized because of their lack of efficiency. These agreements always include rules of origin in order to avoid trade deflection. The stringency of these rules has been pointed out. First empirical assessments have been very pessimistic about the rate of utilization of these schemes (Brenton, 2003; Brenton and Manchin, 2003; Brenton and Ikezuki, 2004), but new methodologies and studies have recently demonstrated that these preferences are rather well utilized by exporters from developing countries, especially in agriculture (Wainio and Gibson, 2003; Candau, Fontagne and Jean, 2004; Candau and Jean, 2005).

Assessing the impact of trade liberalization requires taking into account the interplay between MFN duties and preferential duties and, as far as a Development Agenda is concerned, the one between these duties and bound tariffs. This consideration results in a downwards estimation of the expected benefits of liberalization. Jean, Laborde and Martin (2005) calculate that taking into account applied tariff instead of MFN tariffs in agriculture decreases border protection by 30% (= (24-17)/24; see Figure 21) while the binding overhang is greater than 13 basis point. Preferences (difference between MFN applied and applied) are large in developed countries, whereas very small

[48] The GTAP data on protection are based on MacMap data at the HS6 level but the way data are aggregated up to the GTAP disaggregation level is different from the MacMap methodology. GTAP uses a national imports system of weights while MacMap weighing system is based on imports from a reference group. Doing so GTAP understates the actual level of protection but includes consistent data with respect to tariff receipts. This is of course another source of divergence between assessments using the GTAP method of tariff aggregation (Hertel and Keeney, 2005; Anderson, Martin and Van der Mensbrugghe, 2005) and evaluation using the MacMap method (Bouet, Bureau, Decreux and Jean, 2005).

in LDCs. On the contrary, the gap between bound and MFN duties is large in the latter and small in the former (it is even larger in LDCs than in Middle Income Countries).

Figure 21—Bound and applied agricultural tariff rates (%), by region - 2001



Source: Jean, Laborde and Martin; 2005.

Data on domestic support

Data on domestic support can also greatly differ across studies. Domestic support is a distortion the definition and economic impact of which varies much more than that of tariffs: it can act on production, on intermediate consumption, on farmers' income, on capital or land, and so forth; it can have a direct or indirect effect on production (coupled or decoupled); it can be bound or not.

Bouet, Bureau, Decreux, and Jean (2005) distinguish market price support, output subsidies, capital subsidies, variable input subsidies, land subsidies, and decoupled subsidies in OECD countries and China. Even if decoupled subsidies are modeled to have an indirect effect on production, taking into account this form of domestic support

reduces the impact of liberalization on world prices. Some programs have even a negative impact on production (land set-aside program in Europe, CRP in USA) so that their elimination would entail an increase in domestic production.

Recent research has also pointed to a "*binding overhang*" phenomenon in domestic support programs as developed countries' governments have consolidated these measures and effective subsidies are deemed inferior. Anderson, Martin and Van der Mensbrugghe (2005a and 2005b) demonstrated that very large reduction in bound support is needed before any reduction in actual support would take place.

Different decomposition by sectors and trading zones

CGEMs are sophisticated representations of the world economy. Modeling consumption, production, and trade of several products in several trading zones requires solving a very large system of equations. Thus, it is necessary to identify a limited number of sectors and trading zones as the number of equations increases exponentially when these parameters are increased: some equations have up to four dimensions.

But reducing the number of sectors and trading zones is costly: if the size of the distortion differs from one sector to the other or from one trading zone to the other, it decreases the cost of protection as this cost is proportional to the square of the tariff. It means that two studies assessing the impact of the same trade reform with the same model and the same data, but with different product and geographic decomposition will produce different welfare results.

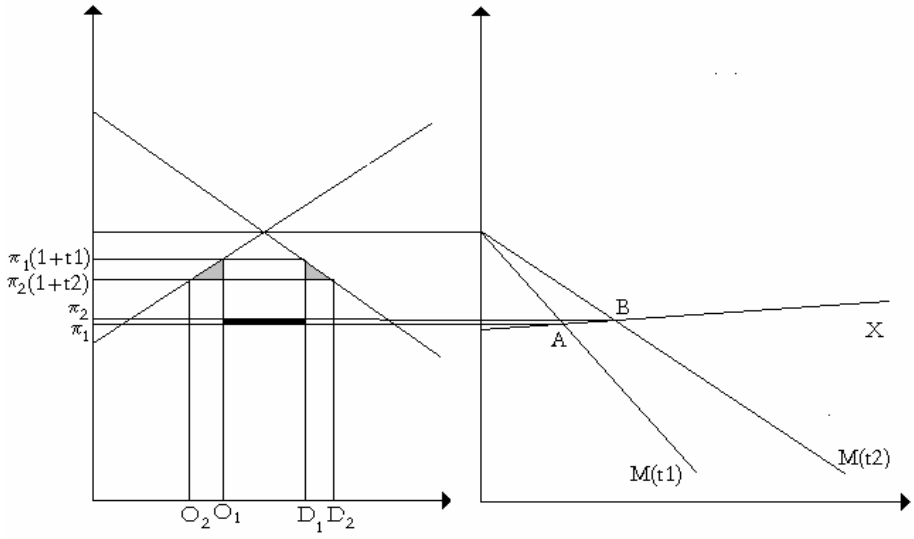
4.2.3 Behavioral parameters are not the same

Welfare effects created by liberalization depend crucially on trade elasticities (or more precisely the price elasticities of exports).

Let us consider first the case of unilateral liberalization. This is modeled in a partial equilibrium analysis in Figure 22. On the left side of the figure, domestic supply

and demand are represented. Initially, the world price is π_1 and this country imposes an *ad valorem* import duty t_1. The domestic price is therefore $\pi_1.(1+t_1)$ leading to a domestic supply 0_1 and a domestic demand D_1. This gap (D_1-0_1) creates imports, represented on the right side where initial equilibrium is in A, intersection of imports demand for a t_1 tariff - $M(t_1)$ – and export supply X.

Figure 22—A partial equilibrium representation of unilateral liberalization



Cutting import tariff implies an upwards shift in imports demand – M (t_2). The new equilibrium is in B. The net effect is evaluated by the difference between the grey area (allocative efficiency gains) and the black area in the figure (terms of trade loss – in that case this is a terms of trade loss as imports price is raised). On Figure 22, due to a very elastic export supply, the world price increases little. This is very beneficial, as the negative impact of liberalization for this country is little. Initial imports are paid by the country at a higher price: this is a loss assessed by the black area (π_2-π_1)*(D_1-0_1).

Let us consider the case of a decrease in trade elasticity. In Figure 22, if X points more vertically, domestic liberalization implies a smaller increase in imports and a higher increase in world price. Gain in domestic welfare is smaller.

So in case of unilateral liberalization, effects on welfare are twofold. First, they are caused by an increase in domestic imports which reflects that domestic production is replaced by more competitive foreign supply, and domestic consumption is profiting from lower consumption prices; simultaneously tariff revenue is modified by an increase in imports (positive effect) and a decrease of the taxation rate (negative). Second, they are a result of the change in the world price; when a commodity is imported a cut in tariff increases the world price leading to negative welfare effects. For the same change in imports, high trade elasticity implies a smaller augmentation of world price, and thus, larger welfare effects.

In case of multilateral liberalization, terms of trade effect can be obtained on exports as access to foreign markets is modified. Figure 22 shows that foreign exporters clearly get a higher price on their exports due to liberalization of the domestic economy. This is of course a positive terms of trade evolution. But, liberalization can decrease export prices: for example, if initially preferences have been granted on a market to specific countries, erosion of these preferences implies lower export prices for these initially preferred exporters due to increased competition.

Finally, at the world level, terms of trade effects are eliminating each other and welfare effects only come from elimination of domestic distortions (in a perfect competition framework). Eliminating distortions have large welfare effects when import demands are very elastic.

As a conclusion of this subsection, trade elasticities are key parameters in global trade modeling. Unfortunately, there is no consensus on their value; moreover, they vary with the level of product disaggregation. On average, the GTAP network provides relatively low trade elasticities even if recent developments have provided higher

estimation of these parameters (see Hertel, Hummels, Ivanic and Keeney, 2004). On the contrary, Harrison, Rutherford and Tarr (henceforth the HRT model, see for example Harrison, Rutherford and Tarr, 1997 and 2001) utilize much higher trade elasticities than the GTAP (see for example Tarr et alii, 2001) while LINKAGE elasticities are intermediate: on average they are 35% higher than the GTAP ones, but 75% higher in agriculture. This point is a direct and important explanation of the divergences highlighted in Annex 1 and Annex 2. Cline's study uses the HRT model and obtains, therefore, higher welfare effects from full trade liberalization. Anderson, Martin and Van der Mensbrugghe (2005a and 2005b) obtain intermediate results; using GTAP elasticities, they even demonstrate that this is the main explanation of differences in assessing welfare effects.

4.2.4 Theoretical assumptions are not the same

The final source of divergence concerns theoretical features of the model. It is nearly impossible to be exhaustive on this topic as modelers have to make numerous theoretical choices. This subsection focuses on the main theoretical assumptions in assessing the impact of trade liberalization.

Perfect vs. imperfect competition

CGEM could adopt either a perfect or imperfect competition framework, or these two features in different productive sectors. In the latter case, industry and services are very often characterized by imperfect competition while in agriculture it is perfect.

In perfect competition, there is no fixed cost and as all producers are price-takers, the equilibrium price is equal to the marginal cost of production. When competition is imperfect there is a fixed cost so that average cost is decreasing. In most models under imperfect competition products are differentiated horizontally (varieties). Two rules guide competition in such sectors: in the short/medium term, firms maximize their profits by equating marginal cost and marginal revenue; this gives birth to a mark-up inversely

related to the price – elasticity of demand and positive profits. This is a monopolistic power coming from differentiating products. Positive profits attract new firms which as a result produce new varieties (product differentiation is increasing): in the medium/long term, profits are annulled and price is equal to average cost.

Imperfect competition implies new sources of welfare gain from trade liberalization. Selling on a larger market, economies of scale are better utilized. Prices decrease. Furthermore there are more varieties in a larger market, meaning that consumers are better off. Nevertheless, imperfect competition is more difficult to model. First, when using the traditional CES (constant Elasticity of Substitution) function, price – elasticity of demand is not constant and specifications of mark-up are complex. Second, imperfect competition with horizontal product differentiation requires a lot of information, and particularly product substitutability, scale economies and competition intensity. Since these parameters are linked by the zero – profit condition in each sector, only two of these parameters are required from external source, the third one being calibrated. It nevertheless demands detailed information about the economic structure in a multi-country multi-product model. It explains why this feature is not systematically adopted in all CGEM though it is clearly more realistic.

Imperfect competition brings new sources of welfare: economies of scale which decreases prices when expanding output, and horizontal differentiation. It is generally supposed that consumers are variety – lovers and that expanded market implies more varieties.

Modeling the factor market

A key feature of CGEM is assumptions attached to the productive factor markets. In a model designed to describe short-term consequences of trade liberalization factors are often supposed to be immobile across sectors. When, conversely, the long-term consequences of openness are assessed, perfect mobility is often assumed. Outside these two options numerous assumptions are feasible: some primary factors (land, natural

resources) are naturally less mobile than others but even in this respect assumptions can differ across studies as one can suppose either complete sector immobility of land or mobility across agricultural activities.

A key issue is labor mobility: it can be supposed that labor is either perfectly mobile (only one price of labor in the entire economy) or perfectly immobile (as many wages as the number of sectors in the economy), or that there is an imperfect mobility of labor between agricultural and non agricultural activities[49], but that mobility is perfect within each activity.

Trade liberalization implies a change in relative prices of goods for an economy. Thus, it must entail a reallocation of productive factors from sectors relative prices of which are declining to sectors where their prices are increasing. In doing so, the economy is being specialized in activities where it has a comparative advantage—it increases its real income. This reallocation is all the more efficient as factors are mobile. So, studies with different assumptions on productive factor markets are giving different results on welfare and real income augmentations.

Static vs. dynamic modeling

A central feature that distinguishes CGEMs is their static vs. dynamic nature. When modeling dynamic mechanism, trade liberalization might affect income, saving and investment, and capital (or other primary factors – skilled labor, land) accumulation rate. The rate in which these factors grow can be exogenously determined, or this mechanism can be endogenously defined: the split of active population between skilled and unskilled can be determined, for example, by the ratio of real remunerations, or can be fixed by simple extrapolation. The technical progress can be accounted for; factor productivity can increase exogenously or total factor productivity can depend on specific

[49] In order to represent this imperfect immobility a Constant Elasticity of Transformation is often assumed between these different types of activities. It means that labor is allocated amongst the different activities according to the ratio of remunerations.

variables (trade openness), etc. Finally, either the dynamics can be recursive (the model is solved for different consecutive periods, the value of each variable being included as initial value of the next period) or it can be fully dynamic with inter-temporal specifications.

In a dynamic CGEM a baseline is simulated: the model is solved without any trade reform for the chosen number of periods, with accumulation of production factors. Then the trade reform is simulated: trade reform is assessed by comparison between the baseline and the simulation.

Dynamic modeling can greatly affect the way trade liberalization is assessed. First, it is a supplementary reason to compare rate of changes in welfare between several studies and not monetary amounts as the dynamic mechanism has increased the size of the world economy. Second, trade reform may have a direct effect on the accumulation of productive factors. Traditionally, investment is determined by savings. The saving rate can be fixed, in which case, investment increases when real income increases. This is a positive effect of trade reform on capital accumulation and welfare. The savings rate can otherwise be determined by the real remuneration of capital. In this case trade reform has a magnified impact on economies where this remuneration is augmented either by a specialization effect in capital – intensive sectors or by an increased profitability due to a better exploitation of scale economies. Otherwise, trade liberalization can affect the real remuneration of land and thus the land supply (LINKAGE, MIRAGE) and the ratio skilled wage/unskilled wage and thus the split of active population between skilled and unskilled labor.

A key assumption explaining divergence across studies (highlighted in Annex 11 and Annex 13) certainly comes from the relation between total factor productivity and trade openness. To recall specification adopted in the World Bank's Global Economic Prospect (2002 and 2004), in Dessus, Fukasaku and Safadi (1999), let γ^e_i be the growth in the sector's productivity due to the change in openness, E_i is exports of sector i and X_i output. The supposed relation takes the form:

$$\gamma_i^e = \chi_i^0 \left(\frac{E_i}{X_i} \right)^{\eta_i} \qquad (34)$$

χ^0_i is calibrated under a specific rule [50] and η_i is the elasticity. This relation mechanically amplifies the expected benefits of trade liberalization.

Several potential channels are supposed to operate positively on factor productivity when an economy is progressively exposed to international competition. As firms export more, they are supposed to learn new technologies through comparison with foreign competitors and improve their production process to match international standards. Moreover, firms can react to more competition by increased Research and Development (RD) which affects positively all factors' productivity.

Are these assumptions pertinent and is it reasonable to include them in global trade modeling? In fact, the previously exposed channels really make sense. Increased competition reduces X – inefficiency and might be a direct incentive to do more RD. Comparison of different production processes is a good way of improving efficiency. So trade openness should increase factor productivity. But the way in which this relation has been introduced in CGEM may be subject to criticism for several reasons.

First, equation (34) has no microeconomic foundations as opposed to all other elements in a CGEM. Microeconomic models of international trade under oligopolistic competition can imply adverse effects: for example Reitzes (1991) and Bouët (2001) demonstrate that protectionism can increase domestic Research & Development, depending on the instrument utilized (tariff vs. quota).

Second, it can be considered as an *ad hoc* element introduced in a CGEM which studies the impact of trade liberalization. Obviously, introducing a function, which is not micro - economically founded, in such an evaluation leads to increasing factor

[50] For example in the World Bank' Global Economic Prospects it is supposed that trade openness explains 40% of total factor productivity growth.

productivity with trade openness, and automatically amplifies the efficiency effect of trade openness.

Third, this *ad hoc* relation brings no conclusion on which countries, sectors or productive factors could be the first beneficiaries of trade liberalization and of a potentially positive impact on productivity. After all, if greater openness increases factor productivity, it makes sense that this relation is not as strong in all countries, in all sectors and for all factors.

A CGEM studying the impact of trade liberalization delivers plenty of information. Of course, information on world or national welfare is important, but it could be argued that this kind of evaluation is much more important when it details the impact on factor, or sector. In most cases trade liberalization is beneficial, but there are a few elements which require the attention of economists using a CGEM:

(i.) Traditionally, with models under perfect competition, expected benefits from trade liberalization are the sum of allocation efficiency gains (always positive when liberalizing) and term of trade effects. Individual countries may lose because of deterioration in their terms of trade. Thus, if a (developing) country does not eliminate its trade barriers (due to Special and Differentiated Treatment for example), but sees its terms of trade worsened (due to eroded preferences or a rise in the world prices of agricultural commodities of which the country is a net importer) it is quite normal that its welfare to decrease.

(ii.) Today, CGEM constitutes additional effects which provide a more realistic picture of liberalization — these effects can be positive or negative. Trade liberalization can increase economies of scale and available varieties. On the other hand, if liberalization implies that a country will have less activity in those sectors featured by decreasing average cost and horizontal differentiation, it means that liberalization can have a negative impact on it. The same contrasting effect from this process can be obtained when considering the impact of factor remuneration

on factor accumulation. Furthermore, when products are differentiated by originating countries (as it is specified in the Armington hypothesis) a country has a monopoly power, which implies that its optimum tariff is not zero[51].

(iii.) Finally, trade liberalization has contrasting effects on productive factors as it increases real remuneration of abundant factors while having an adverse effect for scarce factors.

These mechanisms (and their interplay) represent the most interesting relations in a CGEM. On this topic, equation (34) does not bring information as it does not include any contrasting effect or differentiated impact of trade openness on factor productivity. Furthermore, it can be sufficiently strong to offset all negative mechanisms previously quoted.

Another way of modeling dynamic effects is the Steady State version of the Harrison – Rutherford – Tarr model (see Cline, 2004). The idea is to increase the stock of capital until the rate of return is back to its pre – liberalization level. This can be justified by the following idea. In the long term firms are supposed to benefit from the new opportunities created by a much larger market so that they invest until the rate of return comes back to a normal level. This idea makes sense but, obviously, augmented capital creates more activity and increases real remuneration of all other factors. It automatically amplifies expected benefits from liberalization and the microeconomic behavior of firms is not explicitly modeled.

4.3 EVALUATING THE IMPACT OF TRADE LIBERALIZATION ON POVERTY

Evaluating the potential impact of trade liberalization on poverty has been done according to alternative methodologies.

[51] Even in this case free trade may be a Paretian optimum. It is for example Pareto superior to multilateral protection.

The first method is the one referenced in the GEP (2002 and 2004) and in Cline (2004) as it allows for world-wide assessments of impact on poverty. It estimates (or uses) a parameter known as *poverty elasticity*. For example, the World Bank assessments utilize results from the CGEM to calculate an index representative of the poor people' real income; it is the remuneration of unskilled labor deflated by a consumption price index composed by food products and clothing. At the world level, the same elasticity is applied to calculate the impact on poverty headcount.

For example, the Global Economic Prospects 2002 evaluated that full trade liberalization would imply an increase of x=8.4% in the real wage of unskilled labor in Sub – Saharan Africa. As the poverty elasticity is -2, the report concluded that the poverty headcount in this region would decrease by 16.8%=-2x% if full trade liberalization was applied.

This framework can only approximate the relation existing between trade liberalization and poverty:

i) Income of poor people is affected not only by remuneration of unskilled labor, but also by remuneration of skilled labor, capital, land, natural resources, and transfers.

ii) Applying the same elasticity at the world level is questionable. The relation between trade reform and poverty depends on the distribution of income amongst the population, the source of income at different levels of income, the reaction of economic agents to trade shocks, and so forth. Each of these relations is country – specific. This criticism has been taken into account by the World Bank which is now using country – specific poverty elasticity to assess the impact. It explains partially why recent assessment by Anderson, Martin and Van der Mensbrugghe (2005) is less optimistic in terms of poverty alleviation (see 0).

iii) As variation in the real wage of unskilled labor is calculated for every trading region of the CGEM, these regions have to be defined carefully so that they are homogenous as far as this relation is concerned.

Furthermore, applying the poverty elasticity gives the impression that the relation between trade openness and poverty alleviation is mechanical. According to this scheme, once liberalization is implemented, an increase in the real remuneration of unskilled labor occurs and poverty is reduced to an extent which depends only on the strength of the shock.

Evidently, this is not the case. Trade openness has contrasting distributive effects[52]. Traditionally, it increases real remuneration of unskilled labor in developing countries as their endowment of this factor is abundant. But other components of poor people's income can be negatively affected, particularly transfers due to shrinking tariff receipts. Furthermore, factors are not, especially in the short term, perfectly mobile across sectors. For example, unskilled labor can be imperfectly (or not at all) mobile between agricultural and non agricultural activities. It gives birth to different remuneration of unskilled labor in a developing country. In this case, trade liberalization may have adverse effects on unskilled labor depending on the sector where it is utilized. For example, Cororaton and Cockburn (2004) demonstrate that opening Philippines to world competition can be beneficial to urban poor households and harmful for rural poor households.

Finally, stating that x million of people are lifted out of poverty could be understood as a quantitative and qualitative statement. For the latter, the end of poverty might mean a profound change in the way of life. Even if the construction of statistical indicators needs definition of arbitrary thresholds, the reader has to keep in mind that this

[52] This is a well-known and traditional result as it has been firstly demonstrated by Wolfgang Stolper and Paul Samuelson in 1941. It obviously proves that everybody is not better off after full implementation of trade liberalization unless corrective distributive measures are applied.

qualitative aspect might be neglected for people whose income just passes over this threshold.

Cline (2004) utilizes a marginally improved methodology aimed at evaluating country – specific poverty elasticities. He supposes that:

- In all developing countries the income distribution is log – normal.
- Full trade liberalization implies economic growth which is neutral from the point of view of the income distribution: it changes the average income but it has no effect on income dispersion.
- Poor people' income is composed of 90% remuneration of unskilled labor and 10% transfers.
- The evolution of transfers is strictly parallel to the evolution of domestic welfare.
- Poor people have the same consumption basket as total population.

The first two hypotheses imply that the share of poor people in a population can be expressed as a function of the ratio of poor people's income on the average income and of the dispersion parameter (which is constant). The three last assumptions provide an expression of this ratio.

It is important to note that economic growth changes income inequality[53], and poor people's income is also affected by change in the remuneration of capital, land, natural resources, and skilled labor. Furthermore, there is no systematic reason to think that evolution of transfers is parallel to the evolution of national welfare, and consumption baskets depend on income levels: assumptions (iv) and (v) are not justified. Finally, like for the GEP, Cline's method also offers a picture of a mechanical relation between trade openness and poverty.

[53] A famous empirical demonstration of this point is the Kuznets curve (1955).

The steady state model used by Cline (2004) automatically amplifies the impact of trade liberalization on poverty. As capital is raised, real remuneration of all other productive factors is simultaneously augmented and in particular the unskilled labor's wage. Given that unskilled labor's wage represents 90% of poor people's income, the effect on poverty in this case is greatly reinforced.

There are other ways in which CGEM can be utilized to study the relationship between trade liberalization and poverty. Traditionally, in order to obtain information on final consumption, CGEM studied the behavior of a single household. Household disaggregation allows for studying how income distribution is affected by (trade) reform. The simplest way to do this is to model the behavior of several households featured by an exogenous variable: Kahn (1997) prioritizes a rural/urban distinction while Hertel, Ivanic Preckel, and Cranfield (2001) emphasize the main source of income (unskilled labor, skilled labor, capital). Traditionally, the number of households is limited, from 10 (Levin, 2000) to 24 (Devarajan and Van der Mensbrugghe, 2000) and a distribution of income for each representative household is postulated. The mean and total income of a household group is explained by the model, while dispersion is supposed to be constant. The adopted distribution functions are usually the lognormal or the Paretian distributions even if they received little empirical value.

Recent developments have prioritized two dimensions:

- Thousands of households may be introduced in a CGEM (Cogneau and Robilliard, 2000; Cockburn, 2001; Cororaton and Cockburn, 2005). This allows keeping all information from household surveys and preventing theoretical simplification as constant within - group income dispersion. But CGE - microsimulation is often done at the cost of other simplifications — like a reduced number of sectors.
- Hertel, Preckel, Cranfield and Ivanic (2001) utilize results coming from a multi – country CGEM on commodity and factor prices to feed a post – simulation

framework, which keeps all the information on income levels and simulates the demand response to the change in prices and incomes. These simulation techniques are very useful as they account for a multi – sector, multi – factor framework where agents' reaction to reform is simulated and general equilibrium effect is taken into account. Furthermore, a policy study can be designed to describe the conditions under which losers can be compensated (see for example, Harrison, Rutherford and Tarr, 2001).

These studies show that trade liberalization might have a positive effect on national welfare while entailing a contrasting impact on agents. Trade liberalization might alleviate poverty, but in several cases it increases it. Hertel, Ivanic, Preckel and Cranfield (2001), for example, show that if multilateral trade liberalization decreases poverty in several developing countries, it has the opposite effect in Brazil, Chile, and Thailand. Unfortunately, they cannot provide a world-wide estimation of the impact of full trade liberalization on poverty, unless results are extrapolated across developing countries.

Thus, four explanations of divergences on how trade liberalization increases world real income have been presented. Pre experiments are now systematically integrated and the measurement of market access accounts for preferential schemes and regional agreements. Two methodological choices ―sources of major divergence― remain: the level of Armington elasticities and the integration of a dynamic relationship between trade openness and total factor productivity. There may be other sources of divergence, but with a smaller impact. In order to test the previous explanations on diverging results, a sensitivity analysis is carried out using the CGEM framework of section 3.

4.4 A SENSITIVITY ANALYSIS

This section tests the plausibility of the four rationales presented in this paper to explain why literature on the impact of trade liberalization produces divergent

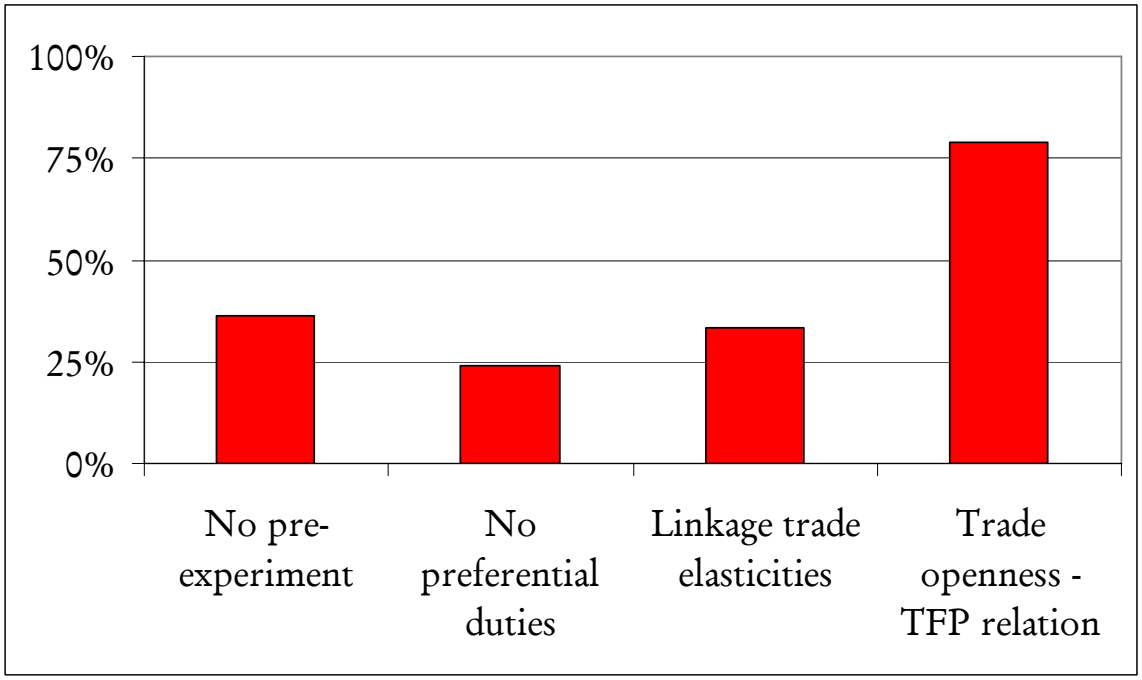
conclusions. These rationales have already been discussed in detail and they are: (i) experiments are not the same; (ii) data are not the same; (iii) behavioral parameters are not the same; and (iv) theoretical features are not the same. To test these rationales, the section provides new simulations of full trade liberalization, each time with one included modification.

Figure 23 gives the main conclusion of this section. The central experiment, as simulated in the previous section, concluded that full trade liberalization would entail a 0.33% increase in world real income. If the pre – experiment had not been accounted for (that is to say, if the trade liberalization that occurred from 2001 to 2005 had not been taken into account before testing the impact of full trade liberalization), this rate of change would have been raised by 36%. The utilization of LINKAGE trade elasticities would have given about the same results (+33%). If the simulations were based on a database with no preferential schemes, the result would have suggested a 24% higher increase in the world welfare. Finally, including a positive relation between trade openness and total factor productivity would have given a rate of change in the world welfare 79% higher.

Though other theoretical features (exogenous or endogenous land supply, imperfect or perfect competition) or empirical choices (different database on distortions, different product and sector disaggregations) may also have an impact, these four explanations obviously play a major role.

Annexes 12 to 19 contain detailed information about the results obtained through these alternative simulations

Figure 23— Why do global trade models differ so much? The rate of change in the world welfare as compared to the central experiment



Source: author's calculation.

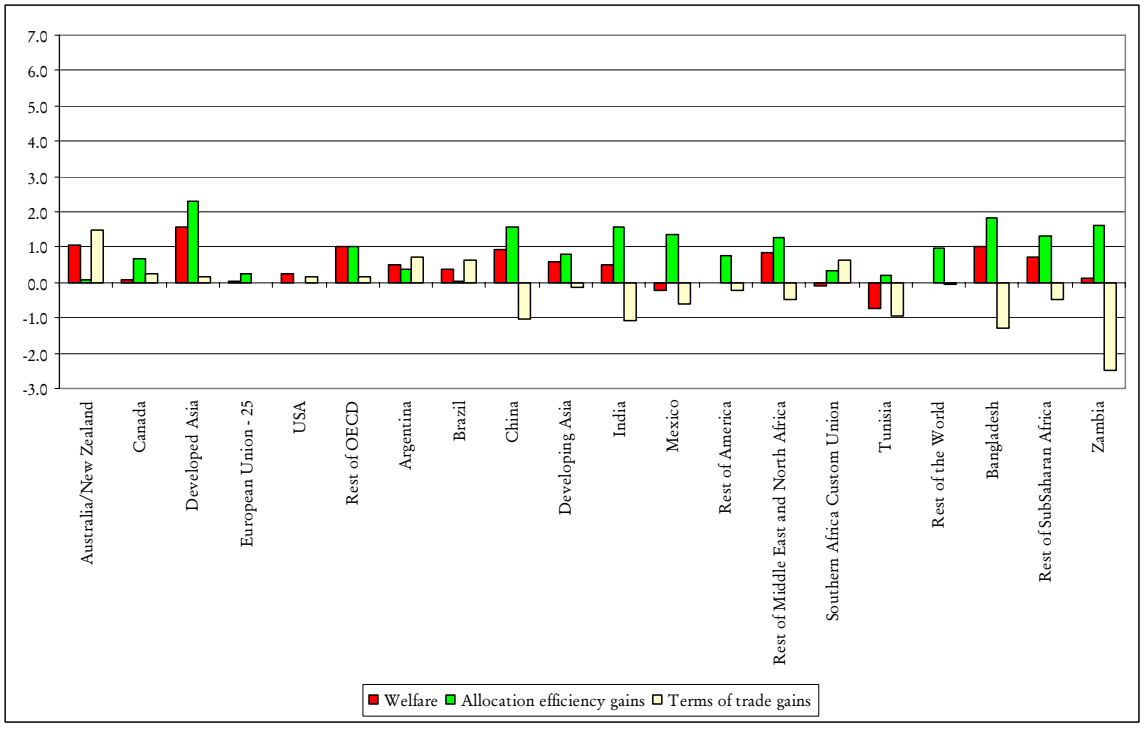
4.4.1 Different experiments: no pre-experiment

If a pre-experiment had not been implemented in the central experiment, the result would have been a 0.45% augmentation in world real income. Figure 24 highlights the welfare gains/losses by region. The broad picture is unchanged; nevertheless, taking into account the end of the Uruguay Round raises allocation efficiency gains in numerous countries (Canada, Argentina, India). The main difference comes from China's WTO accession, which implies a significant cut in Chinese protection and large allocation efficiency gains (+1.6% instead of 0.8%). Furthermore, the end of the Multi-Fibre Arrangement opens access to European, American, and Canadian markets. It entails a reduction in export prices for countries which were beneficiaries of preferential access in the textile / apparel sectors; this phenomenon is significant for Tunisia where the deterioration in terms of trade is 1% instead of 0.4%.

As the reduction in tariff protection is larger, the increase in world agricultural prices is higher. This causes more contrasting variations in terms of trade, with larger gains some (Australia/New Zealand, Argentina, Brazil) and larger losses for others (India, Zambia).

The central experiment shows a clear increase in unskilled labor remuneration in numerous developing countries (which is in favor of poverty alleviation). It is confirmed, even enhanced for Argentina, Brazil, SACU and the rest of Sub – Saharan Africa; in the case of Zambia, Bangladesh and especially Tunisia, the change in this factor's remuneration is less favorable.

Figure 24—Welfare gains by region (%) – Full trade liberalization from 2001



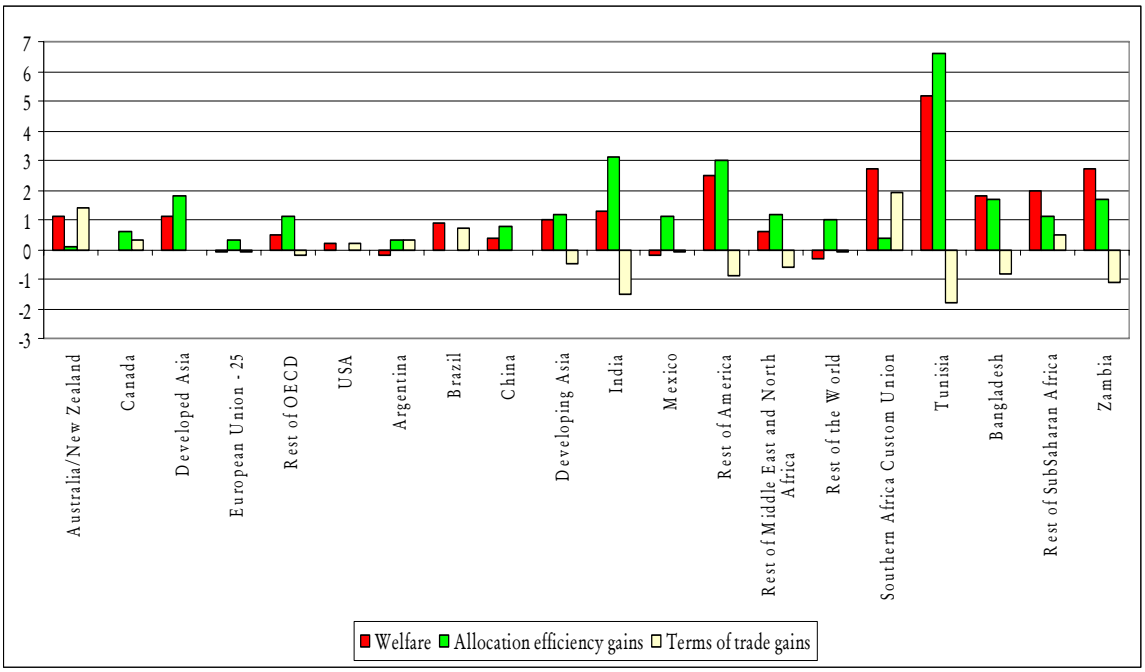
Source: author's calculation.

4.4.2 Different data: MFN vs. preferential duties

The second sensitivity analysis measures the extent to which the complete inclusion of preferential schemes modifies expected benefits. In order to study this element, tariffs are changed in the initial database so that non-reciprocal preferences given by USA, Europe, Developed Asia, Canada and the rest of OECD to developing countries are withdrawn. In other words, only regional agreements and MFN tariffs are kept.

As it was expected, positive impact on world welfare is bolstered up (from +0.33% to 0.41%). Developing countries are the main beneficiaries (see Figure 25). This gain is large in the case of Tunisia (which has a preferential access on the European market in industry) and Sub – Saharan Africa (SACU and Zambia included.)

Figure 25— Welfare gains by region (%) – Full trade liberalization without non-reciprocal preferential schemes



Source: author's calculation.

Why? As previously explained, eroded preferences mean deterioration in terms of trade. On the contrary, in the absence of preferences these countries profit from terms of trade gains or reduced deterioration (see the cases of Brazil, Mexico, SACU, Bangladesh, the rest of Sub – Saharan Africa zone and Zambia by comparing Table 5 and Annex Table 16.2 in Annex 16.)

In the case of Tunisia, allocation efficiency gains and welfare increase are much larger. When the Euro–Mediterranean partnership is not taken into account full liberalization entails a significant increase in textile and clothing/apparel exports to Europe. Reallocation of productive factors is needed in order to carry out this augmented industrial production, while the real exchange rate is appreciated. Domestic agricultural liberalization completes this picture and increases in domestic agro – food imports are much larger than in the case of the central experiment. This means more allocation efficiency gains for the same tariff elimination[54]. Furthermore, the Tunisian economy experiments more specialization in industry, that is to say more economies of scale and more varieties.

When accounting for the impact on factor remuneration similar conclusions emerge. Starting from an initial world, without any non reciprocal preferences, the impact on unskilled labor would be more positive in numerous developing countries (especially Sub – Saharan African countries, but also India and Bangladesh). But supplementary gains might be captured by capital and skilled labor (Brazil, Tunisia.) It is noteworthy that in the case of Tunisia, specialization of its economy in industrial activity has contrasting effects on unskilled labor remuneration and is susceptible to alleviate urban poverty while increasing rural poverty.

The only developing countries which now lose from full trade liberalization are Argentina — due to over-specialization in agriculture — and Mexico whose preferential access to USA is still eroded (NAFTA is a reciprocal agreement.)

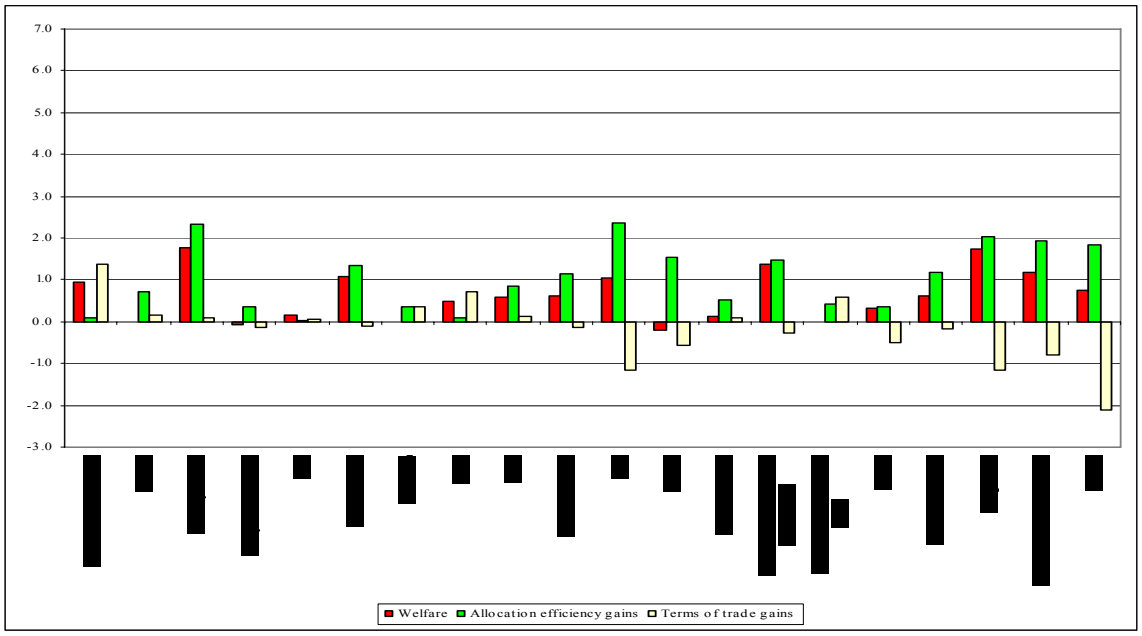
[54] Allocation efficiency gains are proportional to the tariff and the variation in imports.

Preferential duties are partially utilized. That is the reason why this scenario represents an overstatement of the impact of full liberalization on trade and expected benefits in terms of real income. On the contrary, the central experiment understates the same impact. This supplementary world real income would mainly benefit poor countries.

4.4.3 Different behavioral parameters: trade elasticities

The utilization of Linkage trade elasticities, instead of GTAP elasticities has a very positive impact on trade (see Figure 26): for example, international trade of agricultural products is augmented by 57% with Linkage, instead of 34% with GTAP trade elasticities. Consequently, the rate of increase in world welfare is 0.44% vs. 0.33% in the central experiment (world welfare gains depend directly on trade increase).

Figure 26—Welfare gains by region (%) – Full trade liberalization with Linkage trade elasticities



Source: author's calculation.

Is this beneficial for developing countries? Yes, as all developing zones benefits from a higher welfare gain except Tunisia, the welfare of which increases by 0.3%, instead of 0.4%. The gain is impressive for the rest of Sub Saharan Africa and rest of Middle East and North Africa zones, and for Zambia.

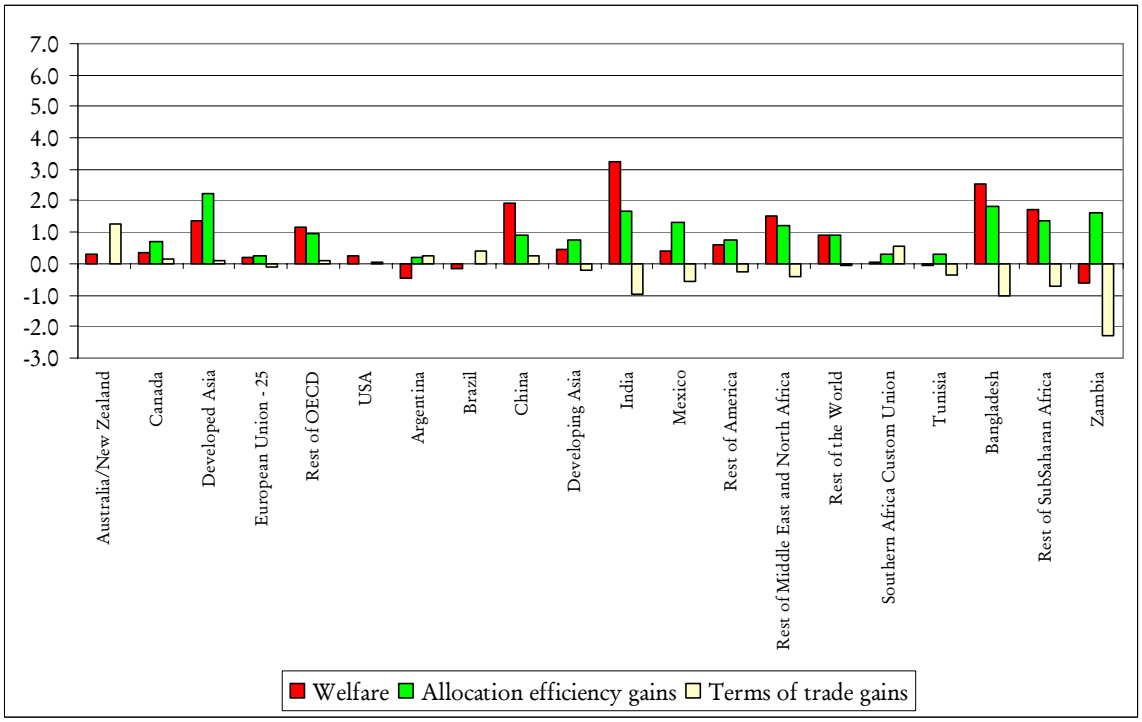
4.4.4 Different modeling features: if trade increases global factor productivity…

As discussed in section 3, trade openness may have a positive impact on total factor productivity. This relation can be presented in a simplistic way in a computable general equilibrium model. Equation (34) is used in this case, which links directly total factor productivity in a sector to the ratio between sector exports and sector output. This is implemented in the MIRAGE model in all sectors and all countries. The constant elasticity is fixed at 0.055 which is comparable to the LINKAGE's elasticity, but inferior to the one adopted by Dessus et al (1999). This relation is equally applied to all sectors, agriculture included: Martin and Mitra (2001) show that this relation is even higher in agriculture.

With this relation between trade openness and total factor productivity, expected benefits of full trade liberalization are much amplified, even more than those resulting from the other three sensitivity analyses. The gain in world welfare is now +0.59%, which represents an augmentation by nearly 80% as compared to the central experiment.

The issue remains on how liberalization benefits are distributed. When compared to the central experiment, the welfare change is smaller for Australia/New Zealand, Brazil and Argentina (the loss is larger in the Argentinean case while Brazil has a small loss instead of a small gain) while China, India, Bangladesh, Rest of Sub Saharan Africa, and Mexico are supporting a higher rate of growth (see Figure 27).

Figure 27—Welfare gains by region (%) – Full trade liberalization under a positive relation between trade openness and total factor productivity



Source: author's calculation.

In this matter agricultural countries could clearly be distinguished from industrial countries. Agricultural specialization is costly due to absence of economies of scale and horizontal differentiation in this sector. The positive relation linking openness and factor productivity amplifies the opportunity cost. In these three agricultural countries, under full trade liberalization, the ratio exports on output calculated at the sector level, increases more in agricultural sectors, thus amplifying the country specialization in this activity due to increased factor productivity and higher competitiveness. The global disengagement of these economies from industry is more pronounced and the opportunity cost in terms of economies of scale and varieties is higher. The opposite process works in countries comparative advantage of which is in industry: it explains higher welfare gains for China, India, Bangladesh and Rest of Sub – Saharan Africa.

The impact on factor remunerations is described in Annex Table 18.3. The liberalization effects are amplified, especially on unskilled labor in the four previously mentioned countries. The impact on industrial unskilled labor in China and India is now high, so that consequences on world poverty can be significant.

4.4.5 Different modeling features

As a multi-country multi-sector trade model requires numerous theoretical choices, this sensitivity analysis might be extended much further. We limit this extension, however, to three theoretical variations.

The first one is implementing perfect competition in industry and services instead of an imperfect one; the second, eliminates the North/South distinction in the model, that is to say the vertical differentiation; the third, assumes perfect mobility of unskilled labor between agricultural and industrial activities.

While the last two sensitivity analyses do not change the picture, the assumption of a perfect competition increases substantially the rate of change in world welfare (from 0.33% up to 0.44%). Furthermore, the distribution of the cake is modified.

In fact, under imperfect competition in industry and services, the world real income appears to move upward for 10 years, both under the baseline scenario and under full trade liberalization. Perfect competition in the baseline scenario, however, pulls down to a larger extent the world economy's path as it is more specialized in industry. On the contrary, adopting full trade liberalization implies more productive factors in the agricultural activity at the worldwide level as initially this activity is more protected. Therefore, the opportunity cost of perfect competition in all sectors is smaller.

As far as the distribution of welfare gains amongst countries/zones is concerned, the picture is fairly unchanged under the last two simulations. This is not the case under perfect competition. As expected, the change in the theoretical features of the model implies more welfare gains for countries with an initial comparative advantage in

agriculture (Australia/New Zealand, Argentina, Brazil, SACU, Rest of America) and less welfare gains for countries specializing in industry (China, India, Tunisia, Bangladesh).

In the case of Canada, Mexico, and Rest of Sub - Saharan Africa, eroded preferences contribute to a contraction of activity both in the agricultural and industrial activities, which were particularly negative in case of imperfect competition. Therefore, when competition is perfect, the erosion of preferences entails less negative consequences.

Table 12—World welfare gains by region (%) – Full trade liberalization under different theoretical variations

	Perfect competition	No vertical differentiation	Perfect labor mobility
World	**0.44**	**0.31**	**0.33**
Australia/New Zealand	1.4	0.8	0.7
Canada	0.0	0.0	-0.1
Developed Asia	1.4	1.4	1.5
European Union - 25	0.1	-0.1	-0.1
Rest of OECD	0.8	1.1	1.1
USA	0.2	0.1	0.1
Argentina	1.0	-0.3	-0.2
Brazil	0.9	0.1	0.1
China	-0.2	0.8	0.7
Developing Asia	0.5	0.3	0.4
India	0.4	0.6	0.7
Mexico	0.3	-0.4	-0.3
Rest of America	0.6	-0.1	0.0
Rest of Middle East and North Africa	0.7	0.9	1.0
Rest of the World	1.1	0.0	0.2
Southern Africa Custom Union	0.5	-0.2	-0.3
Tunisia	0.1	0.4	0.4
Bangladesh	1.3	1.5	1.6
Rest of SubSaharan Africa	0.9	0.6	0.7
Zambia	-1.2	0.5	0.4

Source: author's calculation.

5. CONCLUSION

Recent studies have noted lower expectations regarding the potential impact of trade liberalization on poverty reduction. This is due to improved assessments of existing trade distortions. Regional agreements, preferential schemes and recent policy changes in trade and agricultural policies make for a more globalized world than it was previously thought. Furthermore, lesser benefits stemming from a potential Doha Development Agenda are expected, as assessments take into account the interplay between bound and applied distortions (on tariffs and domestic support).

Nevertheless expected effects from trade liberalization are positive. Our assessment concludes on a $100bln world welfare gain, mainly as a result of elimination of agricultural distortions. This welfare gain could be amplified up to 80% if openness increases factor productivity. At the same time, liberalization should generally contribute to poverty alleviation as remuneration of unskilled labor is expected to rise in numerous developing countries, especially in South America, Sub-Saharan Africa, and Developing Asia. Finally, liberalization could only marginally reduce world inequality.

There are always winners and losers from trade liberalization. In some countries (Mexico, Zambia), poverty may increase as liberalization leads to decreased remuneration of unskilled labor. This is not an uncommon impact as several studies (see Hertel, Ivanic, Preckel, and Cranfield, 2000) have already obtained such results.

This assessment, however, underestimates the positive impact of trade liberalization on world welfare for two reasons:

- It does not include liberalization in services.
- It does not include trade facilitation and elimination of some non tariff barriers (technical, sanitary and phyto-sanitary norms).

One of the major objectives of this study was also to explain divergent results in the literature. The first explanation comes from different assessments of the current level

of trade distortions: it is now widely recognized that these assessments have to take into account preferential schemes and regional agreements. This implies that assessments have now converged, but not fully.

Today, the main source of divergences is the level of trade elasticities and the implementation of dynamic relations. There is no consensus yet on the impact of behavioral parameters. Moreover, the link between openness and factor productivity might be strong, but it is not fully understood and precisely estimated.

To understand the impact of non tariff barriers or the nature of dynamic relation, shortcuts are possible: one can evaluate the impact of trade facilitation by assuming that border controls and administrative rules are equivalent to an x% tariff. One can, also suppose that trade openness increases global factor productivity. These options automatically amplify expected benefits from trade liberalization, but they do not improve the understanding of the impact of globalization. Furthermore, there may appear benefits from liberalization in areas or activities where they do not exist. For example, implementing a positive relation between trade openness and global factor productivity could generate very positive results in all developing countries while the intensity is questionable in certain Least Developed Countries. In addition, trade openness may have much greater effects on capital and skilled labor productivity than on unskilled labor; if this is the case, the introduction of this relation could introduce a systematic bias in the assessment of the impact of trade liberalization on poverty.

It could be argued that all CGE models are structurally identical (these are Walrassian models), and that their duplication is not necessary. From methodological conclusions outlined here, however, (convergence on market access data and divergence on trade elasticities, dynamic relations, understanding of trade in services, and non tariff barriers), it appears that on the contrary, CGE models have to remain competitive. If knowledge on market access recently increased, it was due to competition between research teams. In this respect, one can expect future progress in understanding of dynamic relations, trade in services, the impact of non tariff barriers, and so forth.

The MIRAGE model has shown some real advantages in modeling of international trade: it is a very tractable model as sensitivity analysis is easy to implement; it proposes original features like vertical differentiation of products and foreign direct investment; it is founded on econometrically justified levels of Armington elasticities and micro - economically based relations. Consequently, MIRAGE provides realistic assessments of benefits from trade liberalization so that it is a credible and renowned analytical instrument.

Furthermore, the International Food Policy Research Institute (IFPRI) has a role to play providing consistent analysis of international trade and trade negotiations and agreements. As a non lending institution, its role could appear especially credible for developing countries. Multi country general equilibrium models are only one analytical instrument, particularly appropriate for assessing the impact of multilateral or regional agreements on trade flows and macroeconomic variables. A complete evaluation of benefits of trade reform for developing countries requires the addition of other instruments like single country trade models, partial equilibrium analysis, gravity equation, etc. These are complementary tools, not substitutes —IFPRI also needs to develop an expertise in these fields.

In terms of policy recommendations, trade reform must be very ambitious to be welfare improving and to have a positive impact on development. The Doha Agenda will not entail an implementation of full trade liberalization. On the contrary, it will lead to a more or less ambitious package; recent assessments of trade liberalization scenarios by CGEM have been successful in showing that "*devil could be in the details*." Several policy recommendations emerge clearly from these studies:

- Tariff cuts have to be large and "progressive" (higher rates of reduction on higher tariffs). On the tariff issue, a sensitive products clause could have very negative consequences on the extent of liberalization even if it concerns a limited number of products. Furthermore, implementing a cap on tariffs, even at a relatively high level (200%) could be a measure fostering liberalization.

- Agriculture is the main area where distortions have to be reduced.
- Developing countries have to liberalize their own economy. On this topic the Special and Differentiated Treatment that WTO offers, gives them flexibility, but it may have negative consequences on these countries.

From this modeling exercise and from recent studies in the literature, expected benefits from trade liberalization are surprisingly low. The Asian miracle, Chile's experience, Chinese and Indian liberalization all brought high growth rates per year while CGEM concludes on a less than 3% increase in total real income. It could mean either that dynamic gains are not well captured by global trade modeling or that these gains come from the domestic reform accompanying trade liberalization. Nevertheless, it implies that the relationship between trade and domestic reforms is not well understood.

Thus, CGEMs are providing a better way to understand the impact of trade liberalization. This study can also be useful in defining a research agenda. Four priorities are clearly presented and are aimed at:

- A better understanding and inclusion of non tariffs barriers, administrative controls, and lack of infrastructure.
- A better understanding of dynamic relations and the way in which trade liberalization affects factor productivity and capital accumulation.
- Knowledge of the nature and the exact content of domestic reforms which could amplify expected benefits from trade liberalization.
- A detailed examination of the link between trade and poverty.

The fourth priority has been the object of important progress in the recent years. This is all the more positive as poverty alleviation remains the ultimate objective of this debate.

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Annex 1 —Arable land per person (rural population)

Country Name	2002	Country Name	2002
Australia	2.46	Lao PDR	0.17
Canada	1.46	Saudi Arabia	0.16
Kazakhstan	1.45	Swaziland	0.16
Argentina	0.92	Armenia	0.16
Russian Federation	0.86	Honduras	0.16
Lithuania	0.84	Georgia	0.15
Latvia	0.78	India	0.15
Ukraine	0.67	St. Kitts and Nevis	0.15
Guyana	0.63	Tajikistan	0.15
United States	0.61	Pakistan	0.15
Belarus	0.56	Ethiopia	0.15
Paraguay	0.55	Kenya	0.15
Togo	0.53	Vanuatu	0.15
Zambia	0.51	Italy	0.14
Central African Republic	0.51	Germany	0.14
Sudan	0.50	Burundi	0.14
Mongolia	0.49	Peru	0.14
Hungary	0.45	Rwanda	0.14
Estonia	0.45	Comoros	0.14
Moldova	0.43	Nepal	0.13
Chad	0.43	Suriname	0.13
Romania	0.43	Congo, Dem. Rep.	0.13
Bulgaria	0.43	Dominican Republic	0.13
Denmark	0.42	Chile	0.13
Finland	0.42	Ecuador	0.13
Serbia and Montenegro	0.42	Eritrea	0.12
Namibia	0.41	Guinea	0.12
Mali	0.41	Liberia	0.12
Niger	0.39	Tanzania	0.11
Benin	0.39	Guatemala	0.11
Uruguay	0.39	Somalia	0.11
Turkmenistan	0.39	China	0.11
New Zealand	0.38	Korea, Dem. Rep.	0.11
Cameroon	0.38	Antigua and Barbuda	0.10
Turkey	0.37	El Salvador	0.10
Burkina Faso	0.37	Sierra Leone	0.10
Poland	0.36	United Kingdom	0.10
Nicaragua	0.36	Indonesia	0.10
Samoa	0.34	Venezuela, RB	0.10
Brazil	0.34	Haiti	0.09
Spain	0.34	Cyprus	0.09
Bolivia	0.34	Cape Verde	0.09
Libya	0.33	Slovenia	0.08
Croatia	0.33	Timor-Leste	0.08
South Africa	0.33	Vietnam	0.08
France	0.31	Yemen, Rep.	0.08
Czech Republic	0.30	Mauritius	0.08
Sweden	0.30	Malaysia	0.07
Ireland	0.29	Philippines	0.07
Tunisia	0.28	Dominica	0.07
Morocco	0.28	Jamaica	0.07
Afghanistan	0.28	St. Vincent and the Grenadines	0.06
Cambodia	0.28	Barbados	0.06
Macedonia, FYR	0.28	Bangladesh	0.06
Syrian Arab Republic	0.27	Trinidad and Tobago	0.06
Equatorial Guinea	0.27	Costa Rica	0.06
Kyrgyz Republic	0.27	Jordan	0.06
Belize	0.26	Netherlands	0.06
Thailand	0.26	Switzerland	0.06
Zimbabwe	0.25	Colombia	0.05
Gabon	0.25	Congo, Rep.	0.05
Greece	0.25	Israel	0.05
Mexico	0.25	Sri Lanka	0.05
Senegal	0.25	Sao Tome and Principe	0.05
Algeria	0.24	Egypt, Arab Rep.	0.04
Fiji	0.24	Papua New Guinea	0.04
Bosnia and Herzegovina	0.24	Solomon Islands	0.04
Iraq	0.24	Lebanon	0.04
Cuba	0.24	Netherlands Antilles	0.04
Iran, Islamic Rep.	0.23	Virgin Islands (U.S.)	0.04
Angola	0.23	Korea, Rep.	0.04
Mozambique	0.23	Japan	0.03
Nigeria	0.23	Guam	0.03
Azerbaijan	0.22	Qatar	0.03
Botswana	0.22	Brunei	0.03
Malawi	0.21	Bahamas, The	0.03
Guinea-Bissau	0.21	St. Lucia	0.03
Uganda	0.21	Iceland	0.02
Ghana	0.21	New Caledonia	0.02
Myanmar	0.20	Malta	0.02
Portugal	0.19	Kiribati	0.02
Norway	0.19	United Arab Emirates	0.02
Cote d'Ivoire	0.19	Grenada	0.02
Panama	0.19	Bermuda	0.02
Lesotho	0.19	Oman	0.01
Albania	0.18	Maldives	0.01
Gambia, The	0.18	French Polynesia	0.01
Madagascar	0.18	Seychelles	0.01
Uzbekistan	0.18	Puerto Rico	0.01
Mauritania	0.18	Kuwait	0.01
Austria	0.17	Bahrain	0.00
Bhutan	0.17	Djibouti	0.00
Tonga	0.17	Singapore	0.00

Source: World Development Indicators, 2003.

Annex 2 —Correspondence tables

CORRESPONDANCE TABLE - Sector		
GTAP code	**Label**	**Aggregation c**
pdr	Paddy rice	Otag
wht	Wheat	Whet
gro	Cereal grains nec	Otag
v_f	Vegetables. fruit. nuts	VgFr
osd	Oil seeds	Otag
c_b	Sugar cane. sugar beet	Otag
pfb	Plant-based fibers	Plfb
ocr	Crops nec	Otag
ctl	Cattle.sheep.goats.horses	Meat
oap	Animal products nec	Meat
rmk	Raw milk	Otag
wol	Wool. silk-worm cocoons	Oprm
frs	Forestry	Oprm
fsh	Fishing	Oprm
coa	Coal	Oprm
oil	Oil	Oprm
gas	Gas	Oprm
omn	Minerals nec	Oprm
cmt	Meat: cattle.sheep.goats.horse	Meat
omt	Meat products nec	OtFP
vol	Vegetable oils and fats	OtFP
mil	Dairy products	Milk
pcr	Processed rice	Rice
sgr	Sugar	Sugr
ofd	Food products nec	OtFP
b_t	Beverages and tobacco products	OtFP
tex	Textiles	Text
wap	Wearing apparel	Weap
lea	Leather products	Weap
lum	Wood products	Omnf
ppp	Paper products. publishing	Omnf
p_c	Petroleum. coal products	Mich
crp	Chemical.rubber.plastic prods	Mich
nmm	Mineral products nec	Mich
i_s	Ferrous metals	Mich
nfm	Metals nec	Mich
fmp	Metal products	Mich
mvh	Motor vehicles and parts	Veeq
otn	Transport equipment nec	Veeq
ele	Electronic equipment	Veeq
ome	Machinery and equipment nec	Veeq
omf	Manufactures nec	Omnf
ely	Electricity	Omnf
gdt	Gas manufacture. distribution	Omnf
wtr	Water	OtSr
cns	Construction	OtSr
trd	Trade	TrT
otp	Transport nec	TrT
wtp	Sea transport	TrT
atp	Air transport	TrT
cmn	Communication	OtSr
ofi	Financial services nec	OtSr
isr	Insurance	OtSr
obs	Business services nec	OtSr
ros	Recreation and other services	OtSr
osg	PubAdmin/Defence/Health/Educat	OtSr
dwe	Dwellings	OtSr

GTAP code	Label	Aggregation c
aus	Australia	AUNZ
nzl	New Zealand	AUNZ
xoc	Rest of Oceani	RofW
chn	China	Chin
hkg	Hong Kong	DvdA
jpn	Japan	DvdA
kor	Korea	DvdA
twn	Taiwan	DvdA
xea	Rest of East As	DvgA
idn	Indonesia	DvgA
mys	Malaysia	DvgA
phl	Philippines	DvgA
sgp	Singapore	DvgA
tha	Thailand	DvgA
vnm	Vietnam	DvgA
xse	Rest of Southe	DvgA
bgd	Bangladesh	Bgld
ind	India	Indi
lka	Sri Lanka	DvgA
xsa	Rest of South A	DvgA
can	Canada	Cana
usa	United States	USAm
mex	Mexico	Mexi
xna	Rest of North	Rame
col	Colombia	Rame
per	Peru	Rame
ven	Venezuela	Rame
xap	Rest of Andear	Rame
arg	Argentina	Arge
bra	Brazil	Braz
chl	Chile	Rame
ury	Uruguay	Rame
xsm	Rest of South A	Rame
xca	Central Ameri	Rame
xfa	Rest of FTAA	Rame
xcb	Rest of the Car	Rame
aut	Austria	EU25
bel	Belgium	EU25
dnk	Denmark	EU25
fin	Finland	EU25
fra	France	EU25
deu	Germany	EU25
gbr	United Kingdo	EU25
grc	Greece	EU25
irl	Ireland	EU25
ita	Italy	EU25
lux	Luxembourg	EU25
nld	Netherlands	EU25
prt	Portugal	EU25
esp	Spain	EU25
swe	Sweden	EU25
che	Switzerland	Roec
xef	Rest of EFTA	Roec
xer	Rest of Europe	Roec
alb	Albania	RofW
bgr	Bulgaria	RofW
hrv	Croatia	RofW
cyp	Cyprus	EU25
cze	Czech Republi	EU25
hun	Hungary	EU25
mlt	Malta	EU25
pol	Poland	EU25
rom	Romania	RofW
svk	Slovakia	EU25
svn	Slovenia	EU25
est	Estonia	EU25
lva	Latvia	EU25
ltu	Lithuania	EU25
rus	Russian Federa	RofW
xsu	Rest of Former	RofW
tur	Turkey	Rmen
xme	Rest of Middle	Rmen
mar	Morocco	Rmen
tun	Tunisia	Tuni
xnf	Rest of North	Rmen
bwa	Botswana	RSSA
zaf	South Africa	SACU
xsc	Rest of South A	SACU
mwi	Malawi	RofW
moz	Mozambique	RSSA
tza	Tanzania	RSSA
zmb	Zambia	Zamb
zwe	Zimbabwe	RSSA
xsd	Rest of SADC	RSSA
mdg	Madagascar	RSSA
uga	Uganda	RSSA
xss	Rest of Sub Sal	RSSA

Annex 3 —Initial pattern of protection – Reporting country / Partner - 2005

Reporting	Partner	Australia/New Zealand	Canada	Developed Asia	European Union - 25	Rest of OECD	USA	Argentina	Brazil	China	Developing Asia	India	Mexico	Rest of America	Rest of Middle East and North Afric.	Rest of the World	Southern Africa Custom Union	Bangladesh	Rest of SubSaharan Africa	Zambia	Average
	Australia/New Zealand	1.2%	3.5%	5.2%	5.3%	2.8%	3.1%	2.2%	3.0%	6.0%	3.5%	7.5%	6.6%	4.7%	5.1%	3.7%	4.1%	15.1%	3.6%	0.3%	**4.8%**
	Canada	6.7%		2.9%	4.6%	2.2%	0.5%	2.1%	4.3%	4.8%	2.7%	5.8%	0.2%	2.8%	2.1%	2.0%	1.9%	14.3%	0.8%	0.2%	**3.4%**
	Developed Asia	9.2%	5.2%	4.0%	5.3%	2.6%	4.6%	13.5%	11.1%	4.4%	4.3%	10.6%	4.4%	6.6%	3.2%	4.0%	5.0%	3.9%	4.0%	1.9%	**4.9%**
	European Union - 25	10.8%	4.6%	3.5%		0.4%	3.5%	6.4%	6.9%	4.0%	3.0%	5.4%	1.4%	5.1%	0.6%	1.3%	3.0%	0.0%	1.3%	1.1%	**3.2%**
	Rest of OECD	23.2%	6.3%	1.4%	4.6%	0.7%	5.7%	17.5%	13.9%	2.2%	2.6%	5.2%	5.1%	6.2%	1.9%	3.5%	3.9%	0.4%	2.0%	1.7%	**4.3%**
	USA	2.4%	0.1%	2.1%	2.7%	1.4%		3.4%	2.9%	4.4%	2.3%	4.4%	0.0%	2.3%	1.5%	1.6%	0.8%	11.4%	1.0%	0.9%	**2.3%**
	Argentina	11.7%	12.5%	13.4%	13.7%	11.4%	13.2%		4.7%	15.4%	11.2%	13.9%	9.7%	8.1%	8.3%	10.9%	13.0%	16.0%	5.6%	10.6%	**12.5%**
	Brazil	9.7%	8.8%	13.9%	13.9%	9.4%	10.6%	3.3%		15.2%	11.0%	11.6%	13.4%	9.8%	6.0%	7.3%	11.8%	13.5%	2.4%	7.5%	**11.8%**
	China	7.4%	5.5%	8.7%	8.3%	7.0%	5.8%	7.9%	8.6%		7.2%	7.8%	7.7%	7.7%	5.2%	7.7%	7.8%	7.3%	2.8%	2.9%	**7.6%**
	Developing Asia	7.0%	3.5%	7.4%	5.7%	2.8%	7.8%	11.1%	14.7%	6.4%	5.4%	9.2%	3.9%	8.3%	4.4%	6.9%	8.6%	2.7%	6.8%	6.5%	**6.5%**
	India	34.0%	37.2%	31.8%	30.5%	32.8%	28.5%	48.1%	34.2%	33.8%	35.7%		27.9%	31.2%	28.0%	31.7%	34.6%	13.2%	22.8%	34.4%	**31.8%**
	Mexico	17.9%	1.6%	13.1%	17.0%	11.9%	1.1%	18.9%	24.4%	21.3%	12.2%	20.8%		7.4%	14.1%	17.8%	16.9%	24.7%	14.9%	14.5%	**10.8%**
	Rest of America	9.8%	13.4%	8.6%	10.5%	11.3%	8.0%	9.2%	10.1%	11.2%	8.7%	9.8%	15.1%	9.6%	12.9%	8.6%	9.3%	12.2%	10.9%	6.9%	**9.6%**
	Rest of Middle East and North Africa	14.0%	6.0%	9.4%	7.5%	5.7%	9.6%	14.8%	13.7%	13.6%	9.7%	14.4%	8.3%	14.7%	7.2%	9.8%	12.8%	19.5%	8.5%	9.1%	**9.2%**
	Rest of the World	12.6%	11.3%	8.1%	8.6%	7.9%	9.5%	12.2%	13.0%	11.8%	8.2%	10.4%	9.3%	11.1%	7.2%	4.7%	12.3%	10.0%	5.0%	6.0%	**8.9%**
	Southern Africa Custom Union	16.3%	9.9%	7.0%	8.1%	3.3%	7.9%	8.8%	17.2%	12.2%	5.9%	13.4%	6.2%	11.3%	6.1%	8.0%	0.0%	16.8%	3.3%	3.3%	**8.2%**
	Bangladesh	10.7%	10.1%	19.0%	14.9%	7.4%	15.8%	17.3%	19.2%	20.5%	19.8%	17.2%	27.2%	25.4%	17.0%	15.4%	12.1%		29.0%	17.5%	**17.4%**
	Rest of SubSaharan Africa	11.6%	14.2%	13.0%	16.3%	12.2%	15.6%	16.5%	20.4%	21.9%	20.6%	20.9%	13.8%	14.9%	17.4%	12.6%	19.5%	18.7%	18.7%	12.6%	**16.9%**
	Zambia	7.6%	8.2%	15.1%	11.6%	11.0%	7.2%	8.3%	18.9%	13.8%	14.9%	10.7%	15.1%	10.6%	11.3%	9.5%	11.5%	23.7%	6.5%		**11.8%**
	Average	**9.7%**	**3.9%**	**5.4%**	**5.6%**	**2.4%**	**5.2%**	**10.5%**	**10.1%**	**5.6%**	**5.1%**	**8.3%**	**2.2%**	**6.6%**	**3.0%**	**4.9%**	**7.7%**	**4.9%**	**4.4%**	**4.7%**	

Source: MacMap-HS6 and author's calculation.

Annex 4 —Initial pattern of protection – Reporting country / Product - 2005

	Meat: cattle, sheep, goats, horse	Milk (processed)	Plant-based fibers	Rice (processed)	Sugar (processed)	Vegetables and Fruit	Wheat	Other Agricultural Products	Other Food Products	Other Primary products	Textile	Wearing and Apparel	Metal mineral petroleum and chemical produci	Vehicles and equipment	Other manufacturing products	Average
Australia/New Zealand	0.0%	0.9%	0.0%	0.0%	2.1%	0.5%	0.0%	0.1%	3.9%	3.2%	12.7%	16.8%	3.0%	4.9%	3.4%	**4.8%**
Canada	7.9%	103.2%	0.0%	0.0%	3.7%	2.1%	1.7%	1.1%	10.9%	0.1%	10.4%	13.5%	2.0%	1.7%	1.5%	**3.4%**
Developed Asia	21.5%	46.1%	0.2%	614.7%	139.5%	18.4%	79.8%	38.3%	15.8%	1.6%	6.0%	8.7%	2.5%	3.1%	1.5%	**4.9%**
European Union - 25	39.7%	47.0%	0.0%	138.6%	128.6%	17.9%	0.5%	7.5%	11.1%	0.1%	5.8%	7.1%	2.1%	2.2%	1.0%	**3.2%**
Rest of OECD	102.3%	88.1%	0.0%	13.3%	44.0%	31.5%	108.4%	32.9%	37.0%	0.2%	3.6%	2.7%	0.7%	0.5%	1.1%	**4.3%**
USA	1.7%	18.8%	1.6%	4.9%	34.9%	2.7%	2.4%	2.8%	3.7%	0.0%	9.0%	10.9%	2.1%	1.3%	0.6%	**2.3%**
Argentina	8.6%	16.8%	7.4%	12.2%	17.5%	10.4%	5.7%	7.4%	14.1%	0.8%	18.3%	19.7%	12.1%	12.8%	13.7%	**12.5%**
Brazil	6.0%	19.7%	8.8%	14.5%	17.5%	8.8%	4.6%	6.7%	13.3%	0.8%	18.1%	18.2%	10.7%	13.4%	12.5%	**11.8%**
China	9.9%	11.4%	1.1%	1.0%	19.8%	11.9%	1.0%	11.1%	15.5%	1.2%	11.3%	13.2%	7.9%	7.3%	5.4%	**7.6%**
Developing Asia	3.8%	5.5%	1.6%	16.8%	19.4%	10.1%	7.7%	20.5%	12.1%	1.4%	10.3%	7.5%	5.8%	6.4%	5.6%	**6.5%**
India	24.2%	51.4%	5.6%	72.8%	59.5%	41.4%	100.0%	46.1%	63.1%	19.5%	29.4%	32.7%	32.4%	25.3%	27.4%	**31.8%**
Mexico	14.3%	32.6%	5.2%	17.4%	20.8%	22.8%	28.2%	29.5%	29.9%	10.3%	14.5%	24.0%	9.3%	7.7%	10.6%	**10.8%**
Rest of America	10.3%	19.2%	5.1%	31.2%	29.4%	14.1%	5.9%	8.4%	16.5%	13.2%	11.7%	14.5%	8.1%	8.4%	10.0%	**9.6%**
Rest of Middle East and North Africa	26.4%	40.8%	3.7%	19.3%	30.7%	26.7%	17.1%	18.2%	21.7%	4.8%	14.3%	25.6%	7.4%	6.8%	8.6%	**9.2%**
Rest of the World	14.5%	27.4%	1.1%	9.6%	36.5%	20.3%	22.8%	7.5%	23.4%	2.5%	11.0%	16.3%	7.9%	7.4%	10.1%	**8.9%**
Southern Africa Custom Union	12.5%	38.3%	13.5%	0.0%	97.3%	7.3%	36.3%	9.6%	14.3%	0.3%	21.5%	31.3%	5.4%	6.2%	8.0%	**8.2%**
Bangladesh	17.7%	34.8%	0.2%	5.0%	25.2%	16.8%	5.0%	15.9%	26.5%	22.0%	29.7%	28.7%	16.8%	11.8%	21.8%	**17.4%**
Rest of SubSaharan Africa	16.9%	19.7%	6.1%	32.1%	23.1%	32.3%	10.6%	20.5%	33.4%	7.1%	29.4%	36.0%	15.4%	12.1%	19.9%	**16.9%**
Zambia	9.3%	13.8%	5.5%	4.9%	23.7%	16.7%	5.0%	8.0%	19.0%	7.3%	16.5%	24.4%	8.6%	11.0%	16.2%	**11.8%**
Average	**21.4%**	**33.1%**	**2.3%**	**71.9%**	**52.2%**	**14.2%**	**16.1%**	**14.5%**	**13.9%**	**1.3%**	**9.5%**	**10.3%**	**4.4%**	**3.8%**	**2.9%**	

Source: MacMap-HS6 and author's calculation.

Annex 5 —Initial pattern of trade – Exporting country / importer- 2005

Imp.		Australia/New Zealand	Canada	Developed Asia	European Union - 25	USA	Rest of OECD	Argentina	Brazil	China	Developing Asia	India	Mexico	Rest of America	Rest of Middle East and North Africa	Southern Africa Custom Union	Tunisia	Bangladesh	Rest of SubSaharan Africa	Zambia	Rest of the World	Total
Exp.	*Australia/New Zealand*	5.8%	2.0%	28.2%	19.2%	12.2%	0.9%	0.2%	0.5%	6.6%	10.4%	1.7%	0.9%	1.2%	6.0%	0.9%	0.0%	0.3%	0.7%	0.0%	2.3%	100.0%
	Canada	0.5%	0.0%	4.9%	10.5%	74.6%	0.7%	0.1%	0.4%	1.8%	1.3%	0.3%	1.1%	1.7%	1.3%	0.1%	0.0%	0.0%	0.3%	0.0%	0.5%	100.0%
	Developed Asia	1.8%	2.0%	14.6%	19.0%	25.3%	0.9%	0.2%	0.8%	13.4%	12.0%	0.7%	1.2%	2.4%	3.5%	0.4%	0.0%	0.2%	0.8%	0.0%	0.9%	100.0%
	European Union - 25	0.9%	1.4%	5.3%	59.7%	11.2%	4.0%	0.3%	0.9%	1.8%	2.6%	0.6%	0.8%	1.3%	4.4%	0.5%	0.3%	0.0%	1.0%	0.0%	2.9%	100.0%
	USA	1.8%	16.2%	15.2%	30.3%	0.0%	1.6%	0.6%	1.9%	3.3%	6.1%	0.7%	10.2%	4.6%	4.7%	0.5%	0.1%	0.1%	0.8%	0.0%	1.4%	100.0%
	Rest of OECD	0.8%	2.0%	6.4%	60.2%	12.8%	1.2%	0.2%	0.8%	1.5%	3.2%	0.5%	0.8%	1.6%	5.0%	0.3%	0.1%	0.1%	0.7%	0.0%	1.8%	100.0%
	Argentina	0.5%	1.1%	4.4%	21.8%	10.7%	0.7%	0.0%	19.9%	4.4%	3.8%	1.8%	1.6%	17.8%	7.4%	1.1%	0.3%	0.8%	0.9%	0.0%	1.0%	100.0%
	Brazil	0.5%	1.5%	7.6%	28.7%	23.3%	1.3%	7.4%	0.0%	3.6%	2.7%	0.6%	3.0%	10.0%	5.1%	0.7%	0.1%	0.2%	1.1%	0.0%	2.5%	100.0%
	China	1.7%	2.2%	30.4%	20.0%	28.5%	0.7%	0.3%	0.4%	0.0%	6.6%	0.7%	0.8%	1.7%	2.9%	0.3%	0.0%	0.3%	1.0%	0.0%	1.3%	100.0%
	Developing Asia	2.1%	1.3%	21.1%	20.5%	19.7%	0.7%	0.2%	0.5%	6.4%	18.2%	1.9%	0.9%	0.9%	3.1%	0.3%	0.0%	0.4%	0.9%	0.0%	0.8%	100.0%
	India	1.1%	1.7%	9.3%	29.6%	19.9%	1.3%	0.3%	1.4%	3.5%	9.9%	0.0%	0.7%	1.4%	10.8%	0.7%	0.1%	2.0%	3.7%	0.0%	2.6%	100.0%
	Mexico	0.3%	3.3%	2.2%	6.9%	78.6%	0.4%	0.3%	0.5%	0.7%	0.8%	0.9%	0.0%	4.1%	0.5%	0.1%	0.0%	0.0%	0.1%	0.0%	0.3%	100.0%
	Rest of America	0.5%	2.8%	7.2%	22.7%	33.1%	1.9%	1.1%	2.8%	2.1%	1.9%	2.8%	2.7%	14.6%	1.6%	0.2%	0.0%	0.0%	0.4%	0.0%	1.5%	100.0%
	Rest of Middle East and North Africa	0.8%	0.9%	20.2%	31.8%	17.5%	0.9%	0.2%	1.0%	3.1%	7.6%	2.2%	0.4%	0.7%	8.9%	0.5%	0.2%	0.2%	1.0%	0.0%	1.9%	100.0%
	Southern Africa Custom Union	1.3%	0.9%	10.6%	36.5%	12.5%	1.6%	0.2%	1.0%	2.7%	2.7%	3.3%	0.7%	0.8%	4.5%	9.9%	0.0%	0.0%	8.1%	1.3%	1.3%	100.0%
	Tunisia	0.5%	0.8%	3.1%	71.5%	6.4%	1.0%	0.3%	0.5%	0.9%	1.5%	1.2%	0.4%	0.9%	8.6%	0.2%	0.0%	0.2%	1.1%	0.0%	1.1%	100.0%
	Bangladesh	0.5%	1.8%	4.0%	44.3%	37.4%	1.2%	0.1%	0.4%	0.2%	3.2%	0.8%	0.4%	0.6%	4.2%	0.1%	0.0%	0.0%	0.5%	0.0%	0.4%	100.0%
	Rest of SubSaharan Africa	0.3%	0.7%	6.1%	40.7%	25.5%	1.4%	0.2%	2.5%	4.2%	2.9%	1.4%	0.4%	1.1%	2.3%	3.5%	0.1%	0.1%	5.1%	0.2%	1.2%	100.0%
	Zambia	0.1%	0.1%	8.6%	45.9%	1.6%	3.9%	0.0%	0.1%	3.2%	6.6%	1.1%	0.1%	0.2%	9.6%	12.3%	0.0%	0.1%	5.6%	0.0%	0.8%	100.0%
	Rest of the World	0.6%	0.5%	5.3%	44.0%	7.1%	3.6%	0.1%	0.5%	5.6%	2.1%	0.7%	0.3%	1.5%	7.0%	0.1%	0.1%	0.1%	0.6%	0.0%	20.2%	100.0%

Source: MacMap-HS6 and author's calculation.

Annex 6 —Initial structure of exports - 2005

	Australia/New Zealand	Canada	Developed Asia	European Union - 25	Rest of OECD	USA	Argentina	Brazil	China	Developing Asia	India	Mexico	Rest of America	Rest of Middle East and North Afric.	Rest of the World	Southern Africa Custom Union	Tunisia	Bangladesh	Rest of SubSaharan Africa	Zambia
Meat: cattle, sheep, goats, horse	7.7%	1.4%	0.1%	0.6%	0.2%	0.9%	1.3%	1.8%	0.4%	0.2%	0.7%	0.3%	0.8%	0.3%	0.6%	0.9%	0.5%	0.1%	0.7%	0.3%
Milk (processed)	5.4%	0.2%	0.0%	0.8%	0.3%	0.1%	1.1%	0.1%	0.0%	0.1%	0.1%	0.0%	0.3%	0.1%	0.3%	0.2%	0.2%	0.0%	0.1%	0.0%
Plant-based fibers	1.2%	0.0%	0.0%	0.0%	0.0%	0.3%	0.3%	0.2%	0.0%	0.0%	0.1%	0.0%	0.1%	0.2%	0.6%	0.1%	0.1%	1.2%	1.8%	1.0%
Rice (processed)	0.2%	0.0%	0.0%	0.0%	0.0%	0.1%	0.2%	0.0%	0.2%	0.5%	1.0%	0.0%	0.2%	0.1%	0.0%	0.1%	0.0%	0.0%	0.1%	0.0%
Sugar (processed)	0.8%	0.1%	0.0%	0.1%	0.0%	0.0%	0.1%	2.0%	0.0%	0.2%	0.4%	0.1%	1.2%	0.1%	0.1%	1.2%	0.1%	0.0%	0.7%	3.0%
Vegetables and Fruit	1.7%	0.5%	0.0%	0.6%	0.0%	0.6%	2.5%	0.6%	0.5%	0.5%	1.2%	1.7%	4.0%	1.3%	0.3%	2.6%	1.4%	0.3%	2.4%	0.9%
Wheat	1.8%	1.1%	0.0%	0.2%	0.0%	0.4%	5.2%	0.0%	0.0%	0.0%	0.7%	0.1%	0.0%	0.1%	0.5%	0.1%	0.2%	0.0%	0.0%	0.0%
Other Agricultural Products	1.3%	0.9%	0.2%	0.6%	0.2%	2.0%	19.5%	13.9%	0.7%	1.5%	2.9%	0.4%	3.6%	0.6%	1.1%	1.0%	0.4%	0.6%	8.6%	4.2%
Other Food Products	5.4%	3.2%	0.7%	4.1%	3.2%	2.7%	18.0%	9.2%	1.9%	4.6%	4.2%	2.3%	8.2%	1.7%	3.1%	4.3%	4.5%	4.9%	5.3%	0.7%
Other Primary products	19.1%	7.3%	0.1%	1.0%	14.4%	0.7%	8.2%	6.2%	1.2%	4.5%	2.2%	6.9%	16.2%	40.0%	27.4%	10.6%	5.4%	0.2%	43.6%	0.5%
Textile	0.5%	0.7%	4.8%	1.7%	0.7%	1.3%	0.8%	1.1%	11.9%	4.1%	13.2%	2.2%	2.6%	2.6%	1.4%	1.3%	2.8%	24.5%	1.5%	2.2%
Wearing and Apparel	0.8%	0.5%	1.6%	1.8%	0.6%	0.7%	2.4%	3.0%	29.3%	4.4%	11.9%	3.0%	4.8%	2.8%	3.1%	1.2%	14.3%	45.4%	2.2%	0.3%
Metal mineral petroleum and chemical products	20.3%	17.0%	16.7%	23.0%	26.4%	17.2%	16.2%	18.6%	11.3%	11.6%	20.0%	9.8%	23.7%	19.5%	34.6%	36.7%	16.1%	7.3%	8.4%	70.2%
Vehicles and equipment	10.2%	40.2%	56.3%	38.3%	25.5%	43.8%	10.1%	23.4%	24.9%	48.2%	8.4%	62.2%	9.3%	8.8%	9.6%	14.7%	20.6%	1.8%	3.4%	2.3%
Other manufacturing products	4.6%	15.0%	3.0%	7.5%	8.0%	5.0%	3.3%	7.8%	12.8%	6.1%	13.3%	4.2%	6.1%	5.2%	6.0%	15.5%	2.9%	0.7%	6.7%	11.6%
Transport and Trade	9.8%	4.6%	10.4%	7.4%	8.1%	6.9%	5.0%	3.3%	3.1%	5.7%	7.6%	3.5%	10.1%	8.3%	5.7%	6.5%	18.2%	2.2%	7.1%	1.8%
Other services	9.1%	7.4%	6.3%	12.5%	12.4%	17.5%	5.9%	8.9%	1.7%	8.0%	12.3%	3.4%	9.0%	8.5%	5.5%	3.1%	12.3%	11.0%	7.7%	1.2%
Sum	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: MacMap-HS6 and author's calculation.

Annex 7 —Impact of full trade liberalization on world prices (%).

	World	Australia/New Zealand	Canada	Developed Asia	European Union - 25	Rest of OECD	USA	Argentina	Brazil	China	Developing Asia	India	Mexico	Rest of America	Rest of Middle East and North Africa	Rest of the World	Southern Africa Custom Union	Tunisia	Bangladesh	Rest of SubSaharan Africa	Zambia
Meat: cattle, sheep, goats, horse	5.9	13.0	6.4	-4.6	4.3	-13.4	3.3	-0.4	16.1	7.2	5.0	0.4	2.3	4.0	-6.1	3.3	4.4	3.5	0.8	-1.0	4.3
Milk (processed)	4.6	11.6	-2.5	-5.5	4.6	0.5	5.2	3.2	4.2	0.1	0.2	-3.0	-11.7	2.1	-3.3	-0.2	0.2	1.1	-9.8	-6.9	3.5
Plant-based fibers	6.9	9.0	4.2	6.7	24.1	6.7	8.3	5.8	6.6	3.8	6.9	4.5	4.4	5.4	4.5	4.1	1.3	5.1	-5.7	-0.2	4.1
Rice (processed)	3.0	8.2	4.7	-21.4	-9.7	-2.4	2.1	-6.4	4.9	5.9	4.2	5.5	3.0	2.0	2.2	1.5	2.3	-0.6	0.5	0.5	5.7
Sugar (processed)	2.3	11.3	2.0	-18.2	-7.3	-5.2	1.8	-1.2	3.4	6.6	-1.3	-3.9	4.5	7.1	0.6	-1.3	4.0	-0.2	-0.7	0.3	7.2
Vegetables and Fruit	5.3	11.1	8.7	4.0	1.6	-6.5	9.4	5.2	8.2	9.6	8.1	-0.1	6.2	7.8	1.6	5.6	6.3	4.3	1.0	2.1	8.5
Wheat	10.6	13.5	9.8	-21.5	10.4	-10.4	15.5	9.9	8.4	5.4	10.2	7.2	15.3	5.0	1.1	5.3	5.0	0.4	2.9	7.4	4.9
Other Agricultural Products	8.3	16.3	8.6	-9.6	7.9	3.3	14.8	6.3	10.2	8.5	6.1	1.4	5.4	5.6	1.0	4.6	4.9	2.9	2.1	2.1	7.5
Other Food Products	-0.9	7.8	2.3	-15.1	-1.2	-4.8	2.3	3.3	4.7	-4.7	-2.3	-5.5	0.7	0.9	-0.8	0.9	2.7	-0.8	-5.6	-1.6	5.7
Other Primary products	2.9	6.4	2.2	2.6	3.0	6.2	2.1	-2.7	2.4	4.7	4.3	-6.4	3.8	-1.3	4.4	-0.4	4.7	2.7	-0.3	2.4	5.9
Textile	3.6	4.2	0.1	2.2	-1.6	-1.7	0.8	-1.6	-1.8	12.4	7.1	0.3	-0.5	0.1	-0.8	1.7	0.0	-6.2	7.8	-5.0	1.1
Wearing and Apparel	3.8	2.5	1.0	2.9	-1.0	-1.0	0.5	-0.8	0.8	10.6	1.8	-3.3	-4.3	-0.7	-1.1	0.6	-2.3	-6.6	-7.2	-5.2	1.6
Metal mineral petroleum and chemical products	0.3	5.5	1.6	1.2	1.1	0.4	1.5	4.8	0.3	-2.7	2.4	-7.5	2.2	-0.2	-7.3	1.1	2.8	-0.8	-15.5	-4.9	-6.8
Vehicles and equipment	1.5	4.5	2.1	1.9	4.0	1.3	1.4	4.1	1.1	-2.1	-1.5	-7.7	-1.5	0.6	2.3	1.7	2.0	2.1	12.9	-13.6	-17.4
Other manufacturing products	0.2	5.7	1.3	0.7	-1.2	1.0	1.4	-3.0	3.3	1.5	4.9	-5.2	4.2	0.7	-2.9	1.4	2.4	0.8	-5.9	-1.3	8.4
Transport and Trade	1.2	5.3	1.1	3.0	0.1	2.2	1.4	-5.2	4.6	0.2	5.6	-2.7	-9.9	0.7	1.1	4.1	2.3	4.3	2.8	-0.5	9.1
Other services	1.2	5.6	-1.8	4.5	-0.3	0.5	1.4	8.5	6.2	4.0	5.9	-0.6	7.3	2.8	2.8	5.6	2.3	3.1	2.6	-0.2	9.1

Source: author's calculation.

Annex 8 —Decomposing full trade liberalization by liberalizing region

** North liberalization*

Annex Table 8.1— Impact of full trade liberalization in the North: world indicators for 2015 - rate of change (%)

Indicator	Total
World agricultural trade	10.81
World Trade	-2.37
World Welfare	0.11

Source: author's calculation.

Annex Table 8.2— Impact of full trade liberalization in the North: Macroeconomic indicators for 2015 - rate of change (%)

Country/Zone	Welfare	Allocation efficiency gains	Terms of trade gains
Australia/New Zealand	0.2	0.1	0.6
Canada	0.0	0.6	0.0
Developed Asia	1.2	2.3	-0.2
European Union - 25	-0.2	0.2	-0.3
USA	-0.1	0.0	-0.1
Rest of OECD	0.8	1.0	-0.3
Argentina	-0.4	-0.1	-0.2
Brazil	0.3	0.0	0.3
China	-0.3	-1.0	1.4
Developing Asia	0.3	0.0	0.6
India	0.3	-0.1	0.2
Mexico	-0.5	-0.2	-0.1
Rest of America	0.2	0.0	0.4
of Middle East and North Africa	0.0	-0.2	0.2
Southern Africa Custom Union	-0.2	0.0	0.2
Tunisia	0.3	0.1	-0.1
Rest of the World	0.2	0.0	0.2
Bangladesh	0.8	0.0	0.4
Rest of SubSaharan Africa	0.0	0.0	0.1
Zambia	-0.7	-0.2	-0.2

Source: author's calculation.

** South liberalization*

Annex Table 8.3— Impact of full trade liberalization in the South: world indicators for 2015- rate of change (%)

Indicator	Total
World agricultural Imports	18.66
World Trade	5.19
World Welfare	0.06

Source: author's calculation.

Annex Table 8.4— Impact of full trade liberalization in the South: macroeconomic indicators for 2015- rate of change (%)

Country/Zone	Welfare	Allocation efficiency gains	Terms of trade gains
Australia/New Zealand	0.6	0.0	0.8
Canada	-0.2	0.0	0.1
Developed Asia	0.1	0.0	0.2
European Union - 25	0.0	-0.1	0.2
USA	0.1	0.0	0.1
Rest of OECD	0.1	0.0	0.3
Argentina	-0.5	0.2	0.0
Brazil	-0.2	0.1	-0.1
China	0.2	0.8	-0.2
Developing Asia	0.0	0.7	-0.6
India	0.5	1.5	-1.0
Mexico	0.0	1.3	-0.3
Rest of America	-0.1	0.8	-0.6
Rest of Middle East and North Africa	0.8	1.2	-0.7
Rest of the World	-0.5	1.1	-0.5
Southern Africa Custom Union	-0.1	0.3	0.3
Tunisia	0.7	0.4	0.0
Bangladesh	1.4	1.8	-1.2
Rest of SubSaharan Africa	0.5	1.3	-0.9
Zambia	1.1	1.8	-2.2

Source: author's calculation.

Annex 9 —Decomposing full trade liberalization by activities

** Liberalization in agriculture*

Annex Table 9.1— Impact of full trade liberalization in agriculture: World indicators for 2015- rate of change (%)

World agricultural trade	37.6
World Trade	1.6
World Welfare	0.18

Source: author's calculation.

Annex Table 9.2— Impact of full trade liberalization in agriculture: macroeconomic indicators for 2015- rate of change (%)

	Welfare	*Allocation efficiency gains*	*Terms of trade gains*	
Australia/New Zealand	0.5	-0.1	0.9	
Canada	0.1	0.3	0.0	
Developed Asia	1.1	2.1	-0.2	
European Union - 25	0.0	0.1	-0.1	
USA	-0.1	0.0	0.0	
Rest of OECD	0.8	1.0	-0.3	
Argentina	0.2	0.0	0.2	
Brazil	0.4	0.0	0.6	
China	-0.1	-0.1	1.0	
Developing Asia	0.0	0.4	0.3	
India	0.6	0.7	-0.1	
Mexico	0.0	0.3	-0.1	
Rest of America	0.1	0.1	0.2	
Rest of Middle East and North Africa	0.2	0.4	-0.2	
Southern Africa Custom Union	0.4	0.2	0.2	
Tunisia	0.5	0.2	0.2	
Rest of the World	0.4	0.3	0.0	
Bangladesh	0.7	0.1	0.1	
Rest of SubSaharan Africa	0.6	0.8	-0.3	
Zambia	0.0	0.2	0.0	

Source: author's calculation.

** Liberalization in industry*

Annex Table 9.3— Impact of full trade liberalization in industry: world indicators for 2015-rate of change (%)

World agricultural Imports	-6.2
World Trade	1.0
World Welfare	0.0

Source: author's calculation.

Annex Table 9.4— Impact of full trade liberalization in industry: macroeconomic indicators for 2015- rate of change (%)

	Welfare	Allocation efficiency gains	Terms of trade gains
Australia/New Zealand	0.3	0.1	0.4
Canada	-0.3	0.4	0.1
Developed Asia	0.2	0.4	0.2
European Union - 25	-0.3	0.1	0.0
USA	0.1	0.0	0.0
Rest of OECD	0.2	0.0	0.3
Argentina	-1.1	0.1	-0.4
Brazil	-0.3	0.1	-0.3
China	-0.2	0.1	0.1
Developing Asia	0.2	0.3	-0.4
India	0.1	0.8	-0.7
Mexico	-0.5	1.0	-0.3
Rest of America	0.0	0.7	-0.4
Rest of Middle East and North Africa	0.7	0.7	-0.2
Rest of the World	-0.2	0.6	0.0
Southern Africa Custom Union	-0.7	0.1	0.3
Tunisia	0.5	0.3	-0.3
Bangladesh	1.3	1.6	-0.9
Rest of SubSaharan Africa	-0.1	0.6	-0.4
Zambia	0.5	1.5	-2.4

Source: author's calculation.

Annex 10 —Decomposing full trade liberalization by instruments

** Elimination of tariffs*

Annex Table 10.1—Impact of full elimination of import tariffs: World indicators for 2015-rate of change (%)

World agricultural trade	39.5
World Trade	9.0
World Welfare	0.23

Source: author's calculation.

Annex Table 10.2—Impact of full elimination of import tariffs: Macroeconomic indicators for 2015- rate of change (%)

	Welfare	Allocation efficiency gains	Terms of trade gains
Australia/New Zealand	0.5	0.0	1.0
Canada	0.1	0.4	-0.1
Developed Asia	1.5	2.0	0.1
European Union - 25	0.0	0.2	0.0
USA	0.0	0.0	0.0
Rest of OECD	1.0	1.0	0.2
Argentina	-0.2	0.1	0.0
Brazil	-0.4	0.0	0.2
China	-0.2	0.2	0.5
Developing Asia	0.5	0.7	0.0
India	0.3	1.5	-0.9
Mexico	0.0	0.6	-0.4
Rest of America	-0.1	0.7	-0.3
Rest of Middle East and North Africa	0.2	0.8	-0.4
Rest of the World	0.2	0.7	-0.2
Southern Africa Custom Union	0.5	0.3	0.5
Tunisia	-0.4	0.0	-0.4
Bangladesh	0.4	1.0	-1.4
Rest of SubSaharan Africa	-0.5	1.1	-1.0
Zambia	-0.5	0.8	-1.0

Source: author's calculation.

** Elimination of domestic support*

Annex Table 10.3— Impact of a full elimination of domestic support: World indicators for 2015- rate of change (%)

World agricultural trade	-8.2
World Trade	-6.1
World Welfare	-0.04

Source: author's calculation.

Annex Table 10.4— Impact of full elimination of domestic support: Macroeconomic indicators for 2015- rate of change (%)

	Welfare	*Allocation Efficiency gains*	*Terms of trade*	
Australia/New Zealand	0.1	0.1	0.3	
Canada	-0.3	0.3	0.2	
Developed Asia	-0.1	0.4	-0.1	
European Union - 25	-0.3	0.0	-0.1	
Rest of OECD	0.0	0.0	-0.1	
USA	0.0	0.0	0.0	
Argentina	-0.7	0.1	-0.2	
Brazil	0.3	0.0	-0.1	
China	0.2	-0.3	0.6	
Developing Asia	0.0	0.1	-0.1	
India	0.5	0.0	0.0	
Mexico	-0.4	0.7	-0.1	
Rest of America	0.2	0.0	0.1	
Rest of Middle East and North Africa	0.7	0.3	0.0	
Rest of the World	0.2	0.2	0.1	
Southern Africa Custom Union	-0.8	-0.1	0.0	
Tunisia	1.3	0.5	0.2	
Bangladesh	1.4	0.5	0.4	
Rest of SubSaharan Africa	0.9	0.1	0.3	
Zambia	1.4	1.0	-1.1	

Source: author's calculation.

** Elimination of export subsidies*

Annex Table 10.5— Impact of a full elimination of export subsidies: World indicators for 2015- rate of change (%)

World agricultural trade	-5.6
World Trade	-1.0
World Welfare	-0.1

Source: author's calculation.

Annex Table 10.6— Impact of full elimination of export subsidies: Macroeconomic indicators for 2015- rate of change (%)

	Welfare	Allocation efficiency gains	Terms of trade gains
Australia/New Zealand	-0.1	0.0	-0.1
Canada	-0.2	-0.1	-0.1
Developed Asia	-0.2	-0.1	-0.1
European Union - 25	0.0	0.0	0.0
USA	-0.1	0.0	-0.1
Rest of OECD	-0.3	-0.1	-0.1
Argentina	-0.7	-0.1	-0.4
Brazil	-0.2	0.0	-0.2
China	-0.8	-1.0	1.0
Developing Asia	-0.1	-0.1	0.1
India	0.1	-0.1	0.1
Mexico	-0.2	-0.1	0.1
Rest of America	0.0	0.0	0.0
Rest of Middle East and North Africa	-0.1	0.0	-0.2
Rest of the World	-0.3	0.3	-0.2
Southern Africa Custom Union	-0.1	0.0	0.0
Tunisia	0.6	0.2	0.3
Bangladesh	0.6	0.0	0.3
Rest of SubSaharan Africa	-0.4	-0.1	-0.2
Zambia	0.0	0.0	0.0

Source: author's calculation.

Annex 11 —Assessing the impact of full trade liberalization by CGEM

This annex provides a synoptic table on recent assessments[55] of full trade liberalization on world welfare and poverty[56]. The next one gives the same information for the Doha Development Agenda.

A study might contain several modeling exercises corresponding with different theoretical structures. The USDA-ERS assessment is carried out under a static and a dynamic version. The two Global Economic Prospects from the World Bank (in 2002 and 2004) utilize both a dynamic framework; but the second one supposes a positive relation between trade openness and factor productivity. Cline 1 corresponds to a static model with constant return to scale, while Cline 2 assesses expected benefits from trade liberalization using a Steady State dynamic model under which capital rises until the rate of return on investment returns to the pre - liberalization level.

Annexes 12 and 13 present three experiments of the Doha Agenda by Anderson, Martin and Van der Mensbrugghe (2005): the first one concerns liberalization only in agriculture, the second one adds a sensitive products clause, and the third one adds to the first experiment liberalization in industry. Bouet, Mevel, and Orden (2005) present two alternative scenarios, the ambitious scenario and the unambitious one, to evaluate the potential area of negotiation in the last U.S. and EU proposals.

The columns in these annexes indicate technical features of the experiment conducted (either full liberalization or the implementation of a potential Doha Development Agenda – DDA-), the CGEM under which the experiment was carried out, the geographic and sectoral decompositions (the 1st figure is the number of trading zones,

[55] Since 2001.

[56] In the case of the GEP 2004, it is a pro-poor scenario which would imply elimination of export subsidies, decoupling all domestic support and a significant cut in tariffs: rich countries would be subject to a maximum tariff of 10% in agriculture (5% in industry), with an average target of 5% (1%). For developing countries, the caps would be 15 and 10% with average of 10 and 5%.

the 2nd is the number of sectors) and the data utilized. All simulations are based on the GTAP database, either the GTAP5 version accounting for 1997, or the GTAP6 version, for 2001. This database may be improved (in this case, the notation "+…" is added). For example, Bouët, Bureau, Decreux and Jean (2005) utilize the GTAP5 database, but replace GTAP tariffs by MacMap-HS6 data and construct an original dataset of domestic support for the European Union and the USA. Moreover they simulate a "pre-experiment" shock for 2005, which includes not only these previous changes, but also the EBA initiative and AGOA, the end of the Uruguay Round, the phasing out of the Multi-Fiber Arrangement and the enlargement of the European Union. If these liberalization shocks are not included before the experiment is conducted, the impact on trade and thus the benefits of openness would be overstated.

The amount of world benefits which can be expected from trade liberalization is not the only worthwhile information. Other points are of key importance: is agriculture the main source of benefits? Must negotiators concentrate their efforts on market access, domestic support or export subsidies? Which kind of countries will be the main beneficiaries? Are expected benefits coming from liberalizing developed countries' trade policy or that of developing countries? This is the reason why these two annexes give different macroeconomic results. The 7th and 8th rows focus on world welfare which results from this experiment. The increase in this indicator is assessed in $, then in percentage. In order to address the previous questions, rows 5 to 8 decompose this increase in world welfare: the part of it coming from liberalizing agriculture, then from improving market access, the part of world welfare benefiting developing countries and the one coming from liberalization in developing countries.

Presenting the contribution of each distortion in welfare increase is not strictly consistent: if referring to the theory of second best, the elimination of one distortion in a world where several conditions for a Pareto optimum are not fulfilled does not necessarily entail a welfare improvement. On the contrary, adding a distortion may increase welfare. As a result, eliminating simultaneously tariffs, domestic support, and

export subsidies does not imply the same increase in welfare as the sum of the three separate changes in economic policy. Nevertheless, studies on the expected benefits of trade liberalization frequently present this decomposition. We will keep this presentation in our review of literature, but adopt a more consistent way of presenting results in our central experiment[57].

In these two annexes, the following three rows concern other macroeconomic information: increase in world (global and agricultural) trade and variation of world agricultural prices. This last information is crucial as a frequent criticism addressed to trade liberalization is that it will entail an augmentation of these prices such that net food importing countries could lose. Then the following row indicates if there are losers in this process in terms of national welfare.

Finally, the last row indicates the impact on world poverty (2$ per day definition) when available. This is obviously a key issue of this debate.

[57] The decomposition technique which is used in all these studies has been inspired by Harrison, Horridge and Pearson, 2000.

Annex 12 —Recent assessments of the impact of full trade liberalization

	Dessus et alii (1999)	Dessus et alii (1999)	Dee and Hanslow (March 2000)	Hertel (July-August 2000)	Anderson, Francois, Hertel, Hoekman and Martin (200	USDA - ERS (2001) 1	USDA - ERS (2001) 2	The World Bank (GEP 2002) 1	The World Bank (GEP 2002) 2	The World Bank (GEP 2004) 1	The World Bank (GEP 2004) 2	Cline, 2004 1	Cline, 2004 2	Beghin and Van der Mensbrugghe, 2004	Anderson, Van der Mensbrugghe and Martin, 2005	Francois, Von Meijl and Tongeren, 2005	Hertel and Keeney, 2005	Bouet, Mevel and Orden (2005)	Bouet, 2006
Experiment	Full tariff lib'n	Full tariff lib'n	Full lib'n	Full tariff lib'n	Full lib'n	Full lib'n - Agric.	Full lib'n - Agric.	Full lib'n	Full lib'n	Pro-poor scen.	Pro-poor scen.	Full lib'n	Full lib'n	Full lib'n	Full lib'n	Full lib'n	Full lib'n	Full lib'n	Full lib'n
Model used	Linkage	Linkage	GTAP	GTAP	GTAP	USDA - ERS model	USDA - ERS model	Linkage	Linkage	Linkage	Linkage	HRT	HRT	Linkage	Linkage	GTAP5	GTAP-Agr	MIRAGE	MIRAGE
Static/Dynamic	Dynamic	Dynamic	Dynamic	Dynamic	Dynamic	Static	Dynamic	Dynamic	Dynamic	Dynamic	Dynamic	Static	Dynamic	Dynamic	Dynamic	Dynamic	Static	Dynamic	Dynamic
Specific feature		TO/TFP	FDI						TO/TFP		TO/TFP		SS						
Geogr. and sector decomposition	16*4	16*4	19*30	19*22		12*9 agric.	12*9 agric.	15*20	15*20	23*…	23*…	25*22	25*22	23*22	27*25	16*17	30*	41*18	20*17
Data	1995	1995	1995+…	1995+…	1995	1997+…	1997+…	1997	1997	1997+…	1997+…	1997	1997	1997+…	2001+…	1997+…	2001+…	2001+…	2001+…
World welfare	$82bln	$1212bln	$134bln	$290bln	$254bln	$31bln	$56bln	$355bln	$852bln	$291bln	$518bln	$228 bln	$614bln	$385bln	$287bln	$163bln	$84bln	$157bln	$99.6bln
in %	0,20%	3,10%	0.32%	0.69%	0.62%*	0,13%	0,24%	0,90%	2,10%	0,80%	1,40%	0,93%	2,50%	0,90%	0,70%	0,43%	na	0.5%	0.33%
of which: agric.	na	na	na	na	65%	na	na	69%	71%	0,663	0,69	0,57	na	0,69	0,63	0,65	0,66	na	na
of which: tariffs	na	na	na	na	na	na	na	na	na	na	na	na	na	0,99	0,93	0,91	0,954	na	na
of which: Dvg countries benef.	22%	38%	na	na	43%	8%	38%	52%	65%	55%	67%	38%	47%	56%	30%	8%	26%	na	na
of which: Dvg countries liber.	na	na	na	na	45%	na	na	55%	66%	0,62	0,62	0,44	na	na	0,45	0,58	na	na	na
World trade	na	na	na	17%	na	na	na	na	0,17	0,1	na	na	na	na	na	0,12	0,075	12.1%	5.25%
World agric. trade	na	na	na	na	na	na	15%	na	na	32%	na	na	na	74%	76%	na	21%	na	34%
World agric. prices	na	na	na	na	na	na	12%	na	na	na	na	na	na	na	na	na	na	na	2.5%/11%
Losers ?	na	no losers	Mexico, Canada	Other MENA countries	na	Mexico, RoW	no losers	no losers	no losers	no losers	no losers	Malaysia, Mexico	Malaysia, China	no losers	no losers	South America, China, India	Philipp., Banglad., R.o. Lat. Amer., Mozamb., R.o. SubSah. Afr.	China, Venezuela, Banglad., Mozamb., Zambia	Canada, EU, Argentina, Mexico, SACU
Poverty headcount	na	na	na	na	na	na	na	-320mln	na	-144mln	na	-110mln	-440mln		-72mln	na	na	na	na

Annex 13 —Assessing the impact of a Doha Development Agenda by CGEM: Recent assessments of the impact of a Doha Agenda

	Bouet, Bureau, Decreux and Jean, 2005	Fontagne, Guerin and Jean, 2005	Bchir, Fontagne and Jean, 2005	Francois, Von Meijl and Tongeren, 2005	Anderson, Martin and Van Der Mensbrugghe, 2005 1	Anderson, Martin and Van Der Mensbrugghe, 2005 2	Anderson, Martin and Van Der Mensbrugghe, 2005 3	Bouet, Mevel and Orden, 2005	Bouet, Mevel and Orden, 2005
Experiment	DDA Agr	DDA	DDA Ind	DDA	DDA Agr	DDA Agr + SSI	DDA	DDA	DDA
Model used	MIRAGE	MIRAGE	MIRAGE	GTAP5	Linkage	Linkage	Linkage	MIRAGE	MIRAGE
Static/Dyanmic	Static	Dynamic	Static	Dynamic	Dynamic	Dynamic	Dynamic	Dynamic	Dynamic
Geogr. and sector decomposition	11*30	7*57	22*20	16*17	27*25	27*25	27*25	41*18	41*18
Data	1997+…	1997+…	2001+…	1997+…	2001+…	2001+…	2001+…	2001+…	2001+…
World welfare	$23bln	$146bln	$12bln	$100bln	$75bln	$18bln	$96bln	$41bln	$104bln
in %	0.08%	0.51%	0.04%	0.34%	0.18%	0.04%	0.23%	0.17%	0.33%
of which: agric.		na	na	66%	-	-		na	na
of which: tariffs	na	na	na	91%	na	na	99.70%	na	na
of which: Dvg countries benef.	21%	na	14%	11%	12%	loss	17%	na	na
of which: Dvg countries liber.		na	na	67%	na	na	na	na	na
World trade		na	3.20%	na	na	na	na	2%	4.1
World agric. trade	6.10%	na	na	na	na	na	na	na	na
World agric. prices	0.3%/26.0%	na	na	na	na	na	na	na	na
Losers ?	Mediterr. Countries, Subsharan Afr.	No losers	Canada, Brazil, China, India, Mexico, Rest of South America	South America, China	HK, Singap., Bangladesh, China, Vietnam, Russia, Mexico	HK, Singap., Bangladesh, China, Vietnam, Russia, Mexico, Rest of Sub-Sah. Africa. Middle East and North Africa	HK, Singap., Bangladesh, China, Vietnam, Russia, Mexico, Rest of Sub-Sah. Africa	Venezuela, Zambia, Madag. Mozamb.	Venezuela, Zambia,
Poverty headcount		na	na	na	-1.3mln	+0.3mln	-6.2mln	na	na

Annex 14 —Custom taxes in proportion of domestic GDP

Country	Custom tax
Singapore	0.0%
Luxembourg	0.1%
France	0.1%
Denmark	0.1%
Sweden	0.1%
Finland	0.1%
Greece	0.1%
Austria	0.1%
United States	0.1%
Germany	0.1%
Italy	0.1%
Spain	0.1%
United Kingdom	0.2%
Japan	0.2%
Lithuania	0.2%
Canada	0.2%
Ireland	0.2%
Portugal	0.2%
Rest of Former Soviet Union	0.2%
Netherlands	0.3%
Bulgaria	0.3%
New Zealand	0.3%
Rest of EFTA	0.3%
Estonia	0.3%
Turkey	0.4%
Botswana	0.4%
Madagascar	0.4%
Belgium	0.4%
Australia	0.5%
Rest of Southeast Asia	0.5%
Argentina	0.5%
Poland	0.5%
Indonesia	0.6%
Latvia	0.6%
Mexico	0.7%
Croatia	0.7%
South Africa	0.7%
Taiwan	0.7%
Brazil	0.7%
Rest of South African Customs Union	0.7%
Uganda	0.7%
Uruguay	0.8%
Switzerland	0.8%
Hungary	0.8%
Slovakia	0.8%
Chile	0.9%
Czech Republic	0.9%
Philippines	0.9%
Colombia	0.9%
Russian Federation	0.9%
Peru	0.9%
Venezuela	1.0%
China	1.1%
Romania	1.1%
Rest of Middle East	1.1%
Zimbabwe	1.2%
Rest of Andean Pact	1.3%
Zambia	1.3%
Korea	1.5%
Tanzania	1.5%
India	1.6%
Sri Lanka	1.6%
Rest of FTAA	1.6%
Malaysia	1.6%
Rest of South Asia	1.6%
Rest of South America	1.6%
Rest of the Caribbean	1.7%
Mozambique	1.7%
Bangladesh	1.9%
Rest of North Africa	2.0%
Malawi	2.0%
Central America	2.1%
Cyprus	2.1%
Thailand	2.3%
Slovenia	2.3%
Albania	2.5%
Rest of Europe	2.5%
Rest of Sub Saharan Africa	2.7%
Malta	2.9%
Rest of Oceania	3.1%
Morocco	3.2%
Vietnam	4.0%
Rest of SADC	4.0%
Tunisia	4.3%
Rest of North America	13.9%

Source: GTAP6.

Annex 15 —No pre – experiment

Annex Table 15.1— Impact of a full trade liberalization from 2001: World indicators for 2015- rate of change (%)

Indicator	Total
World agricultural Imports	39.05
World Trade	4.59
World Welfare	0.45

Source: Author's calculation.

Annex Table 15.2— Impact of full trade liberalization from 2001: Macroeconomic indicators for 2015- rate of change (%)

	Welfare	Allocation efficiency gains	Terms of trade gains
Australia/New Zealand	1.1	0.1	1.5
Canada	0.1	0.7	0.3
Developed Asia	1.6	2.3	0.2
European Union - 25	0.0	0.2	0.0
USA	0.3	0.0	0.1
Rest of OECD	1.0	1.0	0.2
Argentina	0.5	0.4	0.7
Brazil	0.4	0.1	0.6
China	0.9	1.6	-1.0
Developing Asia	0.6	0.8	-0.1
India	0.5	1.6	-1.1
Mexico	-0.2	1.4	-0.6
Rest of America	0.0	0.8	-0.2
Rest of Middle East and North Africa	0.9	1.3	-0.5
Rest of the World	0.0	1.0	0.0
Southern Africa Custom Union	-0.1	0.3	0.6
Tunisia	-0.8	0.2	-1.0
Bangladesh	1.0	1.8	-1.3
Rest of SubSaharan Africa	0.7	1.3	-0.5
Zambia	0.1	1.6	-2.5

Source: author's calculation.

Annex Table 15.3— Impact of full trade liberalization from 2001 on factor remuneration for 2015- rate of change (%)

Country/zone	Agr Unskilled real wages	Ind Unskilled real wages	Real return to capital	Real return to land	Real return to natural resources	Skilled real wages
Australia/New Zealand	10.9	2.2	-0.6	4.0	-4.8	1.4
Canada	-0.1	-0.2	-0.2	-24.3	4.2	0.1
Developed Asia	-2.7	2.1	1.6	-31.4	-6.4	2.5
European Union - 25	0.4	0.3	-0.6	-41.4	-3.4	0.1
USA	1.4	0.1	-0.2	-15.7	2.2	0.1
Rest of OECD	-4.6	0.9	0.9	-50.0	5.4	1.3
Argentina	10.5	2.6	-1.1	10.5	-10.7	-0.8
Brazil	9.5	1.7	-0.5	10.9	-9.5	0.2
China	-0.6	4.2	-2.2	-9.3	-21.3	6.6
Developing Asia	0.6	1.3	0.1	-6.0	-17.1	1.0
India	-1.7	1.8	-0.1	-4.8	-25.6	4.2
Mexico	-4.7	0.2	0.5	-23.6	-22.9	-1.8
Rest of America	4.3	1.2	-1.3	7.9	-13.1	-0.1
Rest of Middle East and North Africa	-2.4	0.9	1.1	-7.5	-10.1	1.2
Southern Africa Custom Union	5.0	0.9	-1.6	12.9	9.0	-0.2
Tunisia	0.2	-0.2	-0.4	-0.9	-5.5	-1.0
Rest of the World	-1.1	2.0	-2.5	-5.6	13.2	-0.3
Bangladesh	1.0	0.6	0.7	1.8	-6.2	-0.3
Rest of SubSaharan Africa	0.7	1.8	-1.0	0.2	-4.4	1.5
Zambia	-4.2	-1.1	1.6	-8.9	-22.7	0.3

Source: author's calculation.

Annex 16 —No preferential duties

Annex Table 16.1— Impact of a full trade liberalization: no preferential duties — World indicators for 2015- rate of change (%)

World agricultural trade	30.61
World Trade	4.11
World Welfare	0.41

Source: author's calculation.

Annex Table 16.2— Impact of full trade liberalization from 2001: no preferential duties - Macroeconomic indicators for 2015- rate of change (%)

	Welfare	Allocation efficiency gains	Terms of trade gains
Australia/New Zealand	1.1	0.1	1.4
Canada	0	0.6	0.3
Developed Asia	1.1	1.8	0
European Union - 25	-0.1	0.3	-0.1
Rest of OECD	0.5	1.1	-0.2
USA	0.2	0	0.2
Argentina	-0.2	0.3	0.3
Brazil	0.9	0	0.7
China	0.4	0.8	0
Developing Asia	1	1.2	-0.5
India	1.3	3.1	-1.5
Mexico	-0.2	1.1	-0.1
Rest of America	2.5	3	-0.9
Rest of Middle East and North Africa	0.6	1.2	-0.6
Rest of the World	-0.3	1	-0.1
Southern Africa Custom Union	2.7	0.4	1.9
Tunisia	5.2	6.6	-1.8
Bangladesh	1.8	1.7	-0.8
Rest of SubSaharan Africa	2	1.1	0.5
Zambia	2.7	1.7	-1.1

Source: author's calculation.

Annex Table 16.3— Impact of full trade liberalization from 2001: No preferential duties – factor remuneration for 2015- rate of change (%)

	Agr Unskilled real wages	Ind Unskilled real wages	Real return to capital	Real return to land	Real return to natural resources	Skilled real wages
Australia/New Zealand	11.5	2.3	-0.6	3.8	-12.4	1.5
Canada	0.2	-0.1	-0.4	-24.3	3.8	0
Developed Asia	-2.6	1.6	1.1	-30.1	-0.9	1.8
European Union - 25	-0.6	0.5	-0.8	-42.4	-3.6	-0.2
Rest of OECD	-6.7	0.9	0.2	-50.9	-1.9	1.3
USA	1.1	0.2	-0.2	-17.1	1.8	0.1
Argentina	6.2	1.4	-1.4	2.9	-8.7	-1.6
Brazil	6.1	1.9	1	1.4	-9.7	1.1
China	-1.6	1.1	-0.6	-7.5	-25.5	3.1
Developing Asia	-0.5	0.2	0.1	-7.1	-19.7	0.9
India	-0.4	3.3	-0.5	-4.4	-29.9	6.5
Mexico	-4	0.6	0.8	-23	-13.2	-2
Rest of America	6	4.5	0	4.9	-19.8	3.9
Rest of Middle East and North Africa	-1.5	1.3	0.1	-6.7	-11.3	1.1
Rest of the World	-1.8	1.3	-3.1	-6.9	22.4	-1.6
Southern Africa Custom Union	6.2	3.2	2.1	10.3	-4.3	2.8
Tunisia	-1.1	5.5	7.6	-14.7	-25	7.9
Bangladesh	2.4	1.9	0.3	3.1	-3.1	1.2
Rest of SubSaharan Africa	3	3.2	0.7	2.4	-2.6	2.8
Zambia	-0.9	1	4	-6.3	-26.9	3.7

Source: author's calculation.

Annex 17 —Higher trade elasticities

Annex Table 17.1— Impact of full trade liberalization: Linkage elasticities — World indicators for 2015- rate of change (%)

Indicator	Total
World agricultural trade	57.07
World Trade	5.25
World Welfare	0.44

Source: author's calculation.

Annex Table 17.2—Impact of full trade liberalization from 2001: linkage elasticities — macroeconomic indicators for 2015- rate of change (%)

Country/zone	Welfare	Allocation efficiency gains	Terms of trade gains
Australia/New Zealand	0.9	0.1	1.4
Canada	0.0	0.7	0.1
Developed Asia	1.8	2.3	0.1
European Union - 25	-0.1	0.3	-0.1
USA	0.2	0.0	0.1
Rest of OECD	1.1	1.3	-0.1
Argentina	0.0	0.3	0.4
Brazil	0.5	0.1	0.7
China	0.6	0.8	0.1
Developing Asia	0.6	1.1	-0.1
India	1.0	2.4	-1.1
Mexico	-0.2	1.5	-0.6
Rest of America	0.1	0.5	0.1
Rest of Middle East and North Africa	1.4	1.5	-0.3
Rest of the World	0.6	1.2	-0.2
Southern Africa Custom Union	0.0	0.4	0.6
Tunisia	0.3	0.4	-0.5
Bangladesh	1.7	2.0	-1.1
Rest of SubSaharan Africa	1.2	1.9	-0.8
Zambia	0.7	1.8	-2.1

Source: author's calculation.

Annex Table 17.3—Impact of full trade liberalization from 2001: Linkage elasticities—factor remuneration for 2015 - rate of change (%)

Country / Zone	Agr Unskilled real wages	Ind Unskilled real wages	Real return to capital	Real return to land	Real return to natural resources	Skilled real wages
Australia/New Zealand	10.6	2.1	-0.8	4.8	-3.9	1.2
Canada	-0.7	-0.2	-0.3	-23.0	2.0	-0.1
Developed Asia	-2.1	2.4	1.7	-35.1	-4.9	2.9
European Union - 25	-0.4	0.4	-0.7	-43.0	-3.9	0.0
USA	0.6	0.1	-0.2	-17.0	1.9	0.1
Rest of OECD	-4.7	1.2	0.8	-51.8	0.6	1.6
Argentina	6.6	1.7	-1.5	4.8	-5.7	-1.4
Brazil	9.5	2.1	-0.7	6.6	-9.1	0.6
China	-0.9	2.5	-1.8	-7.9	-16.1	4.3
Developing Asia	-0.3	1.5	0.3	-9.3	-14.3	1.5
India	-3.4	2.6	1.6	-7.8	-17.3	5.4
Mexico	-5.7	0.4	0.6	-26.0	-21.2	-1.7
Rest of America	5.9	1.7	-1.5	11.8	-11.9	-0.2
Rest of Middle East and North Africa	-3.4	1.5	1.6	-9.5	-8.2	2.1
Southern Africa Custom Union	5.6	1.1	-1.7	17.1	6.2	-0.1
Tunisia	0.4	1.0	0.7	-1.8	-7.4	0.4
Rest of the World	-0.4	2.3	-1.6	-3.2	8.5	0.7
Bangladesh	0.3	1.7	1.7	-0.1	-2.5	1.0
Rest of SubSaharan Africa	0.1	2.3	-0.4	0.5	-2.9	2.0
Zambia	-6.3	-0.4	2.8	-11.8	-14.1	1.1

Source: author's calculation.

Annex 18 —Trade increases factor productivity

Annex Table 18.1—Impact of full trade liberalization on world indicators with positive relation between trade openness and factor productivity for 2015 - rate of change (%)

World agricultural Imports	32.49
World Merchandise Trade	4.87
World Welfare	0.59

Source: author's calculation.

Annex Table 18.2— Impact of full trade liberalization on national indicators with positive relation between trade openness and factor productivity for 2015 - rate of change (%)

Country	Allocation efficiency gains	Terms of trade gains	Welfare
Australia/New Zealand	0.0	1.3	0.3
Canada	0.7	0.2	0.3
Developed Asia	2.2	0.1	1.3
European Union - 25	0.2	-0.1	0.2
USA	0.0	0.1	0.3
Rest of OECD	1.0	0.1	1.2
Argentina	0.2	0.3	-0.4
Brazil	0.0	0.4	-0.2
China	0.9	0.3	1.9
Developing Asia	0.8	-0.2	0.5
India	1.7	-1.0	3.2
Mexico	1.3	-0.5	0.4
Rest of America	0.8	-0.2	0.6
Rest of Middle East and North Africa	1.2	-0.4	1.5
Southern Africa Custom Union	0.3	0.5	0.0
Tunisia	0.3	-0.3	0.0
Rest of the World	0.9	-0.1	0.9
Bangladesh	1.8	-1.0	2.5
Rest of SubSaharan Africa	1.4	-0.7	1.7
Zambia	1.6	-2.3	-0.6

Source: author's calculation.

Annex Table 18.3—Impact of full trade liberalization on factor remuneration with positive relation between trade openness and factor productivity for 2015- rate of change (%)

	Agr Unskilled real wages	Ind Unskilled real wages	Real return to capital	Real return to land	Real return to natural resources	Skilled real wages
Australia/New Zealand	8.6	1.5	-1.3	2.1	-4.2	0.8
Canada	-0.4	0.1	0.0	-25.1	4.3	0.2
Developed Asia	-3.1	2.0	1.3	-30.8	-4.1	2.3
European Union - 25	0.0	0.6	-0.4	-41.8	-3.0	0.1
Rest of OECD	-4.2	1.1	1.1	-48.8	5.4	1.4
USA	0.5	0.2	-0.2	-17.6	2.3	0.2
Argentina	5.0	1.4	-1.9	1.8	-6.9	-0.9
Brazil	6.3	1.5	-1.3	3.8	-8.7	0.5
China	0.0	3.5	-0.4	-7.2	-18.0	6.4
Developing Asia	0.4	1.3	-0.1	-6.1	-16.6	1.3
India	-0.1	4.4	3.0	-4.6	-17.9	7.9
Mexico	-3.9	1.1	1.0	-23.4	-23.2	-0.3
Rest of America	4.3	2.0	-0.5	6.8	-13.2	0.9
Rest of Middle East and North Africa	-1.8	1.8	1.8	-7.0	-11.6	2.3
Rest of the World	-1.2	2.4	-1.1	-6.1	11.6	1.3
Southern Africa Custom Union	4.4	1.1	-1.5	11.1	9.0	0.2
Tunisia	0.4	0.6	0.3	-1.6	-6.9	0.0
Bangladesh	1.9	2.8	2.5	0.4	-6.5	2.6
Rest of SubSaharan Africa	1.0	2.6	0.5	0.0	-4.5	2.9
Zambia	-5.3	-1.6	0.9	-10.4	-23.8	0.3

Source: author's calculation.

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