

# **Is agricultural liberalization beneficial to developing countries?**

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(still preliminary – do not quote)

## **Abstract:**

Using an adapted version of the MIRAGE model, this paper aims at assessing the impact of a widespread liberalization in agriculture, as proposed in the revised Harbinson proposal. The CGE model includes imperfect competition and increasing returns to scale in industry and services. It assumes land and labor mobility to be imperfect across sectors, and developing countries have a dual labor market.

Special emphasis is put on measuring properly protection and domestic support. Domestic support data is updated to 2001 for the EU and the US, and accounts for the Agenda 2000 reform and the New Farm Bill. Protection data, from the MAcMaps database, describes applied tariffs, taking preferential agreements exhaustively into account. The liberalization hypothesis used in each scenario are applied at the HS-6 level.

The results provide a contrasted picture of the benefits developing countries may draw from agricultural liberalization.

Key words: CGE model, Doha Round, agriculture, tariff preferences, domestic support.

J.E.L. Classification: F12, F13, D58, Q17.

## **Introduction**

The agricultural sector is one of the main bones of contentions in international trade negotiations, both in the multilateral and regional framework. The Uruguay Round lasted 7 years, mainly because of the difficulty in finding an agreement on agricultural issues. Article 20 of the 1994 Uruguay Round Agreement on Agriculture (URAA) provides the basis for sectoral negotiations on agriculture. Although sectoral negotiations, have been underway since March 2000, the 2001 Doha Ministerial Declaration incorporated them into a comprehensive round of multilateral trade negotiations and set an agreed negotiating mandate for agriculture.

After 7 meetings, 45 proposals and submissions from 127 countries in the first phase (March 2000 to March 2001), six major meetings in the second phase (March 2001 to March 2002), member countries were supposed to agree on numerical targets, formulas and other "modalities" for countries' commitments by 31 March 2003. This was not the case, and a few weeks before the Fifth Ministerial Conference in September 2003, the negotiating positions of the different countries are still very remote. Two successive attempts to synthesize the various positions into draft modalities for further commitments, the so-called "Harbinson proposals" failed to reach a consensus.

There are still major disagreements, on the three main issues surrounding agricultural negotiations, i.e. market access (in particular the proportion and methods for reducing tariffs and tariff peaks), domestic support, and, to a lesser extent, export subsidies and export credits. Some countries find the discipline suggested by the Harbinson proposal still too lenient, while others see it as unbalanced and imposing too many constraints on some countries that use particular instruments.

Nevertheless, if a consensus is to be found, it is unlikely that it will depart significantly from these proposals. The percentage reduction of high tariffs can differ from the proposals, the mandatory reduction of the "blue box" payments could be different, and the special and differential treatment for the developing countries could take other forms. However, the main aspects are likely to be adopted, unless one imagine a major failure of the World Trade Organization (WTO) system, since the absence of an agreement is likely to trigger numerous trade conflicts at the end of the "due restraint" clause of the Uruguay Round. For that reason, in this paper, we still focus on the scenario proposed in the draft Modalities of February 2003 and try to quantify its macroeconomic and trade impact.

## **Recent assessments of the Doha Round impact**

The Doha Round has already been subject to various assessments, using either a partial equilibrium or a computable general equilibrium (CGE) model. Partial equilibrium models have the advantage of being less demanding in terms of data and of theoretical consistency, thus making it possible to work with greater sectoral breakdown, and with more ad-hoc specifications. In contrast to CGE models, however, partial equilibrium models generally focus on a given set of sectors, and ignore interactions between sectors that may notably be important

through input-output relationships.<sup>1</sup> They also ignore the constraints linked to the equilibrium of factor markets, and to the macro-economic equilibrium of the economy. The increasing opportunity cost of production factors for a given sector, the feedback effect through income, the trade balance constraint are thus absent of a partial equilibrium analysis. This is an acceptable approximation for a shock of limited magnitude, in particular in terms of sectors concerned. It is much more problematic as soon as a widespread liberalization is considered. In this case, a CGE analysis is generally deemed to be necessary. And, by not taking into account the above mentioned constraints, partial equilibrium models are likely to overstate the extent of the induced impact on trade and output.

CGE assessments of the impact of agricultural liberalization in the Doha Round include Hertel et al. 2000; Diao et al., 2001; Beghin J. C. Et al., 2002; Elbehri and Leetmaa, 2002; van Meijl and van Tongeren, 2001; Rae and Strutt, 2002; Dimaranan et al., 2003; Francois et al., and this list does not intend to be exhaustive. Although they all conclude that a liberalization of border protection and internal support would increase world prices and world trade, and would have a positive impact on global welfare, the results of the existing studies are rather contrasted. In particular, the outcome for developing countries is found to be uniformly positive in some studies, while some countries are found to suffer a loss in other assessments.

Carrying out a prospective assessment of the consequences of a widespread liberalization of agricultural trade usually requires using complex models, and large databases. Numerous differences thus arise across studies. The most relevant points are the following:

1. *Initial trade patterns.* For any country or region, the terms-of-trade impact of a given variation in world prices depends on its initial trade patterns. In particular, an increase in the world price of agricultural commodities is good news for countries that are (or are in a position to be) net exporters in such commodities. This is not difficult to measure, but the choice of regional aggregation can seriously blur the analysis. This is especially true for Least developed countries (LDCs): they are net food importers, strongly in many instances (according to UNCTAD, 2002, the ratio of exports to imports for LDCs was only 20% in 2001), but this is concealed as soon as these countries are part of an aggregate including also larger developing countries, such as South-Africa (as is often the case), to say nothing of Brazil or Argentina. Very few studies consider separately LDCs or (African-) ACP countries (this region gathers the bulk of LDCs, with the notable exception of Bangladesh) in a CGE analysis. When this is done (as e.g. in Francois et al., 2003, or in Hertel et al., 2003), the outcome generally turns out to be negative for this region.
2. *Initial protection patterns.* To the best of our knowledge, no CGE modeling analysis dealing with multilateral liberalization in agriculture has so far taken into account preferential agreements in measuring protection.<sup>2</sup> Even partial equilibrium models do not account for preferences, with the only exception of Hoekman et al. (2002b). Now, preferences are a

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<sup>1</sup> Note however that the FAPRI (Food and Agriculture Policy Research Institute) modeling system accounts for interactions within some groups of sectors. The FAPRI work is mainly developed at Iowa State University and University of Missouri.

<sup>2</sup> The GTAP database incorporate a handful of preferential agreements, such as the NAFTA or the EU. Data on agricultural protection stem from the AMAD database, of the ERS-USDA, year 1998. It also basically deals with MFN tariffs. Noticeably, Cotonou agreements (or, at that time, Lomé convention) are not accounted for.

crucial device of the present protection patterns, for many countries (see Bouët et al., 2001). In addition, preferences are very contrasted across countries. The poorest countries benefit from preferential access to many countries through the LDCs-GSP (Generalized system of preferences), and in particular to the EU, thanks to the Cotonou agreement and the Everything But Arms (EBA) initiative. In this context, any multilateral liberalization involves an erosion of the preference margin. As shown by Hoekman et al. (2002b), the stiffer competition this implies for LDCs exports might lead to reduced exports (at least exports to the the EU), as a consequence of a multilateral liberalization of market access.

3. *Protection pattern after liberalization.* The main scenarios considered in the present multilateral negotiations rely on non-linear reduction of tariffs, in order to even out their structure. This is important, since the impact of tariffs is non-linear, and tariff peaks are recognized to be widespread in agriculture. The existing literature provides very little insight about the consequence of such evening out. Rae (2002) applies a cocktail, non-linear formula, but directly at the GTAP classification level (12 agricultural commodities, 8 processed food products), where tariff peaks are generally mixed together with many other products: to a large extent, the evening out is already made in the sectoral aggregation. To our knowledge, the only instances of dealing with tariff peaks in a multilateral approach are Hoekman et al. (2002a, b) in a partial equilibrium model, and Fontagné et al. (2002), in a CGE analysis focusing mainly on industry.

A second problem is that negotiations concern bound tariffs or tariffs under the Most Favored Nation (MFN) regime, not applied tariffs. In principle, the applied tariff will be lowered if it exceeds the lowered level of the bound tariff. This implies that the level of effective liberalization of market access may vary widely across countries, given that the level of "binding overhang" is very contrasted, and in general far higher in developing countries than in developed countries. Another consequence is that the preference margins will be more than proportionately eroded: the higher the initial preference margin, the lower the rate of reduction in the applied tariff. However, treating these issues correctly would require to combine information about bound tariffs, MFN tariffs, and preferential treatments. This has never been made so far, to our knowledge. Walkenhorst and Dihel (2002) and OECD (2003), however, show the effect on MFN tariffs of a given liberalization of bound tariffs. In doing so, they assume that the resulting MFN tariff is the lowest among the initial MFN tariff and the final (lowered) bound tariff. These insightful studies highlight how imperfect and heterogeneous the pass-through from bound tariffs to MFN tariffs is. Nevertheless, they let uninformed the question of how MFN liberalization is transmitted to applied tariffs.

4. *Domestic support level.* Measuring domestic support is obviously important in dealing with agricultural liberalization, but it is problematic for several reasons. The WTO Aggregate measures of support (AMS) (used in Hoekman et al., 2002a, or in the ATPSM model, Vanzetti and Sharma, 2002), for instance, are computed on the basis of 1986-88 prices, the economic relevance of which is far from clear in 2003. In addition, such data, by definition, only includes supports belonging to the amber box. This means that the blue and green boxes are excluded from the analysis. Now, the decoupling of these supports is not complete: excluding them from the analysis is thus a source of understatement of the impact of domestic support. Although far from perfect, the Organisation of Economic Co-operation and Development (OECD) Producer support estimates (PSE) data seem to be a more reliable source, but they do not match WTO boxes, and they only cover OECD countries.

Their product coverage is not complete either (the OECD secretariat has gathered PSE data for a larger set of commodities than the ones published, but the data still exclude fruits, cotton and tobacco in some countries, for example). In any case, these data are lagging far behind the reality of the negotiations: the latter deal with domestic support in 2005 and afterwards. Hence the need to incorporate recent (or future) important changes, such the Agenda 2000 reform of the Common Agricultural Policy (CAP), the European Union (EU) enlargement (and the associated CAP's extension), the 2002 US Farm Bill. Such work is done in detail for the EU in studies devoted specifically to the Agenda 2000 reform or to the EU enlargement (see e.g. Bach and Frandsen, 1998, Jensen et al., 1998, Frandsen and Jensen, 2000, Gohin et al., 2000, Brockmeier, et al., 2001); in existing CGE-based studies of multilateral liberalization, however, this does not use to be done,<sup>3</sup> with the exception of Francois et al. (2002), who account for the Agenda 2000 reform and the EU enlargement. Specialised, agricultural partial equilibrium models, are also based on 1997 to 2000 data. Some of them, however, take into account in their baseline the above-mentioned planned changes in domestic support. This is in particular the case of the FAPRI modeling system the baseline of which incorporates a very detailed information on support policies and their planned evolution.

5. *Domestic support modeling.* Following Bach and Frandsen (1998), the literature on the impact of the EU enlargement and the Agenda 2000 reform has stressed the importance to model properly the CAP tools, i.e. not to rely on their price-wedge equivalents, that are likely to be misleading in many instances. However, this is not used in existing studies on multilateral liberalization, except in the FAPRI modeling system. And, for instance, FAPRI (2002) shows that the impact of a removal domestic support on the world price of wheat is negligible, when taking into account the set-aside requirements in European wheat. Decoupling is never complete, and recent estimates suggest that even "decoupled" payments have a positive impact on output, given their role on reducing risk (see Adams et al, 2001, FAPRI, 2002, Gardner, 2002). In this paper, relying on these empirical estimates, we treated 30% or decoupled payments as having an output subsidy like impact.
6. *Supply response.* The flexibility of supply response may strongly influence the assessed impact of a liberalization. In partial equilibrium approaches, one seldom accounts for the competition between sectors for the use of production factors. In particular, the total output of agricultural sectors might be strongly constrained by the level of land supply, and an increased output in one sector raises, *ceteris paribus*, the opportunity cost of land for other agricultural sectors. In CGE models, it is often assumed that land supply is exogenous (this assumption is made in all the above-mentioned CGE assessments of the Doha Round, with the exception of Beghin et al., 2002). In addition, the mobility of capital is generally assumed to be perfect in the medium- or long-run. As far as land is concerned, the mobility is generally assumed to be imperfect, and modeled through a CET function. The mobility of labor is generally assumed to be perfect across sectors, but this not necessarily well-suited: agriculture requires specific skills, and the rural-urban mobility of labor force is limited. Ignoring this is likely to lead to overstate the impacts induced on agricultural output and

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<sup>3</sup> All recent CGE-based assessments of multilateral liberalization use the GTAP database, in its version 5.0 for the most recent, where domestic support is described based on OECD's PSE support data, except for price market support, that is described through tariffs and export subsidies.

labor force, and to understate the induced changes in farmer incomes.

Finally, an arguable assumption generally made in CGE models is that developing economies behave in a similar way as developed economies. This implies, for instance, that any raise in agricultural prices would lead to an increase in rural labor force, at the expense of the urban one. This is inconsistent with the fact that rural depopulation is in practice an irreversible evolution. The approach used a decade ago in the RUNS model (Burniaux and van der Mensbrugge, 1990), based on a rural-urban migration function à la Harris and Todaro (1970), is more consistent in this respect: it takes into account the underlying trend of rural depopulation, and it assumes an imperfect rural-urban mobility. However, we argue that the large asymmetry, in most developing countries, between the agricultural sector and the rest of the economy, would justify modeling them as dual economies.

7. *Demand response.* Agricultural goods are frequently considered by specialists as homogenous goods, and this is indeed by far the most usual assumption in agricultural, partial equilibrium models. In contrast, CGE models use to treat agricultural goods as strongly differentiated goods, with rather low elasticities of substitution. The GTAP model uses elasticities of substitution between domestic and foreign goods averaging 2.3 in agriculture, while elasticities between foreign goods reach twice this level. This level is surprisingly low, compared to the assumptions made in partial equilibrium models, but also compared to manufactured goods (for which this elasticity is higher, reaching 10.4 for domestic-foreign sourcing in motor vehicles, while these goods are generally recognized to be more differentiated), and to recent econometric estimates (see e.g. Hummels, 1999, Herkel-Rousse and Mirza, 2002, Romalis, 2002). The estimates by Romalis (2002) suggest a possible explanation for this: the measure of the price-elasticity of trade flows might be strongly blurred by the difficulty to measure adequately trade protection. He shows that measuring protection based on paid duties, instead of scheduled ones, strongly increases the value of the resulting estimated elasticities (they reach 10 to 12 in this cases, for industrial goods). Let us add that, as soon as agriculture is concerned, the widespread use of quantitative barriers<sup>4</sup> is also likely to blur the estimates of trade elasticities. This might explain why back-casting exercises (see e.g. Gehlhar, 1996, or Liu et al., 2003) are rather consistent<sup>5</sup> with the low values used for substitution elasticities: they are consistent with the measurement error in protection. Since we have made our best to reduce this measurement error in protection, it is consistent here to assume higher levels of substitution elasticities. However, for the sake of comparability, the values used here for the substitution between all suppliers are the same as the ones used in the GTAP model between foreign suppliers.

This paper aims at evaluating the impact of the Harbinson proposals of March 2003, for a compromise on market access, domestic support and export subsidies in the agricultural sector, , with a methodology which takes into account three priorities:

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<sup>4</sup> Until the URAA, at least. However, the TRQs used since then are also frequently alike quantitative barriers, at least when the outside quota tariff rate is prohibitive.

<sup>5</sup> In fact, Gehlhar's study is consistent with elasticities approximately twice as high as those used in GTAP, but this level remains rather low.

- (i) measuring accurately policy variables, with firstly a complete integration of trade preferences and regional agreements. Our data are based on MAcMaps for 2001. Secondly, as far as domestic support is concerned, we have constructed an original dataset which accounts for EU enlargement and the full implementation of EU and US policies (Agenda 2000, and the present US farm bill) Finally, we modelize land set-aside programs and an incomplete decoupling of subsidies.
- (ii) Modelling adequately economic responses; for the supply response we suppose an endogenous land supply (with the opposition of land-constrained and not land-constrained countries), an imperfect labour mobility between agriculture and other sectors and an imperfect land mobility. As far as demand response is concerned, we study the sensitivity of our results, by a value modification of elasticities of substitution between foreign suppliers.
- (iii) Finally we try to address developing countries' specific issues; we include a dual labour '*à la Lewis*' by opposing efficiency wages in industry and services, and competitive wages in agriculture. The modelling we adopted for developing countries accounts for a disequilibrium on the labor market, so that the unemployment appears as disguised in the rural sector (Lewis, 1954). This notably implies that the rural labor force is determined as a residual, once urban employment is determined. A fundamental issue is also to specify a consistent geographical breakdown of developing countries, which tackles the hierarchy of trade preferences and the distinction between net food importers and exporters. With respect to this last issue, we isolate the group of Cotonou - African countries.

## **Description of the model: main aspects**

The model used in this study stems from the MIRAGE model, described in Bchir et al. (2002a, b), with several modifications in order to tackle more properly agricultural issues.

MIRAGE is a multi-sector, multi-region computable general equilibrium (CGE) model, devoted to trade policy analysis. Agricultural sectors are perfectly competitive, but industry and market services are not. Imperfect competition is described in an oligopolistic framework *à la Cournot*. It accounts for horizontal product differentiation linked to varieties, but also to geographical origin (nested Armington – Dixit-Stiglitz utility function). A new calibration procedure allows the available information on these aspects to be used efficiently. A notion of vertical product differentiation is introduced in industrial sectors, by distinguishing two quality ranges, according to the country of origin of the product. This is not the case, however, for agriculture goods and processed food.

Although MIRAGE is a dynamic, sequential model, it is used here, for the sake of simplicity, only for static comparative simulations. The modeling of capital is accordingly simplified, assuming capital stock to be perfectly mobile across sectors. FDI is not accounted for either, in contrast to the standard version of MIRAGE. In terms of macro-economic closure, investment is savings-driven, and the current balance is assumed to be exogenous.

The main other modifications introduced to the model are described below.

## **Factor endowments and factor mobility**

Trade policy can modify the capital stock in the economy, through its impact on income or on the savings rate. This is not taken into account here, since we assume capital stock to be constant.

CGE models generally assume land endowment to be constant for each region. However, land in such models shall be understood as land used for culture or cattle. As such, its surface may evolve when there are incentives for it, and omitting this is likely to induce an understatement of the supply response. This is why land supply is assumed to be endogenous, behaving as an isoelastic function of the real return to land (as in the LINKAGE model, see van der Mensbrugge, 2001). Regions are accordingly classified either as land-constrained (supply elasticity is then equal to 0.25), or not (elasticity equal to 1).<sup>6</sup> This is intended to reflect the fact that the potential for agricultural output can vary widely across country, notably depending on their capacity to increase their surface of arable land.

Developing countries are assumed to have dual economies. The modern sector (industry and services) pays an efficiency wage to unskilled workers, above their marginal productivity. It is thus faced with an infinitely elastic supply of unskilled labor. The primary sector (i.e., agriculture), in contrast, pays a competitive wage, and the supply of unskilled labor it is faced with is set as a residual, once the modern sector has set its unskilled labor employment level.

Land mobility across agricultural sector is assumed to be imperfect, with a transformation elasticity equal to 0.5.

## **Protection and domestic support data**

The model uses GTAP 5.2 database (see Dimaranan and Mac Dougall, 2002), but specific data are used to describe tariff barriers as well as agricultural domestic support.

Trade barriers are described by the *MAcMaps* database (see Bouët et al., 2001, 2002), that provides with a measure of ad-valorem tariffs, and of the ad-valorem equivalent of specific tariffs, tariff quotas, prohibitions and anti-dumping duties, at the bilateral level, for 137 countries with 220 partners. Preferential agreements are taken into account in a quasi-exhaustive way. This information is available at the HS6 or tariff line level, according to the country (i.e. at least for 5 000 products).<sup>7</sup> This description of trade barriers, besides its precision, preserves the bilateral dimension of the information, contrarily to what is commonly done in applied modeling. This information refers to applied protection in 2001, and it replaces the information given in the GTAP database. It takes into account the effect of a full implementation of the Uruguay Round Agreements.

The GTAP database includes data on agricultural support for OECD countries in 1997. This information is most valuable but, as outlined before, it lags far behind the reality of negotiations. This is why we have built an original dataset on agricultural domestic support in

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<sup>6</sup> These values are the same as in the Linkage model. We thank Dominique van der Mensbrugge for providing us information and advice on this point.

<sup>7</sup> In a future draft, scenarios of border protection liberalization will be computed at the HS6 level.

the EU and in the US, mainly based on OECD PSE dataset for the year 2001, (including unpublished data for non standard PSE commodities). In addition, we take into account the effect of the EU enlargement, of a full implementation of the Agenda 2000 reform in the EU, and of the 2002 US Farm Security and Rural Investment (FSRI) Act in the US (see the Appendix for details).

This information about agricultural support is considered through a pre-experiment simulation: from the GTAP dataset, with MAcMaps protection, a new equilibrium is computed, assuming that domestic support is shifted to its new level. The resulting equilibrium corresponds to a notional world economy, based on 1997 data, but incorporating (in addition to 2001 data on market access) the above mentioned changes in agricultural policies.

Subsidies are directly introduced in the model as price wedge, either on output, on variables inputs, on land or on capital. In addition, market price support is modeled through the combination of tariffs and of export subsidies.<sup>8</sup>

Set aside is taken into account in the US and the EU, and modeled as a negative shock on the productivity of land (see Bach and Frandsen, 1998).

### ***Geographical and sectoral breakdown***

From the geographical point of view, priority is given to estimating impact of liberalising agricultural policies in the two highly interventionist zones (USA and EU) which have huge trade preferences, on differentiated groups of developing countries. We concentrate attention to the impact on African Cotonou countries on the one hand, and on the Cairns group on the other hand.

As a matter of fact, the world is divided into 9 regions:

- 1 - the European Union, enlarged to 15 countries;
- 2 – the United States of America (with American Samoa, Guam and Northern Mariana Islands);
- 3 – the African Cotonou countries (called ACP);
- 4 – the Cairns group (with 19 countries: Brazil, Argentina... but also Australia, Canada and New Zealand);
- 5 – China (Hong Kong included);
- 6 – the former Soviet Union (called FSU);
- 7 – Developed Asia, called DA, (including Japan and South Korea);
- 8 – the European periphery, called Periph, with the EFTA, Romania, Bulgaria, Croatia, Turkey and the Maghreb countries.
- 9 – the Rest of the World.

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<sup>8</sup> Work is under way for an explicit modeling of the link between intervention price, export subsidy, and ceilings on the latter. Results will be presented in a future version of the paper.

From the sectoral point of view, economic activity is shared between 32 sectors with a pre-eminence of agricultural and agri – food sectors (23 – see Table 1).

**Table 1: Sectoral breakdown**

Sector	Abbrev.	Type of competition	Category	Subsidized exports
Paddy rice	PadRice	Perfect	Agriculture	EU
Wheat	Wheat	Perfect	Agriculture	EU
Other cereals	Cereals	Perfect	Agriculture	EU
Vegetable and fruits	VegFruits	Perfect	Agriculture	EU
Oil seeds	OilSeeds	Perfect	Agriculture	
Sugar (Cane & Beet)	SugarCB	Perfect	Agriculture	
Fibers	Fibers	Perfect	Agriculture	
Crops	Crops	Perfect	Agriculture	
Living animals	LivAnimals	Perfect	Agriculture	
Animal products	AnimProd	Perfect	Agriculture	
Raw milk	RawMilk	Perfect	Agriculture	
Wool	Wool	Perfect	Agriculture	
Forestry	Forestry	Perfect	Agriculture	
Fishing	Fishing	Perfect	Agriculture	
Other primary products	Primary	Perfect	Other Primary	
Meat	Meat	Perfect	Food products	EU
Meat products	MeatProd	Perfect	Food products	EU / US
Fats	Fats	Perfect	Food products	
Dairy products	Dairy	Perfect	Food products	EU / US
Processed rice	ProcRice	Perfect	Food products	
Sugar (processed)	Sugar	Perfect	Food products	EU
Other food products	Food	Perfect	Food products	EU
Beverage & Tobacco	BevTobacco	Perfect	Food products	EU
Trade and transport service	TrT	Perfect	Services	
Textile	Textile	Imperfect	Industry	
Clothing	Clothing	Imperfect	Industry	
Leather	Leather	Imperfect	Industry	
Wood products	WoodProd	Imperfect	Industry	
Other industrial products	AutreIndus	Imperfect	Industry	
Chemical products	Chemicals	Imperfect	Industry	
Equipment goods	Equipment	Imperfect	Industry	
Other services	AutreSer	Imperfect	Services	

## Experiment design and resulting impact in terms of applied protection

The experiments simulated follow the March 2003 revised Harbinson proposal ("Harbinson 1 ½"), that has by now become the main negotiation basis (WTO 2003). As far as border protection is concerned, the average cuts mentioned in the Harbinson proposal are applied to the ad valorem equivalent (computed according to *MAcMaps* methodology, see Bouët et al., 2002) of the sum of ad valorem tariffs, specific tariffs and tariff rate quotas. The calculation is first made for each product, at the HS-6 level (5,000 products approximately). The liberalized ad valorem equivalent tariff obtained as a result of these calculations are then aggregated in the models' classification, in order to make it possible to carry out simulations. The special and differential treatment is applied to the regions classified as developing economies, that is to every region, except the EU, the US and developed Asia.

As to domestic support, there is no point about special and differential treatment, since, in our data, only OECD countries have domestic support policies (i.e. other than through border protection). The distinction between blue and amber boxes cannot be made either, since our data do not match this typology. As a consequence, a cut of 55% is applied to domestic support (instead of 60% for the amber box, and 50% for the blue box in the Harbinson proposal).

In practice, the liberalisation of domestic support and of border protection are first considered separately, and then jointly. Four scenarios are considered:

- Widespread liberalization of border protection (**WBP**). This scenario consists in a liberalization of border protection (ad valorem and specific tariffs, tariff rate quotas) for agricultural products (including processed foods) in each region, applying the Harbinson proposal at the HS-6 product level.
- Domestic support liberalization (called **DS**). In this scenario, domestic support is reduced by 50% in the US, the EU and Developed Asia. This reduction is applied to each subsidy rate (tax rates are not modified when they are positive) in agriculture. This reduction is also applied to the rate of land set-aside.
- Harbinson proposal (**Harb**).
- Harbinson proposal, doubled elasticities (**Harb, Sigma x 2**). Since we considered Armington elasticities to be understated, another simulation is run, using doubled values for the Armington elasticities.

### **Border protection**

Harbinson proposed a differentiated reduction in border protection, taking into account Special and Differentiated Treatment. For industrial countries, the reduction is very progressive:

- if tariffs are greater than 90%, a reduction of 60%;
- if tariffs are equal to or less than 90% and greater than 15%, a reduction of 50%;
- if tariffs are equal to or less than 15%, a reduction of 40%.

The reduction is much less severe for developing countries (the definition of developing countries is the one adopted by WTO):

- if tariffs are greater than 120%, a reduction of 40%;
- if tariffs are equal to or less than 120% and greater than 60%, a reduction of 35%;
- if tariffs are equal to or less than 60% and greater than 20%, a reduction of 30%;
- if tariffs are equal to or less than 20%, a reduction of 25%.

Market access in the enlarged European Union and in the US is presented in Table 2 and Table 3. Simple averages are given in the last row and the last column. In both areas, protection is concentrated in dairy products, wheat sugar, meat, cereals and live animals. In these sectors, protection is very high in Europe. Its trade policy has conceded extensive preferences to Cotonou countries: the simple average of protection rates granted to Cotonou countries is 5.0%, versus 31% for the Cairns group and 30% for the US. Of course, these figures are very high due to the number of agricultural sectors (about the question of aggregation and proper weighting, see Bouët et al 2003). In the US, agricultural protection is much lower than in Europe, but the industrial protection is slightly higher (see textile, clothing and leather), as confirmed by other studies.

**Table 2: Market access in European Union (25) before the Doha Round (AVE tariff, in %)**

	Cotonou	CAIRNS	China	FSU	EU's Periph	RoW	Dvd Asia	US	EU simple average
Sector									
Dairy	32.1	68.4	37.7	36.2	72.6	31.4	74.5	77.7	<b>53.8</b>
Wheat	5.1	95.9	85.0	86.3	139.4	131.7	84.0	92.8	<b>90.0</b>
Sugar	31.2	77.2	141.2	26.5	18.7	45.6	172.3	32.2	<b>68.1</b>
Meat	8.3	95.4	86.0	79.5	78.7	96.8	25.1	112.0	<b>72.7</b>
ProcRice	6.5	24.3	20.8	18.5	8.9	18.0	21.9	26.4	<b>18.2</b>
Cereals	0.0	121.8	127.3	98.8	110.6	126.5	121.1	176.9	<b>110.4</b>
PadRice	23.8	27.7	24.0	17.8	23.3	25.2	25.6	28.8	<b>24.5</b>
MeatProd	10.0	53.4	38.5	29.0	13.0	64.1	74.8	60.5	<b>42.9</b>
BevTobac	12.7	8.6	9.7	3.7	15.9	5.6	12.4	23.3	<b>11.5</b>
LivAnima	0.0	136.6	177.1	9.0	105.6	150.6	1.2	52.8	<b>79.1</b>
VegFruit	12.8	85.5	30.7	5.9	9.2	55.3	48.4	74.5	<b>40.3</b>
Clothing	0.0	10.5	11.2	10.3	0.0	6.3	11.1	10.9	<b>7.6</b>
Food	1.4	45.2	19.1	6.7	12.3	16.4	21.8	58.7	<b>22.7</b>
Fats	0.0	3.3	4.2	1.5	11.5	1.6	8.3	4.3	<b>4.4</b>
Leather	0.0	5.2	4.7	3.5	0.1	4.8	7.2	5.3	<b>3.8</b>
SugarCB	5.4	29.9	61.4	220.9	58.8	25.4	20.2	19.1	<b>55.1</b>
OilSeeds	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Crops	0.7	3.0	2.7	1.0	6.4	1.1	3.2	4.3	<b>2.8</b>
Textile	0.0	8.0	9.7	7.4	0.5	6.6	8.7	7.8	<b>6.1</b>
Fibers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
WoodProd	0.0	0.7	0.6	0.4	0.2	0.1	0.8	1.2	<b>0.5</b>
AnimProd	0.0	6.8	2.8	0.1	1.5	2.3	0.8	2.8	<b>2.2</b>
Fishing	0.1	9.6	6.3	4.7	25.6	9.3	8.4	9.1	<b>9.1</b>
Wool	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
AutreInd	0.1	4.0	2.9	1.1	0.4	1.3	4.5	2.8	<b>2.1</b>
Chemical	0.0	3.9	3.9	4.7	0.7	1.8	4.4	3.8	<b>2.9</b>
Equipmen	0.0	1.4	1.1	0.4	0.1	0.2	2.1	1.6	<b>0.9</b>
Primary	0.0	0.8	2.1	1.2	0.3	0.1	2.4	2.4	<b>1.2</b>
Forestry	0.0	0.2	0.4	0.0	0.0	0.3	0.2	0.2	<b>0.2</b>
AutreSer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Simple average	5.0	30.9	30.4	22.5	23.8	27.6	25.5	29.7	<b>24.4</b>

(Source: MacMaps for year 2001 and authors' calculations)

**Table 3: Market access in United States before the Doha Round (AVE tariff, in %)**

	Cotonou	CAIRNS	China	FSU	EU's Periph	RoW	Dvd Asia	UE_25	US simple average
Sector									
Dairy	56.6	46.1	15.9	22.4	51.6	22.0	50.5	47.9	<b>39.1</b>
Wheat	0.6	0.7	2.3	2.6	4.9	0.9	1.7	2.2	<b>2.0</b>
Sugar	8.5	68.6	85.8	1.3	10.1	11.7	84.3	74.3	<b>43.1</b>
Meat	5.1	22.2	17.8	3.6	5.0	8.0	7.1	22.7	<b>11.4</b>
ProcRice	0.0	1.8	6.3	6.4	2.6	2.0	6.5	5.5	<b>3.9</b>
Cereals	2.1	0.7	0.6	1.9	0.1	0.4	1.0	0.8	<b>1.0</b>
PadRice	0.0	2.1	3.0	2.9	2.1	1.6	2.6	2.8	<b>2.1</b>
MeatProd	0.8	0.8	4.5	1.8	2.3	0.0	0.9	1.1	<b>1.5</b>
BevTobac	4.0	3.2	8.9	0.3	7.4	3.6	7.7	5.7	<b>5.1</b>
LivAnima	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	<b>0.0</b>
VegFruit	0.5	0.9	10.5	10.2	2.7	0.5	3.7	3.0	<b>4.0</b>
Clothing	11.8	12.0	12.0	14.3	12.3	9.6	14.1	12.3	<b>12.3</b>
Food	0.8	9.6	10.6	0.3	6.3	2.8	10.5	18.0	<b>7.4</b>
Fats	0.8	1.9	3.7	2.0	1.1	0.7	4.2	4.7	<b>2.4</b>
Leather	1.2	9.4	14.8	4.0	8.2	10.0	10.1	8.7	<b>8.3</b>
SugarCB	0.1	0.8	1.6	0.2	0.2	0.2	0.4	0.1	<b>0.5</b>
OilSeeds	0.7	8.7	84.2	0.2	8.1	20.7	6.4	4.5	<b>16.7</b>
Crops	7.8	9.6	5.9	1.4	29.1	3.1	4.4	8.9	<b>8.8</b>
Textile	12.6	8.0	10.3	9.1	11.5	8.6	10.8	9.6	<b>10.1</b>
Fibers	7.4	25.7	26.6	29.0	28.9	25.2	23.5	25.6	<b>24.0</b>
WoodProd	0.1	0.2	0.9	0.2	0.4	0.1	0.5	0.4	<b>0.3</b>
AnimProd	0.0	0.3	0.3	0.0	0.5	0.3	0.2	0.2	<b>0.2</b>
Fishing	0.2	0.1	0.4	0.0	0.1	0.3	0.1	0.4	<b>0.2</b>
Wool	0.0	0.0	0.9	0.4	0.1	4.4	0.6	0.5	<b>0.9</b>
AutreInd	0.1	0.4	2.1	0.3	1.3	0.2	1.7	2.3	<b>1.1</b>
Chemical	0.2	1.0	4.6	0.3	2.5	1.7	3.4	3.2	<b>2.1</b>
Equipmen	0.9	0.6	2.4	0.4	1.4	0.1	2.0	1.4	<b>1.2</b>
Primary	0.0	0.3	2.8	0.4	0.4	0.1	3.1	1.5	<b>1.1</b>
Forestry	0.0	0.0	0.5	0.0	0.0	0.0	0.5	0.1	<b>0.2</b>
AutreSer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	<b>0.0</b>
Simple average	<b>4.1</b>	<b>7.9</b>	<b>11.3</b>	<b>3.9</b>	<b>6.7</b>	<b>4.6</b>	<b>8.8</b>	<b>9.0</b>	<b>7.0</b>

(Source: *MAcMaps* for year 2001 and authors' calculations)

Table 4 and Table 5 illustrate the impact of Harbinson 1½ on this level of protection: these figures are changes in rates of protection. It means for instance that while Cotonou dairy products are taxed by a 32.1% duty before the Round, Harbinson 1½ reduces this duty to 30.1%. As Harbinson 1½ only deals with agriculture, industrial sectors are removed from Table 4 and Table 5.

The essential result of Harbinson 1½, as indicated in tables 4 and 5, is an erosion of trade preferences for Cotonou countries. Their market access in Europe improves by only 1 point (1 point also in the US) while duties decrease by 13 points for the Cairns group, China and the US. The erosion of Cotonou preferences in USA is much lower. Market access in USA improves by 3 points for the Cairns group, 4 points for European Union and Other Industrialized Countries, 5 points for China. Obviously, it is related to higher initial trade preferences in European Union.

**Table 4: Impact of Harbinson 1 ½ on European market access (changes in percentage points)**

Sector	Cotonou	CAIRNS	China	FSU	EU's Periph	RoW	Dvd Asia	US	EU simple average
Dairy	-2	-32	-17	-17	-37	-13	-39	-39	<b>-24</b>
Wheat	-3	-53	-48	-48	-77	-68	-48	-51	<b>-49</b>
Sugar	-7	-8	-59	-11	-8	-5	-87	-15	<b>-25</b>
Meat	0	-39	-29	-27	-36	-37	-10	-52	<b>-29</b>
ProcRice	0	-2	-2	-1	-1	-1	-2	-2	<b>-1</b>
Cereals	0	-66	-59	-53	-61	-71	-66	-99	<b>-59</b>
PadRice	0	0	0	0	0	0	0	0	<b>0</b>
MeatProd	-3	-29	-20	-14	-5	-36	-43	-34	<b>-23</b>
BevTobac	-7	-3	-2	-1	-2	-2	-2	-1	<b>-3</b>
LivAnima	0	-78	-105	-3	-60	-87	0	-31	<b>-45</b>
VegFruit	-7	-49	-17	-2	-5	-30	-27	-43	<b>-22</b>
Food	0	-19	-5	0	-2	-6	-4	-11	<b>-6</b>
Fats	0	-1	-1	0	-5	0	-3	-2	<b>-2</b>
SugarCB	0	-16	-33	-88	-1	-13	-6	-9	<b>-21</b>
OilSeeds	0	0	0	0	0	0	0	0	<b>0</b>
Crops	0	0	0	0	0	0	-1	0	<b>0</b>
AnimProd	0	-3	-1	0	-1	-1	0	-2	<b>-1</b>
Fishing	0	0	0	0	0	0	0	0	<b>0</b>
Total	-1	-13	-13	-9	-10	-12	-11	-13	<b>-10</b>

(Source: *MAcMaps* for year 2001 and authors' calculations)

**Table 5: Impact of Harbinson 1 ½ on US market access (changes in percentage points)**

Sector	Cotonou	CAIRNS	China	FSU	EU's Periph	RoW	Dvd Asia	UE_25	US simple average
Dairy	0	0	0	0	0	0	0	0	0
Wheat	0	0	0	0	0	0	0	0	0
Sugar	0	0	0	0	0	0	0	0	0
Meat	0	-1	-3	0	-3	-1	-4	-1	-2
ProcRice	-1	0	0	-1	0	0	0	0	-1
Cereals	0	0	0	0	0	0	0	0	0
PadRice	0	0	0	0	0	0	0	0	0
MeatProd	0	0	0	0	0	0	-1	-1	0
BevTobac	-33	-27	-9	-13	-31	-13	-30	-29	-23
LivAnima	0	0	0	0	0	0	0	0	0
VegFruit	0	0	-1	-1	0	0	-2	-2	-1
Food	0	0	0	0	0	0	0	0	0
Fats	0	-5	-4	0	-3	-1	-5	-7	-3
SugarCB	0	0	0	0	0	0	0	0	0
OilSeeds	0	0	0	0	0	0	0	0	0
Crops	0	-13	-11	-2	-3	-3	-4	-14	-6
AnimProd	0	0	0	0	0	0	0	0	0
Total	-1	-3	-5	-1	-2	-1	-4	-4	-3

(Source: *MAcMaps* for year 2001 and authors' calculations)

## Main results

### *Liberalization of border protection*

Let us examine firstly the impact of a border liberalization scenario: they are illustrated on tables 6 to 8. Table 6 gives the evolution of macroeconomic variables (welfare, GDP, termes of trade, global and agricultural exports and imports...).

**Table 6: Evolution of macroeconomic variables in case of WBP scenario**

	EU_25	US	DA	ACP	RoW	China	CAIRNS	Periph	FSU	World
Welfare	0.39	0.01	0.43	-0.17	0.18	0.39	1.03	2.10	-0.14	0.26
GDP (volume)	0.26	0.01	0.30	-0.07	0.06	0.14	0.35	1.47	-0.10	
Terms of trade	0.28	0.12	-0.45	-0.60	-0.14	0.14	0.49	-0.91	-0.37	
Real effective exchange rate	0.04	0.14	-0.57	-0.28	0.11	0.21	0.64	-1.08	0.07	
Unskilled real wages	-0.63	0.73	-0.80	-0.25	0.18	0.25	1.64	-0.66	-0.14	
Agricultural real wages	-2.06	1.92	-2.64	-1.12	0.81	1.05	7.07	-4.17	-0.23	
Non agricultural unskilled real wages	0.24	-0.02	0.31	0.00	0.00	0.00	0.00	1.51	-0.09	
Skilled real wages	0.37	-0.11	0.48	0.14	0.08	0.16	0.17	2.84	-0.16	
Real return to capital	0.36	0.02	0.29	0.05	0.05	0.14	0.25	1.82	-0.07	
Real return to natural resources	0.29	-0.38	-1.83	0.38	-0.06	-0.09	-0.41	3.07	-0.20	
Real return to land	-0.55	0.95	-5.56	0.05	-0.22	-0.49	0.18	-0.00	-0.16	
Exports (volume)	2.31	1.24	1.74	0.87	1.54	1.06	2.96	4.46	0.40	2.01
Imports (volume)	2.66	1.07	2.14	0.80	1.51	1.03	2.94	4.58	0.71	
Agricultural exports (volume)	31.81	23.45	30.79	0.85	14.58	20.93	29.40	32.59	5.47	25.32
Agricultural imports (volume)	33.59	11.67	26.91	12.30	14.34	7.85	43.12	58.21	3.64	
Tariff revenue (points of GDP)	0.02	-0.01	-0.10	-0.12	-0.06	-0.02	0.04	-0.02	-0.11	

Note: Unless otherwise specified, all changes are expressed in %.

World welfare increases by 0.26% under the WBP scenario. Agricultural exports strongly increase worldwide (by 25%), but they are barely changed for ACP countries (+0.85%). Welfare increases in all regions (with a strong relative gain in the European periphery), except the FSU. Welfare gains are however minimal in ACP countries and in the US. Terms of trade are positively affected in case of net exporting regions (the Cairns group, the US, the EU) due to a general increase in world agricultural prices, and in particular in dairy products, wheat and paddy rice. Only three agricultural products' world prices are negatively affected in this case (see Table 7 – evolution of world prices in case of sugar cane, sugar beet and raw milk are not significant because they are nearly not traded).

Amongst the returns to primary factors, agricultural real wages and the real return to land are the most strongly affected by this global liberalization. They are positively oriented in the Cairns group (+7% for the agricultural labor, +0.2% for landowners), negatively in Europe, the rest of the world, the European periphery, the Former Soviet Union and especially Developed Asia (-2.6% for agricultural labor, -5.6% for landowners).

**Table 7: World import price changes (in %)**

	Scenario			
	WBP	DS	Harb	Harb $\sigma \times 2$
Paddy rice	3.80	11.74	14.54	14.26
Wheat	5.24	6.39	10.12	11.03
Cereal grains nec	1.89	7.34	8.47	9.22
Vegetables, fruit, nuts	0.89	0.54	1.22	1.72
Oil seeds	1.04	7.81	8.85	8.80
Sugar cane, sugar beet(*)	0.20	-1.29	-0.96	-0.73
Plant-based fibers	0.01	11.05	11.01	10.86
Crops nec	0.06	1.34	1.39	1.21
Cattle, sheep, goats, horses	0.90	6.64	7.71	8.49
Animal products nec	-0.18	1.81	1.58	1.42
Raw milk (*)	-1.71	-3.04	-4.05	-5.17
Wool, silk-worm cocoons	1.88	0.70	2.66	4.03
Forestry	0.12	0.26	0.33	0.35
Fishing	0.11	0.32	0.39	0.41
Meat: cattle, sheep, goats, horse	0.81	5.19	6.04	6.51
Meat products nec	-0.17	3.15	2.94	2.65
Vegetable oils and fats	0.30	3.33	3.65	3.95
Dairy products	11.83	30.51	31.28	25.80
Processed rice	1.04	1.29	2.29	3.06
Sugar	2.27	9.53	10.03	10.55
Food products nec	1.15	4.01	3.37	2.71
Beverages and tobacco products	0.20	0.42	0.24	0.02
Primary products	0.08	0.11	0.16	0.20
Textiles	-0.06	0.60	0.52	0.62
Wearing apparel	-0.05	0.45	0.37	0.48
Leather products	0.02	0.48	0.47	0.62
Wood products	0.19	0.16	0.36	0.41
Chemical, rubber, plastic products	0.01	-0.03	-0.03	0.00
Machinery and equipment nec	0.02	-0.08	-0.07	-0.06
Other Industries' products	0.03	-0.02	0.01	0.00
Transportation and Trade	0.03	-0.01	0.01	0.03
Other Services	0.05	-0.09	-0.04	0.01

Note: (\*) International trade is virtually zero in this sector.

Evolution of exports in the WBP scenario is given in Table 8. Trade flows especially increase in the meat sectors (live animals and animal products), in the cereal sectors (wheat, rice...), in the

dairy products and sugar sectors. It reflects the high level of initial protective duties in these activities.

**Table 8: Evolution of exports in the WBP scenario (changes in %)**

	UE_25	US	DA	ACP	RoW	China	CAIR NS	Periph	FSU
Paddy rice	-61.5	47.6	35.9	62.2	9.2	15.2	86.8	102.2	37.8
Wheat	124.3	54.0	67.5	-0.6	66.4	124.7	52.4	236.7	131.5
Cereal grains nec	60.9	37.3	94.2	-2.1	74.4	-4.8	48.2	131.4	89.7
Vegetables, fruit, nuts	75.6	42.4	38.5	3.2	30.8	42.3	66.2	3.5	-16.2
Oil seeds	15.1	5.1	28.1	7.8	15.2	75.9	-1.0	18.0	11.9
Sugar cane, sugar beet	6.4	26.4	0.0	-7.6	16.0	-24.6	-23.2	3.9	23.4
Plant-based fibers	0.5	0.8	4.7	3.3	0.1	0.6	-3.6	7.6	0.1
Crops nec	50.4	-2.9	12.3	-1.5	-1.3	-3.4	-5.6	21.7	-10.5
Cattle, sheep, goats, horses	45.2	47.0	34.3	8.6	100.6	292.5	11.7	253.2	25.6
Animal products nec	55.0	0.1	23.5	-1.9	-5.2	9.1	-5.3	28.6	-9.2
Raw milk	129.7	102.2	690.3	71.5	61.3	56.5	31.3	77.8	27.0
Wool, silk-worm cocoons	1.7	3.3	11.0	5.4	0.9	-0.8	-4.2	11.1	2.1
Forestry	0.5	-0.0	5.4	1.1	0.6	0.7	-1.3	2.3	-0.1
Fishing	-1.7	-2.0	5.5	0.5	-1.0	-5.2	-3.8	0.7	-5.2
Meat: cattle, sheep, goats, horse	51.4	45.3	27.6	-5.0	47.2	17.7	63.7	128.5	24.5
Meat products nec	57.9	31.6	59.7	13.4	61.9	68.3	48.4	49.2	35.5
Vegetable oils and fats	15.6	7.0	34.5	2.4	5.0	3.9	6.1	33.0	-0.7
Dairy products	47.3	161.3	216.4	198.8	59.5	162.5	109.1	225.1	71.7
Processed rice	37.8	98.3	37.1	179.9	29.9	62.9	34.4	61.5	49.5
Sugar	22.5	79.2	85.5	20.3	19.9	54.9	61.5	55.5	54.3
Food products nec	7.5	36.7	26.9	-4.6	9.5	14.9	32.2	24.7	-6.2
Beverages and tobacco products	32.9	5.9	31.2	37.1	21.1	19.0	19.3	31.9	17.8
Primary products	0.6	0.1	1.4	0.6	0.0	0.1	-0.8	1.0	0.3
Textiles	-0.3	-1.1	1.2	1.6	0.5	0.2	-1.4	8.8	-1.4
Wearing apparel	-2.9	-1.6	1.7	3.3	0.6	0.2	-2.7	12.6	-3.2
Leather products	-1.7	-4.7	7.3	7.2	1.2	0.2	-3.1	7.6	3.2
Wood products	-0.5	-0.2	1.8	2.4	1.3	1.1	-0.6	4.4	-0.5
Chemical, rubber, plastic products	-0.3	-0.3	1.2	1.6	0.7	0.5	-0.7	3.2	0.2
Machinery and equipment nec	-0.1	-0.9	1.8	2.5	0.9	0.5	-1.1	3.0	-0.0
Other Industries' products	-0.1	-0.9	1.8	1.9	0.8	0.6	-1.1	2.8	-0.0
Transportation and Trade	0.2	-0.5	1.2	1.1	0.4	0.1	-0.6	1.9	0.1
Other Services	0.3	-0.3	1.0	1.2	0.5	0.4	-0.4	1.6	0.3

### ***Domestic support liberalization:***

In this scenario (called DS), domestic support is reduced by 55% in the US, the EU and Developed Asia. This reduction is applied to each subsidy rate (tax rates are not modified when they are positive) in agriculture. This reduction is also applied to the rate of land set-aside.

The lowering of price supports involves a strong increase of world prices in some sectors (up to +10% or more in paddy rice, plant-based fibers, and dairy products). It mainly reflects the increase of the cost of production in the liberalizing countries. World agricultural exports remain unchanged, but European and US exports are negatively affected. Agricultural world market shares are gained by ACP countries, the Cairns group and the Former Soviet Union.

The cut in domestic support only benefits those economies that decrease their farm support. This result is surprising. It is due in part to the price increase in the EU and the US agricultural exports: since the Armington elasticities are assumed to be rather low, this means that importing countries value these particular varieties and, as a consequence, suffer from their price increase.

In the EU, US and developed Asia, the gain is due primarily to a better allocation of resources. Asian developed countries are an exception mainly because domestic support is not the main supporting tool in favor of agriculture. As they are net importers of agricultural products, the better allocation of resources is therefore not sufficient to compensate for the significant deterioration of their terms of trade. The main effect on exports is in the EU and the US, because of their high initial level of domestic support.

Agricultural wages are reduced in the EU as well as in the US, but they rise in the rest of the world, particularly in the developing countries (Rest of World, Cairns, China and ACP Africa). Killed wages also increase in developing countries, with the exception of ACP Africa where they stay stable.

Domestic support in the EU and US is often seen as detrimental to exports of developing countries, in particular in the sugar and cotton sector. The results presented in Table 10 suggest that a decrease in domestic support could indeed lead to higher export from ACP countries in the cotton (Crops nec) sector, but that the Cairns group and China would gain a larger market share in the sugar sector.

**Table 9: Evolution of macroeconomic variables in case of DS scenario**

	EU_25	US	DA	ACP	RoW	China	CAIR NS	Periph	FSU	World
Welfare	0.51	0.02	-0.21	-1.34	-1.17	-0.69	-0.39	-1.21	-0.57	0.16
GDP (volume)	0.33	0.02	-0.14	-0.42	-0.38	-0.23	-0.13	-0.81	-0.39	
Terms of trade	0.27	0.08	-0.35	-0.24	-0.13	0.15	0.30	-0.34	-0.90	
Real effective exchange rate	-0.59	-0.22	-0.11	0.86	0.63	0.28	0.47	0.34	0.53	
Unskilled real wages	-0.06	-1.43	0.08	0.28	0.18	0.02	0.28	-0.27	0.53	
Agricultural real wages	-1.02	-3.84	0.42	1.24	0.78	0.07	1.23	0.73	1.99	
Non agricultural unskilled real wages	0.53	0.08	-0.13	0.00	0.00	0.00	0.00	-0.86	-0.33	
Skilled real wages	0.94	0.21	-0.17	-0.79	-0.69	-0.33	-0.35	-1.46	-0.57	
Real return to capital	0.03	0.01	-0.15	-0.62	-0.58	-0.30	-0.11	-0.82	-0.42	
Real return to natural resources	1.40	1.04	0.66	-1.70	-1.34	-0.29	-0.86	-1.48	-1.01	
Real return to land	-15.40	-5.26	1.03	-0.10	0.42	0.61	0.27	0.48	1.15	
Exports (volume)	-0.71	-0.35	-0.18	-0.37	-0.58	0.00	0.21	-1.10	-0.91	-0.37
Imports (volume)	-0.82	-0.36	-0.22	-0.38	-0.58	-0.02	0.17	-1.15	-1.03	
Agricultural exports (volume)	-23.90	-7.27	2.25	3.22	1.25	4.64	6.35	-2.63	6.25	-5.19
Agricultural imports (volume)	0.57	-1.27	-1.70	-14.10	-12.90	-5.86	-9.81	-14.80	-12.10	
Tariff revenue (points of GDP)	-0.00	-0.00	-0.03	-0.04	-0.06	-0.03	-0.06	-0.32	-0.04	

Note: Unless otherwise specified, all changes are expressed in %.

**Table 10: Evolution of exports in the DS scenario (changes in volume, in %)**

	EU_25	US	DA	ACP	RoW	China	CAIRN S	Periph	FSU
Paddy rice	-70.8	-51.8	0.1	14.4	13.5	15.5	12.0	8.9	15.2
Wheat	-29.8	-14.6	1.5	-9.3	-3.6	14.0	11.1	10.1	4.6
Cereal grains nec	-50.0	-4.3	4.2	10.1	6.0	15.9	13.7	10.3	9.3
Vegetables, fruit, nuts	3.3	1.6	0.4	-5.7	-3.4	0.9	-1.8	-3.7	-7.7
Oil seeds	4.8	-16.7	2.4	13.4	11.2	15.4	13.0	10.1	5.8
Sugar cane, sugar beet	65.7	-14.6	0.0	-18.1	-17.0	6.4	10.2	-9.4	-0.3
Plant-based fibers	-42.4	-32.8	7.7	36.4	29.0	57.4	36.4	52.7	53.7
Crops nec	-3.4	1.0	5.1	3.8	2.8	3.5	4.4	4.1	3.2
Cattle, sheep, goats, horses	-59.3	16.4	68.5	22.9	35.2	51.0	17.0	66.4	33.3
Animal products nec	-8.8	0.8	2.6	3.9	6.6	10.0	6.9	10.9	5.3
Raw milk	120.8	-51.5	-37.4	-20.3	-22.6	-19.7	-22.1	-21.1	-22.3
Wool, silk-worm cocoons	4.6	-7.4	0.0	-0.9	-0.4	2.2	0.3	1.2	-1.6
Forestry	2.3	1.1	1.1	-2.5	-0.6	-0.7	-0.6	-1.3	-1.1
Fishing	4.0	1.2	0.8	-4.6	-0.4	0.7	-0.3	-1.5	-3.6
Meat: cattle, sheep, goats, horse	-52.9	-0.4	6.8	32.0	6.7	13.7	14.4	18.3	11.6
Meat products nec	-14.2	1.8	3.2	3.3	2.2	5.0	4.0	5.2	0.3
Vegetable oils and fats	-10.9	-9.1	-1.8	27.7	10.7	11.7	13.1	21.7	14.5
Dairy products	-62.5	4.0	13.4	1.6	-7.0	15.1	14.6	-79.4	-34.1
Processed rice	2.6	-4.8	0.2	2.3	1.7	4.7	3.3	0.6	1.7
Sugar	-66.3	-4.1	5.1	-12.4	0.8	6.9	6.9	-5.1	-1.3
Food products nec	-33.4	1.0	2.3	-2.6	0.3	2.8	2.0	-1.1	-0.9
Beverages and tobacco products	-0.2	1.9	2.1	-2.8	-2.9	0.9	-1.7	0.1	-2.8
Primary products	1.4	1.0	0.8	-1.0	-0.5	-0.1	-0.7	0.4	-0.8
Textiles	1.7	-0.5	1.9	-0.4	0.5	-0.5	1.7	-2.1	-0.6
Wearing apparel	3.7	0.7	1.8	-3.2	-0.6	-0.8	0.9	-3.5	-3.2
Leather products	2.0	0.4	1.4	-5.8	-1.0	-0.5	1.6	1.2	-8.9
Wood products	1.9	0.8	-0.0	-2.7	-0.6	0.2	-0.5	-1.8	-2.4
Chemical, rubber, plastic products	1.3	0.5	0.5	-0.4	-0.4	0.5	-0.4	-1.0	-1.7
Machinery and equipment nec	1.5	0.5	-0.3	-2.9	-1.0	0.4	-0.8	-1.4	-2.3
Other Industries' products	1.9	0.7	-0.2	-2.4	-0.8	0.2	-0.8	-1.3	-2.3
Transportation and Trade	1.1	0.3	-0.1	-1.3	-0.5	0.6	-0.4	-0.3	-1.4
Other Services	1.3	0.2	-0.1	-1.1	-0.4	0.3	-0.3	-0.5	-1.3

## Complete application of Harbinson 1 ½

We study now a complete application of Harbinson 1<sup>1/2</sup>, which means reduction in border protection, in domestic support and suppression of export subsidies, with a special and differential treatment.

The Harbinson proposal for a WTO agreement in agriculture would mainly benefit the Cairns group and the non-EY European countries. The welfare would nevertheless increase more in the EU than in the US, in percentage terms, but agricultural income and unskilled labor would deteriorate. The results are given in percentage in Table 11. Given the present level of trade, the Cairns group and the EU would be the main beneficiaries of an agreement, from a mercantilistic perspective (the agricultural exports). ACP countries would gain little, even though farm incomes would experience a significant increase. The increase in their agricultural exports (Table 12) would be limited, compared to those experienced by the Cairns group or the US. The scenario with higher Armington elasticities provides results that give another, perhaps more realistic benchmark in the simulation (Tables 13-14).

**Table 11: Evolution of macroeconomic variables in case of Harb scenario**

	EU_25	US	DA	ACP	RoW	China	CAIR NS	Periph	FSU	World
Welfare	0.84	0.06	0.23	-0.85	-0.56	-0.27	0.63	1.49	-0.43	0.42
GDP (volume)	0.55	0.05	0.16	-0.27	-0.18	-0.08	0.22	1.03	-0.30	
Terms of trade	0.30	0.21	-0.75	-0.60	-0.15	0.31	0.88	-1.10	-0.95	
Real effective exchange rate	-0.46	-0.11	-0.67	0.43	0.68	0.49	1.15	-0.85	0.37	
Unskilled real wages	-0.87	-0.78	-0.66	0.12	0.46	0.28	1.95	-0.52	0.31	
Agricultural real wages	-3.42	-2.16	-2.06	0.52	2.03	1.17	8.40	-3.20	1.28	
Non agricultural unskilled real wages	0.69	0.08	0.18	0.00	0.00	0.00	0.00	1.12	-0.27	
Skilled real wages	1.21	0.15	0.31	-0.35	-0.41	-0.18	-0.20	2.16	-0.45	
Real return to capital	0.34	0.04	0.15	-0.39	-0.38	-0.18	0.12	1.24	-0.31	
Real return to natural resources	1.59	0.73	-1.34	-0.88	-1.11	-0.40	-1.38	2.63	-0.67	
Real return to land	-16.30	-4.91	-4.82	-0.00	0.30	0.22	0.56	0.94	1.21	
Exports (volume)	1.81	0.91	1.54	0.90	1.25	1.12	3.14	3.46	0.12	1.73
Imports (volume)	2.05	0.74	1.90	0.78	1.20	1.07	3.09	3.54	0.36	
Agricultural exports (volume)	12.78	15.56	33.38	4.48	16.91	26.82	36.68	24.57	12.66	21.36
Agricultural imports (volume)	35.07	11.85	25.08	4.29	4.80	2.92	31.33	45.16	-2.48	
Tariff revenue (points of GDP)	0.02	-0.01	-0.12	-0.11	-0.08	-0.05	-0.00	-0.16	-0.11	

Note: Unless otherwise specified, all changes are expressed in %.

**Table 12: Evolution of exports in the Harb scenario (changes in volume, in %)**

	EU_25	US	DA	ACP	RoW	China	CAIRN S	Periph	FSU
Paddy rice	-59.5	-23.0	33.3	81.4	21.8	33.3	106.5	119.8	53.3
Wheat	121.9	32.3	65.6	-9.8	68.4	152.0	65.0	266.4	149.0
Cereal grains nec	7.4	30.1	100.7	7.3	83.7	7.9	65.9	154.2	110.7
Vegetables, fruit, nuts	87.2	43.8	38.3	-1.6	26.1	43.3	62.3	1.4	-19.9
Oil seeds	20.9	-12.6	32.2	21.5	29.3	105.7	11.3	29.5	19.3
Sugar cane, sugar beet	67.3	8.1	0.0	-25.9	-13.3	-21.2	-21.5	-6.6	24.0
Plant-based fibers	-42.5	-32.4	12.4	40.3	28.8	58.3	31.2	64.3	54.3
Crops nec	46.0	-1.8	17.7	2.3	1.5	-0.1	-1.4	26.6	-6.1
Cattle, sheep, goats, horses	-38.4	98.2	102.6	28.2	298.0	734.9	39.6	627.1	62.6
Animal products nec	42.0	1.0	26.4	2.0	0.8	19.0	0.8	42.8	-2.2
Raw milk	305.8	24.7	618.5	57.8	46.2	45.7	13.5	65.8	13.8
Wool, silk-worm cocoons	6.6	-3.9	11.0	4.7	0.3	1.4	-4.1	13.1	1.5
Forestry	2.5	1.1	6.6	-0.7	0.0	0.0	-2.1	1.5	-0.5
Fishing	1.4	-0.8	6.6	-2.8	-1.3	-4.9	-4.4	-0.2	-6.7
Meat: cattle, sheep, goats, horse	-25.2	48.6	36.9	21.1	58.8	33.2	90.3	172.0	46.9
Meat products nec	36.2	35.0	66.2	17.7	69.1	77.6	55.3	54.8	39.4
Vegetable oils and fats	2.5	-2.6	33.0	31.1	16.1	14.9	19.4	62.2	15.5
Dairy products	-9.8	175.4	249.0	228.3	53.9	206.7	121.8	-38.0	21.1
Processed rice	41.8	94.7	33.3	192.0	32.0	71.6	38.6	64.7	55.2
Sugar	-48.2	72.7	92.9	6.5	20.5	61.9	71.0	48.9	55.3
Food products nec	-10.1	37.1	29.2	-6.0	9.6	17.3	33.5	23.7	-5.7
Beverages and tobacco products	36.4	7.4	32.8	33.2	18.1	20.0	16.9	31.0	16.8
Primary products	1.9	1.0	2.2	-0.2	-0.5	-0.0	-1.6	1.4	0.0
Textiles	1.2	-1.7	3.1	1.9	1.2	-0.4	-0.0	7.9	-1.1
Wearing apparel	-0.0	-1.0	3.3	1.6	0.6	-0.8	-2.4	10.3	-4.7
Leather products	0.1	-4.3	8.5	2.6	0.4	0.0	-2.5	9.2	-4.2
Wood products	1.0	0.6	1.7	0.7	1.1	1.3	-1.3	3.2	-2.0
Chemical, rubber, plastic products	0.8	0.2	1.6	1.6	0.5	1.0	-1.3	2.8	-1.0
Machinery and equipment nec	1.2	-0.3	1.5	0.7	0.1	0.9	-2.2	2.3	-1.4
Other Industries' products	1.5	-0.1	1.6	0.3	0.3	0.8	-2.1	2.1	-1.5
Transportation and Trade	1.1	-0.1	1.1	0.3	-0.0	0.6	-1.2	1.7	-0.6
Other Services	1.4	-0.0	0.9	0.5	0.2	0.7	-0.9	1.3	-0.4

### ***Complete application of Harbinson 1 ½ , with doubled Armington elasticities***

World welfare increases by 0.71%, thanks to an increase in agricultural world trade by more than 50% in volume. The two largest increases in national welfare arise in the European periphery (+4.4%) and in the Cairns group (+2.5%), but it is due to opposite evolutions.

In the European periphery, the Harbinson proposal induces a large reallocation of primary factors from agricultural sectors to the industrial one. Output contraction is very significant in the animals, meat and cereals sectors, while there is an increase in the production of textile, wearing apparel and leather sectors. As a consequence, agricultural real wages are substantially reduced. Figures in table 14 illustrate the same process in the EU, US and Other Industrialized Countries. If in these zones, the increase in national welfare is much lower than in the European periphery (less than 1%), the factors that are specific to the agricultural sector experience a large fall in their real remuneration (from -2.9% for agricultural wage in US to -13.6% for landowners in EU-25).

On the opposite, the Cairns group experiences a huge increase in exports of products for which they have an initial comparative advantage. Even if protection is not reduced in sectors where they have a comparative disadvantage (industry), the increase in their agricultural exports is such high that the impact on global welfare is very positive. The augmentation of agricultural real wages is impressive (+15.8%), which could mean a positive impact on poverty of some Cairns group's members (Brazil, Argentina...). Real return to land is only slightly modified: it could come from a parallel increase in land supply (these are essentially land-unconstrained countries).

In computable general equilibrium models, such a result is unusual. Large increases in national welfare are generally associated to decreased domestic distortions, due to the lowering in (or removal of) inefficient policy instruments. This Cairns group's welfare increase comes from the combination of more exports and higher world agricultural prices. Table 13 highlights the fact that an application of the Harbinson proposal leads to a general increase of these world prices, especially in the case of paddy rice, plant-based fibers, dairy products, wheat and oil seeds.

This liberalization is quite disappointing for African – Cotonou countries, which experience the lowest increase in agricultural exports (in volume) and a deterioration in their terms of trade. All variations in their remunerations of primary factors are very small.

The slightly positive impact is conditional to an increase in exports of primary products (see table 14), which are the very first exporting activity in this zone. It means that a positive impact of liberalization on African countries is conditional on this effect; or, that for countries of this group, which are not exporters of primary products, the global picture is quite different.

**Table 13: Evolution of macroeconomic variables in case of  $\sigma^*2$  scenario**

	EU_25	US	DA	ACP	RoW	China	CAIR NS	Periph	FSU	World
Welfare	1.34	0.11	0.59	-0.27	-0.10	-0.49	2.07	3.46	-0.31	0.74
GDP (volume)	0.88	0.08	0.41	-0.07	-0.02	-0.15	0.71	2.38	-0.21	
Terms of trade	0.21	0.22	-1.01	-0.59	-0.03	0.55	1.10	-1.17	-0.73	
Real effective exchange rate	-0.48	-0.09	-1.04	0.34	0.90	0.75	1.43	-1.14	0.36	
Unskilled real wages	-2.04	-0.92	-1.55	0.22	0.96	0.49	3.58	-0.42	-0.02	
Agricultural real wages	-6.99	-2.60	-4.93	0.97	4.25	2.06	15.61	-5.49	0.25	
Non agricultural unskilled real wages	1.01	0.14	0.47	0.00	0.00	0.00	0.00	2.74	-0.17	
Skilled real wages	1.74	0.21	0.78	0.01	-0.26	-0.39	0.34	4.79	-0.32	
Real return to capital	0.82	0.09	0.42	-0.25	-0.39	-0.42	0.47	2.72	-0.15	
Real return to natural resources	2.08	0.70	-2.05	-0.35	-1.03	-0.83	-0.91	5.49	-0.55	
Real return to land	-19.50	-7.28	-6.75	0.75	0.95	0.93	0.86	3.11	2.01	
Exports (volume)	4.58	2.03	3.44	1.60	2.75	2.03	7.27	7.74	0.68	4.00
Imports (volume)	5.17	1.74	4.20	1.46	2.67	1.97	7.16	7.96	1.23	
Agricultural exports (volume)	38.80	29.96	118.60	5.60	32.49	69.93	68.58	88.87	19.65	46.54
Agricultural imports (volume)	73.37	24.64	48.20	11.51	16.68	8.31	99.20	77.75	2.05	
Tariff revenue (points of GDP)	0.17	-0.00	0.01	-0.02	0.01	-0.03	0.20	0.52	-0.11	

Note: Unless otherwise specified, all changes are expressed in %.

**Table 14: Evolution of exports in the  $\sigma^*2$  scenario (changes in volume, in %)**

	EU_25	US	DA	ACP	RoW	China	CAIRN S	Periph	FSU
Paddy rice	-67.5	-27.2	234.6	219.2	38.4	38.5	300.6	466.6	139.4
Wheat	371.4	32.8	392.0	-24.1	175.0	371.3	86.8	1489.0	262.8
Cereal grains nec	19.1	44.9	373.3	36.1	198.5	24.9	105.8	475.5	154.4
Vegetables, fruit, nuts	285.9	90.5	122.6	-14.0	38.0	80.3	107.9	11.9	-41.5
Oil seeds	49.8	-20.3	105.4	45.9	55.9	327.5	8.5	105.6	36.9
Sugar cane, sugar beet	227.2	67.0	0.0	-47.2	-34.6	-28.3	-58.7	-1.0	36.1
Plant-based fibers	-58.6	-41.8	30.0	120.4	53.1	128.0	50.8	171.7	158.6
Crops nec	95.3	-10.3	50.2	-1.3	-5.7	-7.6	-14.2	105.0	-15.7
Cattle, sheep, goats, horses	-47.4	199.4	280.0	64.8	1101.0	4096.0	82.4	3591.0	116.5
Animal products nec	122.0	1.9	92.0	-1.9	-18.2	20.0	-15.2	151.4	-9.9
Raw milk	5206.0	526.1	189800.0	371.7	234.3	256.1	142.0	483.1	69.9
Wool, silk-worm cocoons	20.0	-4.2	44.3	15.8	-2.6	-0.9	-14.7	47.2	7.7
Forestry	4.9	1.4	14.5	-0.7	-0.8	-2.1	-6.0	3.8	-0.8
Fishing	1.7	-4.5	20.5	-5.6	-4.7	-15.7	-12.2	-1.2	-14.1
Meat: cattle, sheep, goats, horse	-55.9	98.0	102.9	18.7	128.5	55.4	189.7	803.2	62.2
Meat products nec	77.7	81.5	247.7	27.5	153.9	288.0	127.4	205.9	82.7
Vegetable oils and fats	-3.1	-5.5	92.6	78.5	30.9	28.6	33.5	190.4	26.2
Dairy products	2.0	550.2	1551.0	845.2	80.1	940.9	310.6	-69.7	27.3
Processed rice	160.7	430.7	190.1	1077.0	70.6	298.9	59.7	259.6	132.6
Sugar	-81.5	247.6	363.2	10.0	29.9	168.9	131.4	135.2	112.2
Food products nec	-13.2	90.3	80.5	-15.9	13.6	25.9	63.4	70.1	-12.1
Beverages and tobacco products	83.9	5.9	83.7	67.1	38.6	26.7	28.8	89.2	41.4
Primary products	2.0	1.2	3.0	0.1	-0.4	-0.1	-1.6	1.5	0.2
Textiles	1.3	-1.2	4.4	3.2	1.5	-1.4	0.7	9.0	-1.5
Wearing apparel	-0.7	-0.8	5.3	4.4	2.0	-2.1	-1.0	13.5	-5.2
Leather products	0.7	-5.9	11.6	6.5	0.5	-1.3	-1.3	10.7	-2.6
Wood products	0.9	0.6	2.9	2.1	1.3	0.8	-1.2	4.5	-1.8
Chemical, rubber, plastic products	0.5	0.2	2.6	2.8	0.8	0.9	-1.5	3.9	-0.9
Machinery and equipment nec	1.1	-0.5	3.1	2.2	0.3	0.8	-2.0	2.4	-1.2
Other Industries' products	1.2	-0.5	2.9	1.6	0.4	0.4	-2.1	2.7	-1.3
Transportation and Trade	1.1	-0.1	2.0	1.0	0.1	0.5	-1.1	2.0	-0.4
Other Services	1.4	0.1	1.8	1.3	0.4	0.7	-0.7	1.8	-0.2

## Conclusion

Using an adapted version of the MIRAGE model, this paper aimed at assessing the impact of a widespread liberalization in agriculture, concerning border protection as well as domestic support. The CGE model includes imperfect competition and increasing returns to scale in industry and services. It assumes land and labor mobility to be imperfect across sectors, and developing countries have a dual labor market.

Special emphasis has been put on measuring on measuring properly protection and domestic support. Protection data, from the MAcMaps database, describes applied tariffs, taking preferential agreements exhaustively into account. Domestic support data is updated to 2001 for the EU and the US, and accounts for the Agenda 2000 reform and the New Farm Bill.

The results show that, far from being uniform, the impact of agricultural liberalization on developing countries is strongly contrasted. This has been blurred, in many previous analyses, by geographical aggregation, or by not taking tariff preferences into account.

This draft is preliminary. In future development, we plan to model more explicitly agricultural policy instruments, to refine the dataset on domestic support, and to build scenarios of market access liberalization directly at the HS6 level, to stick as close as possible to the existing proposals.

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## Appendix : Agricultural data and policy assumptions for the baseline

*The data.* We distinguish 22 agricultural and food sectors. The core of the dataset relies on the GTAP 5.2. data, except for tariffs and agricultural policy instruments. Tariffs come from the MAcMaps dataset, and include bilateral applied tariffs. Data for farm support include various policy instruments, that are converted into different types of taxes and subsidies for modeling purposes. We distinguish market price support, output subsidies, capital subsidies, variable input subsidies, land subsidies, and decoupled subsidies to a particular agricultural sector.

For OECD countries, a detailed dataset that rely on primary information from the OECD on the PSEs was constructed so as to model the farm policies. For non PSE commodities data from national sources have been used (e.g. budget data for subsidies to cotton, tobacco, olive oil in the EU; data provided by the Economic Research Service of the USDA for US programs). In the case of the EU and the United States, the data on farm support was amended so as to reflect the full implementation of major ongoing reforms, i.e. the 2002 farm bill in the US and the 1999 Agenda 2000 in the EU. For non-OECD countries such as China and the former Soviet Union, the data that has been used for domestic agricultural policies is the have been limited to the instruments available in the standard 5.2 version of the GTAP dataset.

Farm support is treated as various types of price wedge, either on output, on variables inputs, on land or on capital. In addition, market price support is modeled through the combination of tariffs and of export subsidies. Output subsidies include all subsidies (limited and unlimited) that are a function of the volume of output. Capital subsidies include support for on farm investment (e.g. national subsidies on interest charges given by some EU member states), and payments per head of cattle (e.g. beef premia in the EU) . Variable input subsidies include tax deductions (fuel in some countries), subsidies to particular inputs (e.g. cotton seeds in the EU). Direct payments per hectare that are based on reference yields (e.g. arable crops payments in the EU) are treated as land subsidies. Decoupled payments (payments to self-employed labor) include all payments that are conditional to input constraints, agri-environmental payments, and payments that are based on reference levels and not tied to land, input use or output.

With these assumptions, it is noteworthy that most of the EU support to the beef sector is treated as a capital subsidy; most of the support to cereals in the EU is treated as land subsidy; most of the support to the dairy sector is treated as market price support in both the EU and the US; most of the support to cereals and oilseed is treated as decoupled in the US (with the exception of marketing loans, treated as output subsidies).

*The baseline.* Figures on farm support for OECD countries refer to the year 2001. They are then expressed in a percentage of the sectoral output in 2001, and included in the original dataset. Because of the medium-run nature of the MIRAGE simulations, it has been assumed that the two major policy reforms already under way, i.e. the US Farm Security and Rural Investment (FSRI) Act of 2002 and the EU Agenda 2000, were fully implemented. That is, we amended the data on domestic policies collected for the year 2001 so as to include developments in the level of support, in the EU and the US that will be implemented over the 2002-2005 period. Nevertheless, we did not explicitly constructed a baseline for the year 2005 in the sense that we left other parameters and data at their 2001 level. That is, we chose not to use forecasts of

demand, supply and prices in establishing this baseline. Forecasts on changes in central and Eastern European countries, or in China, are indeed hard to predict. Using predicted world prices for 2005 would have led to introduce in the baseline some results drawn from other models, which would have made the assumptions underlying the simulations less transparent.

Land set aside that prevailed in the EU in 2001 is modeled as a negative shock on the productivity of land (see Jensen et al., 1998). It is then amended so as to take into account changes in the Agenda 2000 and the FSRI. The increase in the acreage under conservation programs caused by the FSRI is only partially taken into account (as an extra negative productivity shock on land for wheat). We consider that only a share of the increased acreage eligible will be used for conservation (Westcott et al., 2002), and that the overall effect on output will be limited, because of several arguments put forward by Gardner (2002) and Sumner (2003). In order to account for exemption of small producers and other forms of slippage, the 10% set aside on arable crops in the EU was taken into account as as 7% negative productivity shock on land.

Relatively to the 2001 figure, the effects of the implementation of the FSRI were taken into account by an increase in the output subsidy for wheat (6%) and other cereals (3%), and a decrease in the case of soybean (4%). An output subsidy on dairy (3% of the value of production) was introduced. It has been shown that, because they affect risk and resource allocation, the flexibility contract payments in the FAIR Act were not completely decoupled (Adams et al., 2001; Gardner 2002). In addition, the possibility to update the base for the FSRI countercyclical payments has led to a degree of "recoupling" of these payments. In order to take into account the indirect effect of these subsidies on output we considered that 35% of the amount of these payments are in fact output subsidy on the range of commodities covered by the program.

In the European Union, the implementation of the Agenda 2000 was taken into account in the data on intervention prices and support for 2001, except in the case of oilseeds (where a further 13% decrease in subsidies based on acreage was introduced) and in the case of beef (a 32% decrease of the intervention prices was applied in order to account for the July 2002 decrease in intervention price). In order to account for the final (i.e. 2002) increase in beef premia, the overall support per head of cattle (introduced in the model as a capital subsidy in the live bovines sector), the 2001 support was increased by 13%. Finally, the first step of a reform in the milk sector (supposed to take place in 2005) was introduced as a 20% decrease in intervention price for fluid milk and 976 million euros subsidy to capital in the fluid milk sector.