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WTO AGRICULTURAL NEGOTIATIONS

A COMPARISON OF THE HARBINSON PROPOSAL AND THE SWISS FORMULA

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Abstract

The WTO agricultural negotiations of the Doha round are a key issue in the public debate. This paper analyses the effects of different options to improve market-access on the basis of a GTAP model, comparing the impact of the Harbinson proposal and the Swiss formula on trade balances. An extended version of the GTAP model is used to first project a base run that includes factors arising from Agenda 2000, EU enlargement, the EBA agreement and the EU's mid-term review. The policy simulation run additionally includes the WTO negotiations. Here, the model is differentiated between three experiments. While the first experiment simply implements the Harbinson proposal, the second one additionally takes into account an adoption of the EBA agreement by all industrialised countries. In the third experiment, the tariff cuts are based on the Swiss formula using a coefficient of 33 instead of the tiered approach of the Harbinson proposal.

After comparing the results of the three experiments, the paper concludes that the results from the different options for improving market access show parallel developments, with more- or less-pronounced increases or decreases in trade balances. Implementation of the Harbinson approach results in negative changes in the EU's trade balances for most agricultural products, except for the sugar, milk and other animal products sectors. The application of the Swiss formula to cut tariffs predictably results in severe losses to highly protected sectors worldwide in comparison to the Harbinson approach. In the EU, the highly protected sectors of beef and other processed food products would be particularly affected.

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1. Introduction

A great deal of attention is currently being paid to the discussion of the reform of global agricultural trade. In 2000, the WTO initiated a new round of trade negotiations on agriculture and services. According to the Doha mandate adopted on 14 November 2001, the WTO members committed themselves to substantially improve market access, to reduce (with a view to phasing out) all forms of export subsidies and to substantially reduce trade-distorting domestic support (WTO, 2001). Furthermore, it was also agreed that non-trade concerns and special and differential treatment for developing countries should become an integral feature throughout the negotiations.

In February 2003 a first attempt to agree on modalities, the so-called Harbinson paper, was presented to the WTO members (WTO, 2003a) and revised after intensive discussion. Based on the resulting Harbinson 1½ paper[1] (WTO, 2003b), the Doha Ministerial Declaration requested WTO members to agree upon formulas and other modalities by 31 March 2003 at the latest. But negotiators missed this deadline. While the US and the Cairns Group considered the tariff reductions of the Harbinson 1½ paper as too low and preferred the Swiss formula, the EU considered the liberalisation proposals as too far reaching. Together with 75 other WTO members (friends of the Uruguay formula) the EU pleaded for a repetition of the Uruguay round of agriculture and especially for the implementation of the Uruguay formula for tariff reduction (Brockmeier & Salamon, 2004).

After 31 March 2003, negotiators selected a number of controversial issues and aimed at achieving a framework agreement at the ministerial conference taking place in Cancún on 11-14 September 2003. The EU and the US were the first to come forward with a draft (WTO, 2003c). The joint US-EU text suggested a blended formula under which the tariffs were subdivided into three groups. The tariffs of the first group were categorised as duty free, while the tariffs of the second group were to be reduced by an average with a minimum reduction per product (the Uruguay round formula). The third group of tariffs were supposed to be reduced by the Swiss formula (WTO, 2004a, p. 12).

Subsequently, six alternative drafts resembling the US-EU structure followed, which were developed by the G-20, four Central American countries, Japan, Norway, Kenya and a European-East Asian grouping including Switzerland and the Republic of Korea. Comments on all these drafts led to an annex in the draft ministerial declaration submitted to the Cancún conference by General Council Chairperson Péres del Castillo (WTO, 2003d). The Castillo text

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[1] The 'Harbinson 1½ proposal' is the revised form of the Harbinson proposal, which is often called 'Harbinson 2'. Because the revised draft is only partially revised from the first version, the term Harbinson 1½ proposal is used in the following text (see also Josling, 2003, p. 12).

was revised on 13 September 2003 by the Mexican Foreign Minister Luis Ernesto Derbez (WTO, 2003e). Yet because of the deadlock on the four Singapore issues,[2] the Derbez text was never negotiated in detail at the 5th ministerial conference in Cancún.

After the failure of Cancún a new negotiation process started at the beginning of 2004. On 16 July 2004, the chairman of the agricultural committee, Tim Grosser, presented a new proposal on modalities for negotiations on agricultural trade (WTO, 2004b). An amended version of the Grosser text was then presented (WTO, 2004c) and adopted in a revised form by the WTO General Council on 31 July 2004 as part of the Doha Work Programme or Oshima-text (WTO, 2004d).

Although it seemed as if the disputing parties had reached an agreement, the outcome of the negotiations is still highly uncertain. In contrast to the former papers, the content of this recently adopted proposal is very vague. It contains (almost exclusively) qualitative information about tariff cuts, the abolition of export subsidies, etc., but does not make any concrete statement regarding the time horizon or magnitude of the protection cuts. Nor does the more or less nebulous consistency of the Doha Work Programme July package help to resolve the most important issue of market access: What kind of tiered formula will be used to cut down the import tariffs? What effect does a tiered formula, such as the Harbinson formula, have in contrast to a more flexible one, such as the Swiss formula? How will the preferential treatment of the developing countries be achieved?

Against this background this paper analyses different options currently discussed for market access focusing on variations of the Harbinson 1½ proposal and the Swiss formula. Simulating several modified approaches sheds light on the impacts resulting from certain policy interventions. In order to provide a brief overview about the contents of the previous proposals, section 2 illuminates the Harbinson 1½ paper, the Swiss formula and the Doha Work Programme in greater detail. In section 3 the methodological instrument – the Global Trade Analysis Project (GTAP) –is introduced together with the theoretical extensions it uses for the calculations. Thereafter, model design and experiments are introduced in section 4, while results and conclusions are presented in sections 5 and 6.

2. Overview of proposals, formulas and compromises

2.1 Harbinson 1½ approach

The Harbinson paper shows that the classic negotiation topics are still at the centre of the Doha round. For **domestic support,** the overall reduction of the aggregated measurement of support (AMS) is proposed to be 60% for developed countries and 40% for developing countries. At the same time, the product-specific AMS is not allowed to exceed the average level of the years 1999-2001. The direct payments of the blue box could either be limited to the specified level, and then be reduced by 50% for developed and 33% for developing countries, or they could be integrated into the AMS presently specified in the GATT and then be reduced by 60%. The payments should be reduced in equal annual instalments over a period of five years for developed countries and ten years for developing countries. The green box measures will be maintained. Furthermore, a reduction of the *de minimis* level of 5% annually by 0.5% over a period of five years for developed countries is proposed. For developing countries, the *de minimis* level of 10% should be maintained.

With respect to **export competition,** the Harbinson 1½ proposal calls for a 100% elimination of export subsidies within two staggered categories (five and nine years). For developing

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[2] The Singapore issues include the following four topics of the Singapore ministerial conference (1996): investment, competition policy, transparency in government procurement and trade facilitation.

countries, special and differential treatment is proposed with reduction categories of 10 and 12 years. Export credits, export credit guarantees and insurance programmes as well as international food aid and state-trading export enterprises shall be subject to disciplines.

To improve **market access,** three ranges of reduction commitments are defined for developed countries and four are defined for developing countries according to their specified GATT commitments. These ranges are summarised in Table 1.

It is proposed that the tariff reductions should be implemented in equal annual instalments over a period of five years. Moreover, the tariff rate quotas (TRQs) of developed (developing) countries that are smaller than 10% (6.6%) of domestic consumption shall be extended to that level. Alternatively, developed (developing) countries could extend the TRQs to 8% (5%) of their domestic consumption for some products, providing that the volume of a corresponding number of TRQs is expanded to 12% (8%). The implementation period is also favoured to be five years. Tariff rates within the TRQs are not subject to any change provided the fill rate of the TRQ exceeds 65%. For tropical products, the in-quota tariff should be zero.

Table 1. Tariff reduction formulas of the Harbinson 1½ proposal (%)

	Initial tariff rate (ad valorem)	Average reduction rate	Minimum cut
Developed countries	> 90	60	45
	≤ 90 and > 15	50	35
	≤ 15	40	25
Developing countries	> 120	40	30
	≤ 120 and > 60	35	25
	≤60 and >20	30	20
	≤ 20	25	15

Source: WTO (2003b).

In addition to the **special and differential treatment** for developing countries, the Harbinson 1½ paper accords special treatment for less developed countries laces. They should be exempt from any reduction commitments and developed countries should provide duty and quota-free market access for all imports from developing countries.

2.2 Swiss formula

In the course of the negotiations held in the Uruguay round, the Swiss formula was an approach proposed by Switzerland concerning tariff cuts in the field of industrial commodities. According to this formula the new tariff rate is determined by the base rate (T_0) and a coefficient (a): $T_1 = (T_0 * a) / (T_0 + a)$. In the current agricultural negotiations of the Doha round, the US proposed applying a coefficient value of 25 to this formula. Under these conditions, all tariff rates on agricultural products will be harmonised at a level below 25% within a five-year period through a non-linear reduction process. Since tariff cuts based on the Swiss formula are dependent on the level of the base rate, it brings about larger reductions in the highest tariff rates.

2.3 Doha Work Programme

The Doha Work Programme comprises an overall cut of all trade-distorting **domestic support** according to a tired formula. Under this formula, higher levels of trade-distorting domestic support will be subject to deeper cuts to achieve a harmonised result. For all developed countries a down payment of 20% during the first year of the implementation period will be made. The cut will be based on binding rates.

Furthermore, a reduction of the *de minimis* loophole will be negotiated and the criteria for the green box will be reviewed. The blue box support should not exceed 5% of the average total value of agricultural production during a historical reference period that has not yet been specified. This stands in contrast to the Derbez text, which suggests dates for the reference period (2000-02) and linear reductions for an (x) number of years (ICTSD, 2004).

On **export competition,** the Doha Work Programme ensures the elimination of all forms of export subsidies. Moreover, all export measures with effects equivalent to export subsidies will be eliminated, such as export credits, export credit guarantees or insurance programmes with repayment periods beyond 180 days. Export credits of less than 180 days and trade distorting practices of state trading enterprises (STES) will be subject to strict disciplines. Moreover, concrete disciplines will be imposed on food aid that is used for commercial displacement.

A substantial reduction in **market access** barriers will be achieved through a tiered approach with deeper cuts in higher tariffs. The reduction commitments will be made from binding tariff rates applicable to all members other than the least developed countries (LDCs). Countries can self-select sensitive products that will be treated in a more flexible way. As compensation, the TRQs of sensitive products have to be expanded.

For developing countries, **special and differential treatment** is provided. They will be accorded longer implementation periods, lower tariff and subsidy cuts and special concessions for their market access. Furthermore, trade with tropical products will be fully liberalised and the erosion of trade preferences will be addressed. LDCs do not have to lower their tariffs or their domestic farm support. Developed countries and capable developing countries should provide duty- and quota-free market access for LDC products (European Commission, 2004, p. 1).

In sum, if the Grosser text is compared with the Harbinson 1½ paper, it is obvious that there is less detail in the decision adopted in July 2004. A detailed comparison of the Harbinson 1½ paper with the July 2004 General Council Decision is given in Table A1 of the appendix.

3.   GTAP framework

3.1 Standard GTAP model

The analyses in this paper are based on the GTAP model (a comparative-static, standard multi-regional general equilibrium model). It provides an elaborate representation of the economy including the linkages between the farming, agribusiness, industrial and service sectors of the economy. The use of the non-homothetic constant difference of elasticity (CDE) functional form to handle private household preferences, the explicit treatment of international trade and transport margins and a global banking sector that links global savings and consumption are innovative in the GTAP. Trade is represented by bilateral trade matrices based on the Armington assumption. Further features of the standard model are perfect competition in all markets as well as a profit- and utility-maximising behaviour of producers and consumers. All policy interventions are represented by price wedges.[3]

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[3] The framework of the standard GTAP model is well documented in the GTAP book (Hertel, 1997) and available on the Internet (retrieved from http://www.gtap.agecon.purdue.edu/). The GTAP model is solved using the GEMPACK (General Equilibrium Modeling Package) software, version 8.0 and RunGTAP, version 3.23 (Harrison & Pearson, 1996).

3.2   Extensions of the standard GTAP model

3.2.1 Policy instruments of the CAP

Agricultural policy instruments are represented through price wedges in the standard GTAP model. Therefore, the standard GTAP model is complemented with an explicit modelling of the most important policy instruments of the common agricultural policy (CAP).

As a result of implementing the outcome of WTO negotiations, the EU trade regime and consequently prices on the internal market will be changed. How does this affect the raw milk and sugar markets, which are both regulated through quantitative restrictions? Whether an implemented quota restricts production depends on the actual price reduction caused by the changing trade regime. If market prices exceed production costs, a quota rent exists and the quota is binding. When the relevant price drops below production costs the quota rent disappears and the quota might become non-binding. Thus, a quota module that allows for a binding and a non-binding quota system depending on the economic environment would be favourable. Such a formulation can be integrated into the GTAP model in the form of a complementary approach (Bach & Pearson, 1996; Van Tongeren, 2002). This approach enables the model to endogenously switch between binding and non-binding states. Additionally, the quota rent is determined endogenously as well.

Another important modelling issue is related to the EU's mid-term review (MTR. Following the approach of Frandsen et al. (2002), we introduce an additional land subsidy rate into the model that is equalised across all sectors entitled to direct payments.[4] With the implementation of the MTR, the existing domestic support measures are converted into a region-specific, fully decoupled land-area payment, while budgetary outlays for total domestic support are held constant.

3.2.2 EU budget

The EU budget is introduced in the GTAP model using an innovative Social Accounting Matrix (SAM). This SAM not only covers the expenditures and revenues of already existing agents (e.g. producers, government and private households), but also the European Agricultural Guidance and Guarantee Fund (EAGGF). This EU budget receives 75% of the import duties for agricultural and non-agricultural products from producers, private households, government and capital accounts. Additional revenues result from an endogenously calculated GDP-related tax, which flows from regional households to the EU budget. Here, all EU member countries face an equal GDP tax rate. Revenues of the EU budget are used to cover agricultural output and export subsidies as well as direct payments. In contrast to these product-specific instruments, expenditures for structural policies are not covered within the EU budget module. Owing to their characteristics and specific aims, structural funds cannot be allocated to certain commodities. This strongly hampers their incorporation in a product-specific model such as the GTAP.

Obviously, revenues of the EU budget from one member country are not identical with the expenditures of the EU budget on the same member country. A comparison of revenues and expenditures of each member state therefore shows the net transfer that takes place within the EU financial system. Analogous to capital transfer, the net transfer within the EU is part of the current account balance, which makes up the difference between exports and imports of goods and services. Nevertheless, the sum of net transfers of all member countries equals zero, since the EU budget is balanced through the endogenous GDP tax rate.

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[4] We are grateful to Hans Jensen for his support with regard to implementing the decoupling.

In the standard GTAP model, EAGGF revenues and expenditures are organised through regional households. All components of the EU budget are therefore introduced with the help of dummy variables allowing an easy shift from regional households to the EU budget and vice versa. Consequently, a preliminary simulation is employed to move the GTAP database from the initial situation without the EU budget to a new equilibrium where the EU budget is in charge of the EAGGF (Brockmeier, 2003, pp. 100-12).

3.2.3 Projection module

Along with changes in the political environment of an economy, macroeconomic developments such as technical progress are of great importance for the economic growth of an economy. In order to take these changes into account, corresponding trends are incorporated in the analysis at hand. For this purpose an approach by Walmsley et al. (2000) is used, which allows the inclusion of exogenous projections of the global and regional GDP and factor endowment in the extended GTAP model. In the simulations, technical progress is generated endogenously by the model, enabling the projected growth pattern.

4.   Simulations

4.1   Database and aggregation

The simulations are based on the GTAP database version 5 with 1997 as the base year. The database consists of bilateral trade, transport and protection matrices that link 57 sectors in 76 countries or regions. In order to keep the calculation effort within a reasonable scope, the database is aggregated into 23 regions and 19 sectors (see Tables A2 and A3 in the appendix). The regional sets are put together with regard to geographical nearness, developmental status or membership in certain regional agreements. With regard to the sectoral aggregation, it was important to distinguish between primary and processed agricultural production sectors as well as between production commodities regulated through a quota and sensitive products.

4.2   Experiments

Before the actual simulations are carried out, it is necessary to conduct some pre-simulations to implement the extended model structure and to update the protection rates (see Figure 1 and Table A4). This includes CAP instruments and the EU's common budget.

Figure 1. Base run and simulations
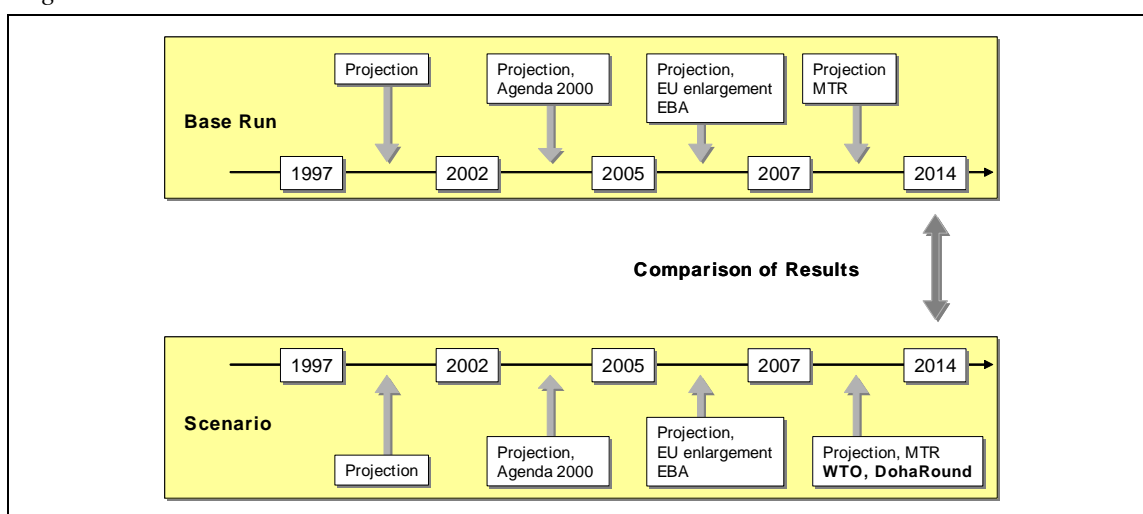
Based on the results of the pre-simulation, a base run is conducted, which represents a projection of the exogenous variables of population, GDP and factor endowment up to the year 2014. Additionally, Agenda 2000 (2005), EU enlargement and the EBA agreement (2007), as well as the MTR are implemented (for details see Table A4). The base run only considers political intervention in the EU-15 and in the candidate countries. Developments in other regions, such as those specified in the US Farm Bill, are not taken into account.

Parallel to the base run, a scenario is implemented as well. It takes account of the same projections and policy shocks (Agenda 2000, EU enlargement, the EBA agreement and the MTR), but in the time period from 2007 to 2014; additionally, it includes simulations related to the WTO round. The July package leaves a lot of room for speculation on how market access will be enabled through agricultural trade negotiations. Thus, in the following experiments various options for market access as implemented in the Doha round are played through. A total of three simulations are carried out. The first two simulations capture the Harbinson 1½ proposal and a possible modification.

In Experiment 1 all countries implement a cut on the import tariffs according to the Harbinson 1½ proposal (as discussed in section 2.1), while export subsidies are completely abolished. Experiment 2 is identical to Experiment 1, but all other developed countries implement the EU's EBA initiative by granting preferential market access to LDCs. Experiment 3 also resembles Experiment 1, but countries are obliged to reduce their import tariffs according to the Swiss formula using a coefficient of 33. The effects of the WTO round are obtained by comparing the results of the base run and the scenario in 2014. Table 2 summarises the simulations.

Table 2. WTO simulations

Experiment	Import tariff cut		EBA adopted in developed countries
	Harbinson 1½	**Swiss formula**	
1	x	–	–
2	x	–	x
3	–	x	–

5. Results

This section discusses the results of six experiments analysing the implementation of the WTO negotiations under different options for market access. The results are presented in $US millions for the 1997 GTAP database. We mainly focus on the trade balance. The appendix provides detailed results for the output of production (Tables A5 to A7) on a disaggregated country level. Changes in the output of production are mainly induced by the changes in the trade regime. The output results show a pattern that is similar to the changes in the trade balance and is only being discussed rudimentarily.

Tables 3 and 4 report the changes in the regional trade balance by commodity for Experiments 1 and 2 respectively. The change in trade balance represents the change in the value of fob exports minus the value of cif imports.

Examination of the entries in Table 3 shows that the biggest changes in the EU-27 occur in the highly protected beef and other food product sectors. Other sectors, such as wheat, other crops, fruit and vegetables also experience a decrease in export values relative to imports, although these sectors are only moderately protected. Conversely, the dairy products and sugar sectors show a positive development in the trade balance.

It is not surprising that the trade balances of sensitive sectors such as beef will deteriorate in the EU-27. But where does the positive development in the trade balances of sugar and milk products come from? Milk products are one of the most protected products worldwide. Apparently, the loss in the EU trade balance for dairy products owing to EU import tariff cuts is overcompensated by the gain resulting from an increase of EU dairy product exports following the decrease of third countries' import tariffs. Accordingly, this development is mirrored in the negative trade balances of the US, Canada, Japan, other European countries (SONEU) and Mediterranean and North African countries (MEDNO). The biggest gain, however, accrues for Australia and New Zealand (Oceania) where the trade balance shows an impressive increase of over $1.6 billion.

Table 3 also reveals an extremely negative impact of the implementation of the Harbinson 1½ proposal on the trade balance for sugar in the EBA region, which is accompanied by a moderate deterioration of the sugar trade balance in the US. Given the Everything But Arms (EBA) agreement already in place, the LDCs have to face an erosion of their preferences in the WTO negotiations. Nevertheless, the loss is not solely attributable to the reduction of import tariffs by developed countries and the EU. Rather, the abolition of the EU's sugar export subsidy also strongly effects this development. Brazil and the other African, Caribbean and Pacific (ACP) countries (AAKP) can take advantage of this development and show an anticipated increase of exports relative to imports.

Significant negative changes after the implementation of the Harbinson 1½ package are also shown in the sector comprising a variety of **processed food products**. Here, Table 3 reveals that the EU-27 and Japan account for the highest loss while all other industrialised regions show positive changes in their trade balance. A decomposition of the results for the EU-27 is presented in Figure 2.[5] It indicates a particularly negative development of the EU's trade balance as a result of the reduction of the EU's import tariffs applied to imports coming from developing countries and other industrial countries. In contrast, the abolition of export subsidies has a surprisingly minor negative impact. The trade-related changes are passed on to the EU's production of processed food, which shrinks by 2.7% (see Table A5).

Figure 2. Decomposition of the changes in the EU-27's trade balance of processed food products (Experiment 1, Harbinson 1½ proposal) ($US millions)
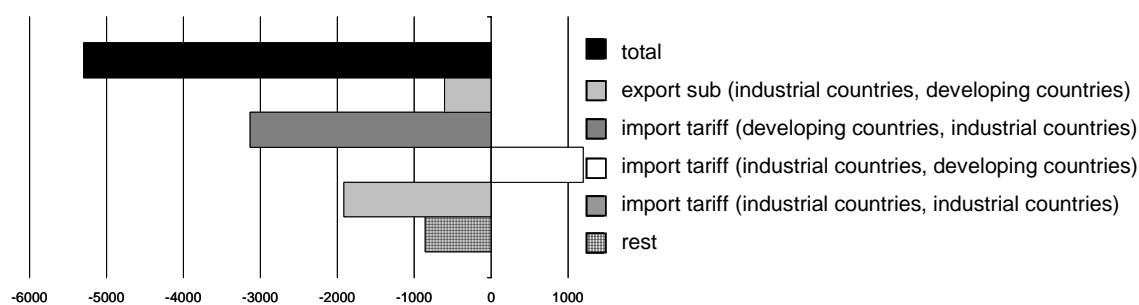
Source: Authors' own calculations.

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[5] The results (total changes) are decomposed into parts (so-called 'subtotals') attributable to changes in individual exogenous variables (e.g. policy instruments). The decomposition of the total effect into subtotals thereby allows the identification of changes that govern the results. Here, the decomposition is based on the changes of policy instruments (import tax and export subsidies) that are applied on bilateral trade flows. Thus, the policy instrument as well as the source (first expression in brackets) and destination (second expression in brackets) of the trade flow subject to the policy instrument can be identified.

Table 3. Changes in the trade balance in Experiment 1 (Harbinson 1½ proposal) ($US millions)

	EU-27	USA	CAN	OZE	INDO	MAL
Wheat	-61	533	853	52	-37	-13
Other Crops	-592	639	179	168	-11	-19
Oil Seeds	188	584	99	10	-16	-31
Rice	-124	129	-1	36	-1	1
Vegetables, Fruits	-92	-402	-25	-91	99	-156
Cattle	201	178	-8	-33	-6	-1
Other Animal Products	566	-165	-81	-150	-13	-2
Beef	-2606	1055	74	1369	-2	-4
Other Meat Products	-253	1036	-94	35	-7	-20
Vegetable Oils and Fats	-284	-30	-30	-22	10	210
Dairy Products	205	-140	-79	1631	-15	21
Sugar	768	-393	58	86	2	-10
Other Food Products	-5300	1602	365	300	266	-45
Beverages and Tobacco	318	-379	-31	-110	-3	-1
Primary Products	125	-69	-3	-199	13	-98
Manufactures	4261	-3212	-773	-2283	-133	32
Services	2996	-1175	-244	-1144	-52	-466

	BRA	INDIEN	CHINA	EBA	AAKP	HICAS
Wheat	-39	29	-376	59	-30	-58
Other Crops	2	1	-133	37	-34	-124
Oil Seeds	244	5	-405	14	1	-204
Rice	-8	35	16	-8	-13	-1
Vegetables, Fruits	390	-161	-297	-24	205	-402
Cattle	-3	-2	5	0	-1	2
Other Animal Products	-6	-29	-306	18	-15	71
Beef	174	22	-10	4	2	-11
Other Meat Products	275	0	-141	8	-38	80
Vegetable Oils and Fats	66	-278	-306	57	-28	289
Dairy Products	-22	4	34	6	-49	18
Sugar	310	26	-25	-1773	564	6
Other Food Products	158	110	26	-357	155	772
Beverages and Tobacco	-22	0	25	31	-51	29
Primary Products	-40	17	-166	243	-45	-45
Manufactures	-1297	56	-327	1241	-552	-667
Services	-335	17	-81	547	-252	-48

	JAP	FSU	SONEU	SONAS	MEDNO	SONLA
Wheat	-179	22	-81	-37	-613	-38
Other Crops	75	55	-51	-11	-165	-38
Oil Seeds	-250	-15	-90	-22	-33	-128
Rice	-114	2	-3	17	5	23
Vegetables, Fruits	-586	-64	-249	-43	553	761
Cattle	-71	1	-29	-16	-208	-33
Other Animal Products	127	-28	180	-61	-58	-47
Beef	-456	156	-28	-27	-394	422
Other Meat Products	-364	-30	-175	23	-232	-151
Vegetable Oils and Fats	289	-9	169	-33	-159	28
Dairy Products	-612	155	-655	-61	-604	5
Sugar	-81	104	-1	41	97	177
Other Food Products	-2820	299	2181	607	-376	1152
Beverages and Tobacco	117	-73	172	14	72	-70
Primary Products	52	-40	-36	-17	367	-26
Manufactures	3884	-628	-134	-113	2280	-1367
Services	991	-193	245	-82	1433	-416

Source: Authors' own calculations.

In the case of the developing countries, almost all the regions experience a positive change in their trade balances for processed food products. Here, other Latin American countries show the strongest increases. A decomposition of the results (not shown here) indicates that the positive change of other Latin American countries' trade balances for processed food is predominantly determined by the tariff cuts taking place in developed and developing countries. In contrast, the abolition of tariffs among industrialised countries reduces Latin America's gains in the trade balance for processed food owing to increased trade activities among the developed countries.

The agricultural sector producing the highest trade balance gain for industrialised countries is the **wheat sector**. Particularly the US, Canada and Oceania are able to take advantage of the change in the trade regimes. In contrast, the EU-27, Japan and other European countries (SONEU) show negative impacts on their trade balances. Compared with the developed countries, the group of developing regions encounters its largest trade balance loss in the wheat trade. In most of the individual regions belonging to this group this negative development is reflected. Particularly China, Brazil and MEDNO show very significant negative impacts, which are almost exclusively determined by the developing countries' tariff cuts applied to industrial countries' imports.

Particularly interesting from the developing countries viewpoint is the **fruit and vegetable sector**, where strong impacts resulting from the implementation of the Harbinson 1½ approach can be observed. According to country category, the impacts are quite diverse, with most of the developed countries experiencing a significant decline in their trade balances. In contrast, the developing world is gaining ground. The US and Japan represent the regions that take the bulk of the great trade balance loss of the industrial countries' group. The abolition of their import tariffs, as applied to developing countries' imports, caused the major part of their trade balances to decline. But even though the loss in trade balance looks very severe, production quantity in this sector is reduced by only 1% in Japan and by 1.9% in the US (see Table A5 in the appendix). Compared with the situation in most other developing countries, the EBA region shows a negative development of their trade balance for fruit and vegetables. Besides sugar and other food products, fruit and vegetables are the most important export products of the EBA region.

Table 4 shows the results when the EBA agreement is extended to other developed countries (Experiment 2). In examining the outcome for developed and developing countries, it is obvious that the results differ only slightly from those obtained in Experiment 1. Nevertheless, it certainly makes a difference to the LDCs. Compared to Experiment 1, Table 4 clearly shows an improvement in the trade balances of the most important export products of the LDCs, namely sugar, fruit and vegetables, oilseeds and particularly the trade in manufactures. In order to achieve the increased output in these export sectors, resources must be drawn from other sectors, such as the wheat sector. Figure 3 shows a decomposition of the changes in EBA countries' trade balances for wheat in Experiment 2. Although the total impact is of a small magnitude, it can undoubtedly be seen that the extension of the EBA agreement to other developed countries has a negative effect for the wheat sector in the LDCs. This effect can also be observed for other crops and oil seeds.

In contrast, Figure 4 reveals a positive effect in Experiment 2 (Harbinson, 1½ proposal, EBA adopted by developed countries) in the processed food product sector of the LDCs, which is clearly induced by the adoption of EBA agreement by all industrialised countries. Still dominating, however, is the negative effect resulting from the liberalisation between industrialised countries and the induced trade-creation effect between these countries.

Table 4. Changes in the trade balance in Experiment 2 (Harbinson 1½ proposal, EBA adopted by developed countries) ($US millions)

	EU-27	USA	CAN	OZE	INDO	MAL
Wheat	-53	557	862	65	-37	-13
Other Crops	-593	641	179	167	-11	-20
Oil Seeds	187	565	89	10	-16	-33
Rice	-123	120	-1	29	-2	1
Vegetables, Fruits	-34	-557	-38	-88	98	-157
Cattle	199	177	-8	-34	-6	-1
Other Animal Products	567	-158	-80	-150	-13	-1
Beef	-2608	1054	74	1368	-2	-4
Other Meat Products	-252	1036	-94	35	-7	-20
Vegetable Oils and Fats	-279	-25	-29	-22	15	239
Dairy Products	208	-142	-80	1628	-15	21
Sugar	764	-437	52	80	2	-9
Other Food Products	-5185	1542	345	283	254	-49
Beverages and Tobacco	307	-349	-36	-109	-3	-1
Primary Products	135	-67	32	-163	37	-91
Manufactures	4347	-3494	-878	-2337	-149	-12
Services	3138	-701	-147	-1111	-46	-448

	BRA	INDIEN	CHINA	EBA	AAKP	HICAS
Wheat	-39	30	-375	-5	-30	-58
Other Crops	2	1	-133	9	-26	-121
Oil Seeds	239	5	-404	54	1	-204
Rice	-8	35	15	54	-13	-1
Vegetables, Fruits	361	-153	-296	275	181	-399
Cattle	-3	-2	5	5	-1	2
Other Animal Products	-6	-28	-298	-8	-15	73
Beef	174	22	-9	-1	3	-11
Other Meat Products	276	0	-138	0	-37	79
Vegetable Oils and Fats	69	-279	-304	-20	-27	293
Dairy Products	-22	4	34	18	-48	19
Sugar	336	30	-24	-1718	549	6
Other Food Products	156	111	15	-110	154	748
Beverages and Tobacco	-22	0	28	7	-48	29
Primary Products	-32	13	-145	-211	-37	-53
Manufactures	-1292	74	-339	1979	-536	-955
Services	-314	22	-26	-818	-234	281

|	JAP	FSU	SONEU	SONAS	MEDNO	SONLA
Wheat	-178	22	-81	-37	-615	-32
Other Crops	78	55	-52	-11	-166	-32
Oil Seeds	-258	-14	-89	-21	-33	-128
Rice	-159	2	-3	19	5	23
Vegetables, Fruits	-627	-62	-278	-44	556	681
Cattle	-72	1	-30	-15	-208	-32
Other Animal Products	130	-28	182	-60	-57	-45
Beef	-452	156	-28	-27	-395	426
Other Meat Products	-362	-30	-177	23	-232	-149
Vegetable Oils and Fats	296	-9	169	-33	-159	41
Dairy Products	-625	155	-656	-60	-605	7
Sugar	-83	106	-8	40	100	172
Other Food Products	-2996	286	2185	590	-374	1135
Beverages and Tobacco	121	-75	167	15	70	-66
Primary Products	64	19	-11	-14	515	31
Manufactures	3964	-654	-144	-130	2192	-1427
Services	1146	-197	255	-37	1390	-328

Source: Authors' own calculations.

Figure 3. Decomposition of the changes in EBA countries' trade balances for wheat in Experiment 2 (Harbinson 1½ approach, EBA adopted by developed countries) ($US millions)
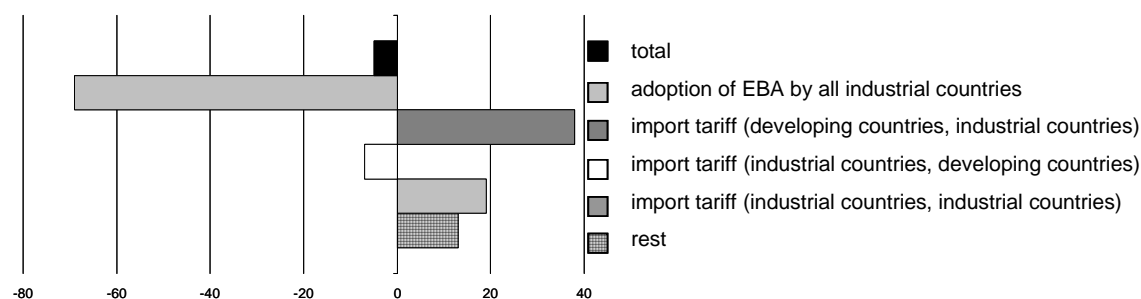
Source: Authors' own calculations.

Table 5 finally documents the changes in the trade balances of Experiment 3. What difference is to be expected when instead of the Harbinson 1½ approach, the Swiss formula is applied to cut the tariffs? The tariff cuts under the Harbinson 1½ proposal will reduce even very high import tariffs by 60% at most. Thus, protection for sensitive sectors in developed countries, such as sugar, beef, milk products and partly wheat and other coarse grains will still be kept at high magnitudes, while these tariffs are reduced below 33% under the Swiss formula. In general, it is therefore to be expected that the impact on these highly protected sectors is higher when the Swiss formula is implemented.

Figure 4. Decomposition of the changes in EBA countries' trade balances for processed food products in Experiment 2 (Harbinson 1½ approach, EBA adopted by developed countries) ($US millions)
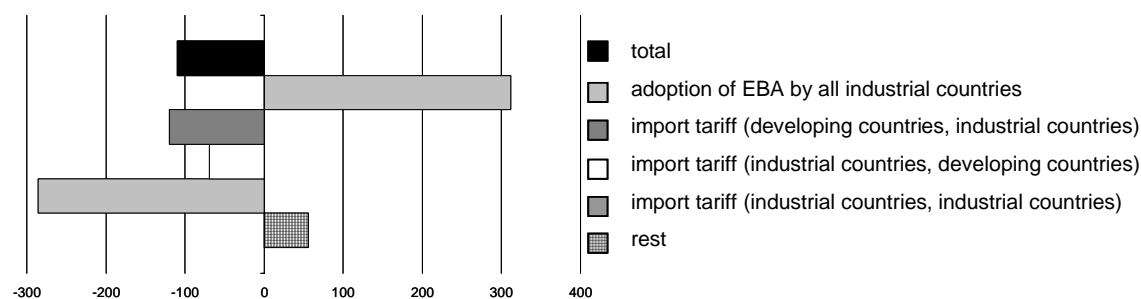
Source: Authors' own calculations.

A comparison between Experiments 1 and 3 reveals that the results for wheat and beef are especially different. The loss of the EU's beef trade balance in Experiment 3 is particularly noticeable. Comparing the worldwide protection structure of beef, it is obvious that beef is one of the highest protected sectors and that the EU's beef sector is more or less a front runner. Negative developments in the EU's trade balance therefore originate from import tariff cuts in all third countries, regardless of whether they are developed or developing (Figure 5). Compared with Experiment 1, the loss is much more pronounced, because higher tariff cuts under the Swiss formula induce an increasing trade-creation effect among third countries. Apparently, the EU cannot take advantage of the improved access to third countries' beef markets.

Table 5. Changes in the trade balances in Experiment 3 (Swiss formula, 33) ($US millions)

	EU-27	USA	CAN	OZE	INDO	MAL
Wheat	141	1037	1768	85	-63	-27
Other Crops	-473	-444	400	481	-8	-29
Oil Seeds	142	1351	94	44	-7	-40
Rice	-175	290	-1	106	-1	3
Vegetables, Fruits	569	235	-180	-266	145	-467
Cattle	528	239	-48	-63	-2	-1
Other Animal Products	673	-507	-166	-315	-13	18
Beef	-3988	1806	122	2142	-3	-8
Other Meat Products	44	1859	-225	30	-11	-50
Vegetable Oils and Fats	335	-87	-70	-36	-110	129
Dairy Products	1018	216	-413	2813	-19	44
Sugar	944	-507	111	88	12	-8
Other Food Products	-4429	2011	180	360	254	41
Beverages and Tobacco	342	-634	-43	-177	-4	4
Primary Products	108	-109	-4	-346	23	-224
Manufactures	1640	-5030	-769	-3644	-54	266
Services	3020	-1912	-219	-1834	-29	-1088

	BRA	INDIEN	CHINA	EBA	AAKP	HICAS
Wheat	-32	54	-1246	77	-32	-112
Other Crops	-3	2	79	52	-34	-122
Oil Seeds	617	4	-1195	21	8	-514
Rice	-8	55	40	-10	-14	-2
Vegetables, Fruits	245	-248	-495	49	172	-732
Cattle	-2	-3	10	0	0	6
Other Animal Products	-3	-34	-146	29	-18	210
Beef	319	48	-3	6	-11	-10
Other Meat Products	395	0	-198	12	-49	134
Vegetable Oils and Fats	0	-539	-599	90	-27	758
Dairy Products	-42	8	61	20	-62	19
Sugar	195	81	-46	-2780	868	4
Other Food Products	55	-32	-284	-404	62	1608
Beverages and Tobacco	-25	1	59	46	-61	82
Primary Products	-39	35	-378	331	-57	-61
Manufactures	-1449	203	-596	1822	-662	-1630
Services	-378	39	-162	779	-302	-143

|	JAP	FSU	SONEU	SONAS	MEDNO	SONLA
Wheat	-314	27	-212	-57	-1142	-10
Other Crops	147	67	-92	-16	-150	79
Oil Seeds	-401	-13	-140	-34	-49	-29
Rice	-390	3	-5	29	12	45
Vegetables, Fruits	-504	-102	-377	-161	345	954
Cattle	-147	1	-50	-6	-478	-25
Other Animal Products	162	-54	259	-69	37	-34
Beef	-391	131	-38	-34	-1321	772
Other Meat Products	-492	-140	-337	-19	-606	-456
Vegetable Oils and Fats	424	-24	234	-76	-247	-174
Dairy Products	-1474	288	-854	-75	-2119	-13
Sugar	-114	343	8	31	107	383
Other Food Products	-3118	68	2827	832	-1609	560
Beverages and Tobacco	140	-84	250	34	209	-79
Primary Products	23	-56	-51	-21	875	-26
Manufactures	5191	-619	-42	-151	6941	-1142
Services	1276	-152	412	-66	4273	-416

Source: Authors' own calculations.

Figure 5. Decomposition of the changes in the EU's trade balance for beef in Experiment 3 (Swiss formula, 33) ($US millions)
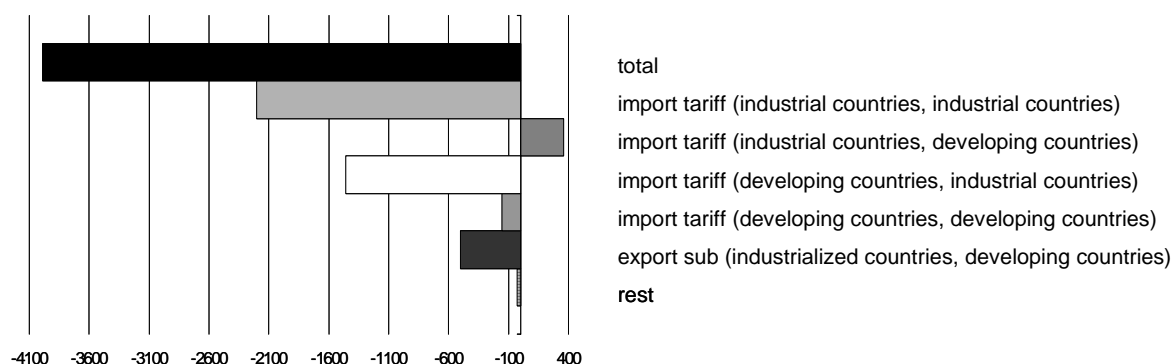
Source: Authors' own calculations.

In the wheat sector, industrialised countries, particularly the US and Canada are experiencing a highly positive change in their trade balances, while Japan and other high-income countries in Asia (HICAS) along with the other European countries have to accept an increase of imports relative to exports. Developing countries are also facing a negative change in their trade balances, which is more pronounced in China and the Mediterranean and Northern African countries. The decomposition in Figure 6 reveals that this is mainly induced by the cut of import tariffs in developing countries for wheat imports coming from industrialised countries. The reduction of import tariffs between developing and between developed countries as well as the abolition of export subsidies can almost be completely disregarded.

Figure 6. Decomposition of the changes in China's trade balance for wheat in Experiment 3 (Swiss formula, 33) ($US millions)
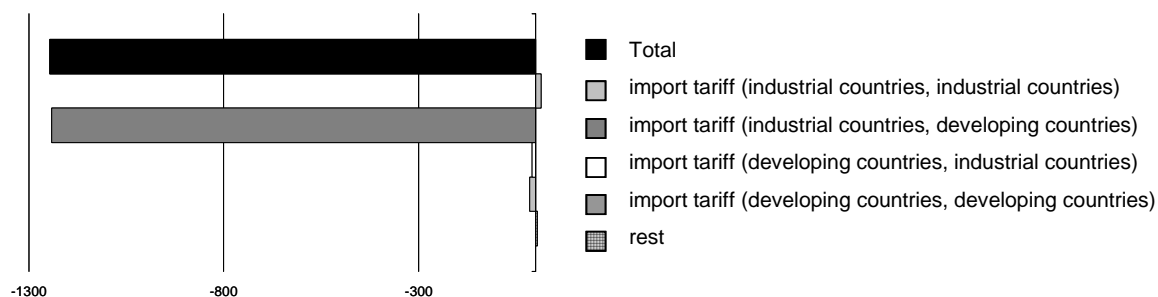
Source: Authors' own calculations.

This effect is not surprising and can be explained with the help of the following arguments. First, most of the export subsidies in developed countries are concentrated in the sugar, milk and beef sectors, while they are more or less completely reduced in the wheat sector. Second, wheat, and other coarse grains already have to cope without import protection. Thus, they are much more competitive than the sensitive products of most developed countries. Conversely, wheat and other coarse grains are among the highest protected products in most developing countries. A tariff cut based on the Swiss formula therefore accounts for a much higher reduction in these sectors and accordingly results in higher negative changes in trade balances than the Harbinson 1½ proposal. This can also be seen from Figure 7, which decomposes the change in Canada's trade balance for wheat. Again, the predominant but positive effect here is the reduction of developing countries' import tariffs for wheat imports coming from industrialised countries.
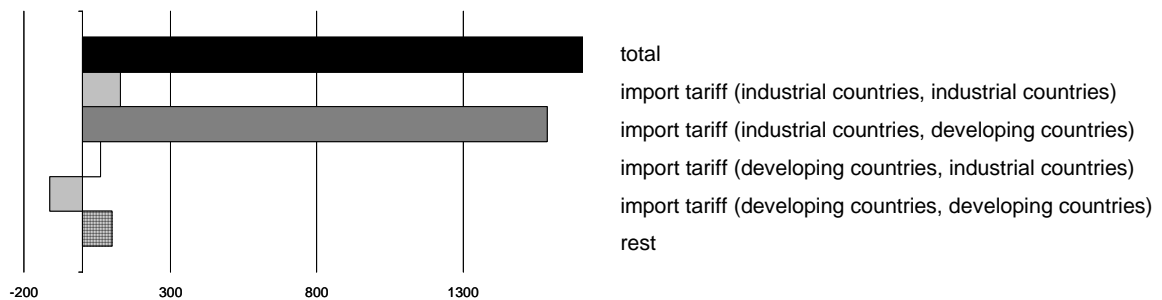
Figure 7. Decomposition of the changes in Canada's trade balance for wheat in Experiment 3 (Swiss formula, 33) ($US millions)

Source: Authors' own calculations.

6.   Conclusions

The WTO agricultural negotiations of the Doha round are a key issue in the public debate. This paper analyses the effects of different options to improve market-access on the basis of a general equilibrium GTAP model. An extended version of the GTAP model is used to first project a base run that includes factors arising from Agenda 2000, EU enlargement, the EBA agreement and the EU's mid-term review. The policy simulation run additionally includes the WTO negotiations. Here, the model is differentiated between three experiments. While the first experiment simply implements the Harbinson 1½ proposal, the second one additionally takes into account an adoption of the EBA agreement by all industrialised countries. In the third experiment, the tariff cuts are based on the Swiss formula using a coefficient of 33 instead of the tiered approach of the Harbinson proposal. The results and a comparison of the three experiments reveal the following points:

- Results from different options for market access in the WTO negotiations of the Doha round show parallel developments. For example, the increase or decrease of the trade balance is more or less pronounced, while a change of direction is merely an exception and of a negligible magnitude.

- Implementation of the Harbinson 1½ proposal results in negative changes in the EU's trade balances for most agricultural products. Particularly affected are processed food products and beef. In contrast, the trade balances for sugar, milk and other animal products show slightly positive developments.

- Similar effects can be observed in Japan, other high-income Asian countries, Mediterranean and North African countries as well as in other European countries, where agricultural protection is also above average.

- Conversely, the US, Canada, Australia and New Zealand are able to realise some gains in trade in the wheat, other crops, beef, other meat products and other processed food sectors. Unsurprisingly, Australia and New Zealand also realise an impressive gain in the dairy products sector.

- The analysis does not reveal a uniform pattern in the results of the developing countries and the LDCs. Yet in most countries and regions there is a predominant increase of imports relative to exports. Specifically, the EBA region experiences a significant loss in the sugar trade balance. Given the EBA agreement already in place, the LDCs have to face an erosion of their preference in the WTO negotiations. Somewhat diverging from the mainstream of

developing countries are the other ACP countries, which at least realise some trade gains in their main export sectors of fruit, vegetables and sugar.

- The additional extension of the EBA agreement to the industrialised world leaves the developed and developing countries mainly untouched. EBA countries take advantage of the free access to the markets of industrialised countries and increase exports relative to imports for sugar, fruit and vegetables, oilseeds and particularly the trade in manufactures. To achieve the necessary increase in output in these main agricultural export sectors, resources are drawn from other sectors, mostly affecting wheat and other meat products.

- What difference does it make when the Swiss formula is used to cut tariffs instead of the tiered formula suggested in the Harbinson 1½ proposal? Predictably, it can be shown that worldwide the highly protected sectors experience severe losses relative to the application of the Harbinson 1½ approach. In the EU this mainly concerns the highly protected beef sector and other processed food products.

- Another sector that is much more affected under the Swiss formula is the wheat sector. Canada and the US experience a much higher positive change in their trade balances, while China and the Mediterranean and North African countries especially face severe losses owing to their high protection levels.

- Particularly interesting from the developing countries' viewpoint are the trade balances for fruit and vegetables as well as sugar. Here, a comparison between the application of the Harbinson approach and the Swiss formula reveals a much higher impact on trade balances if the tiered formula of the Harbinson approach is used. In the case of sugar, the higher reduction of sugar import tariffs worldwide under the Swiss formula does not change trade balances very much in industrialised countries. Developed countries would be able to achieve a reasonable gain in their sugar trade balances, which would be more or less financed through erosion of the trade preferences of the EBA countries.

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Appendix

Table A1. Comparison of the Harbinson 1½ proposal and the Doha Work Programme

	Harbinson 1 $\frac{1}{2}$ proposal (TN/AG/W/1/Rev.1)	Doha Work Programme (WT/L/579)
Market access		
Tariffs	Reduction from final bound tariffs **Initial tariff rate** → **Reduction rate (Ø / at least)** Developed countries: > 90% →Ø -60% / -45% < 90% >15% →Ø -50% / -35% ≤ 15% →Ø -40% / -25% Developing countries: > 120% →Ø -40% / -30% ≤ 120%, > 60% →Ø -35% / -25% >20%, ≤60% →Ø -30% / -20% ≤ 20% →Ø -25% / -15% Implementation within five years	Reductions through a tiered formula (single approach) from bound rates for all members other than LDCs; "Progressivity… through deeper cuts in higher tariffs with flexibilities for sensitive products"; no more details
Tariff rate quotas	For developed (developing) countries TRQs<10% (6.6%) of 'current' domestic consumption shall be extended to that level (10%), or extension to 8% (5%), provided that the volume for a corresponding number of TRQs is expanded to 12% (8%) of 'current' domestic consumption Implementation within five years	Expansion for sensitive products
In-quota tariff rates	In-quota duty free for all tropical products Where fill rates of TRQs on an average of three years have been less than 65% the in-quota tariffs shall not be reduced.	Reduction or elimination
Special agricultural safeguard provisions	Outline of a new special safeguard mechanism to enable developing countries to take account of their development needs	Remains under negotiation
Export competition		
Export subsidies	-100% for agricultural products representing at least 50% of the aggregate final bound level of budgetary outlays (B) for all products subject to export subsidy commitments, final bound levels of budgetary outlays and quantities (Q) as specified in members' schedules shall be reduced over five years. (formula: $B_j = B_{j-1} - c \cdot B_{j-1}$ (c = 0.3)[5]); the remaining 50% of the export subsidy commitment should be reduced within nine years (formula: $Q_j = Q_{j-1} - c \cdot Q_{j-1}$ (c = 0.25)[6]); reduction categories of 10 and 12 years for developing countries	-100%; end date to be agreed
Export credits, export credit guarantees and insurance programmes	Shall be subject to disciplines	-100% for export credits, export credit guarantees and insurance programmes with repayment periods beyond 180 days

Table A1. Comparison of the Harbinson 1½ proposal and the Doha Work Programme (continued)

Domestic support		
Overall cut AMS + permitted de minimis level + Blue box payments		-20% for all developed countries during the first year of the implementation period, cuts will be made from bound levels.
AMS (Amber box)	-60% (developed countries) within five years, -40% (developing countries) within 10 years for individual products: ≤ ∅ AMS 1999-2001	Reduction using the tiered approach: "Product-specific AMSs will be capped at their respective average levels according to a methodology to be agreed".
Green box	Will be maintained	Review of the criteria
Blue box	-50% of direct payments in five years; implementation in equal annual instalments (developed countries) -33% in 10 years (developing countries) Shall be included in the calculation of the AMS	Should not exceed 5% of average total value of agricultural production during a yet to be specified reference period (the Derbez text goes further: it suggests dates for the historical period 2000-02 and linear reductions thereafter for an (x) number of years (ICTSD, 2004)
De minimis	-0.5% annually over a period of five years for developed countries The level of 10% for developing countries shall be maintained	Reduction commitments will be negotiated

Sources: WTO (2003b) and WTO (2004d).

Table A2. Aggregation of countries and regions

Countries and regions	Abbreviation
1. European Union 15 Austria, Belgium, Denmark, Finland, France, Germany, Ireland, the United Kingdom, Greece, Italy, Luxembourg, the Netherlands, Portugal, Spain and Sweden	**EU-15**
2. Central and Eastern European countries **(middle and south-east European countries)** Bulgaria, Czech Republic, Hungary, Malta, Poland, Romania, Slovakia, Slovenia, Estonia, Latvia, Lithuania and Cyprus	**MOEL**
3. United States	**US**
4. Canada	**CAN**
5. Oceania Australia, New Zealand	**OZE**
6. Indonesia	**INDO**
7. Malaysia	**MAL**
8. Brazil	**BRA**
9. India	**INDIEN**
10. China	**CHINA**
11. Everything But Arms countries Bangladesh, Rest of South Asia, Malawi, Mozambique, Tanzania, Zambia, Other Southern Africa, Uganda and the rest of Sub-Saharan Africa	**EBA**
12. Other African, Caribbean and Pacific countries Central America, Caribbean, Botswana and Zimbabwe	**AAKP**
13. High-income Asia Hong Kong, Korea, Taiwan and Singapore	**HICAS**
14. Japan	**JAP**
15. Former Soviet Union The rest of the former Soviet Union	**FSU**
16. Other European countries Switzerland and the rest of the EFTA members	**SONEU**
17. Other Asian countries Philippines, Thailand, Vietnam and Sri Lanka	**SONAS**
18. Mediterranean and North African countries Turkey, the rest of the Middle East, Morocco and the rest of North Africa	**MEDNO**
19. Other Latin America Mexico, Colombia, Peru, Venezuela, Rest of Andean Pact, Argentina, Chile, Uruguay, Rest of South America	**SONLA**
20. Rest of world Croatia, the rest of the South African Customs Union and the rest of the world	**ROW**

Source: Authors' own aggregation.

Table A3. Aggregation of sectors

Sectors	Abbreviation
1. Wheat	**WEIZ**
2. Cereal grains nec	**AGETR**
3. Oil seeds	**OELSAAT**
4. Sugar cane, sugar beet	**ZUKR**
5. Paddy rice	**REIS**
6. Vegetables, fruit, nuts, crops nec	**GMFRAP**
7. Cattle, sheep, goats, horses	**RIND**
8. Animal products nec	**ANDTIER**
9. Raw milk	**MILCH**
10. Meat: cattle, sheep, goats, horses	**RINDFL**
11. Meat products nec	**ANDFL**
12. Vegetable oils and fats	**OELE**
13. Dairy products	**MIPRD**
14. Sugar	**ZUCKER**
15. Processed rice, food products nec	**SNM**
16. Beverages and tobacco products	**GTTAB**
17. Primary sectors Plant-based fibres, wool, silk-worm, cocoons, forestry, fishing, coal, oil, gas, minerals nec, petroleum, coal products	**PRIMA**
18. Industry Textiles, wearing apparel, leather products, wood products, paper products, publishing, chemical/rubber/plastic prods., mineral products nec, ferrous metals, metals nec, metal products, motor vehicles and parts, transport equipment, electronic equipment, machinery and equipment, manufactures nec	**INDU**
19. Services Electricity, gas manufacture, distribution, water, construction, trade, transport nec, sea transport, air transport, communication, financial services nec, insurance, business services nec, recreation and other services, public admin./defence/health/education, dwellings	**DIENST**

Source: Authors' own aggregation.

Table A4. Pre-simulations, Agenda 2000 and EU enlargement

Pre-simulations:

CAP instruments

- complementarity approach is taken for milk and sugar (assumption: quantity in the database represents production quotas)
- land subsidy is equalised across sectors to implement a homogeneous area payment

EU's common budget

- 75% of tariff revenues as well as a share of GDP is accrued to the EU budget; determination of a uniform endogenous GDP rate
- expenses of the EAGGF are paid for by the common EU budget
- entails net transfers between EU member states

Agenda 2000:

Cereals

- reduction of intervention prices by 15%
- unification of direct payments for cereals, oilseeds and protein plants
- reduction of set-aside rate from 15% to 10%

Beef

- reduction of intervention prices by 18%
- no change in direct payments (assumption: an increase in direct payments is compensated by a lower output)

Milk

- reduction of intervention prices by 15%
- retention of quota regulation
- increase of quota by 2.4%

EU enlargement:

Creation of a customs union

- EU-15 and the middle and south-east European countries (MOEL) abolish all bilateral trade barriers
- MOEL to establish the trade protection of the EU-15
- production quotas for milk and sugar are fixed at the current production level of the MOEL
- there is no set-aside in the new member countries
- direct payments in the EU-15 remain unchanged
- 100% of the current land and animal premiums in the EU-15 are transferred to the new member states (standard procedure)
- ceilings are fixed for direct payments with an endogenous adjustment of the premium rate for land and animals in the EU-15

Common EU budget

- complete integration of the MOEL in the common budget of the EU: 90% of tariff revenues as well as a share of GDP to the EU budget
- payments in the framework of the EAGGF in the MOEL through the common budget
- implementation of net transfers between the EU-15 and the MOEL

Table A5. Changes in output in Experiment 1 (Harbinson 1½ proposal) (%)

	EU27	USA	CAN	OZE	INDO	MAL
Wheat	-1.9	3.2	8.3	-0.8	6.9	-3.0
Other Crops	-6.3	1.6	3.9	6.3	0.0	1.5
Oil Seeds	1.7	1.1	0.0	0.7	-0.2	4.7
Sugar Cane, Sugar Beet	-0.1	-7.4	14.6	2.3	0.3	0.8
Rice	-12.8	6.1	0.3	13.9	0.7	0.9
Vegetables, Fruits	-0.6	-1.0	-1.3	-1.4	0.3	-3.4
Cattle	-3.6	2.1	-0.2	6.5	-0.1	4.2
Other Animal Products	0.5	0.2	-5.0	-4.8	-0.3	0.9
Raw Milk	0.0	-0.6	-4.1	15.3	-0.5	7.0
Beef	-5.9	1.8	1.0	14.5	0.0	2.0
Other Meat Products	-0.5	1.8	-3.8	0.8	-0.8	-1.2
Vegetable Oils and Fats	-1.0	-0.3	-0.6	-1.9	0.0	5.9
Dairy Products	-0.2	-0.6	-5.7	17.6	9.6	7.6
Sugar	0.0	-7.7	27.3	2.5	0.4	0.0
Other Food Products	-2.7	0.7	1.7	2.0	0.7	1.5
Beverages and Tobacco	0.6	-0.3	-0.5	-1.4	-0.1	0.0
Primary Products	0.0	0.0	-0.1	-0.7	-0.1	-0.2
Manufactures	0.1	-0.1	-0.3	-1.9	-0.3	0.5
Services	0.0	0.0	0.0	0.0	0.0	-0.3

	BRA	INDIEN	CHINA	EBA	AAKP	HICAS
Wheat	0.2	0.3	-4.4	2.1	1.5	4.8
Other Crops	0.4	-0.1	-0.7	0.2	-0.9	-21.0
Oil Seeds	1.7	0.0	-5.2	-0.4	0.9	-8.1
Sugar Cane, Sugar Beet	1.0	0.0	-0.5	-6.1	9.3	3.4
Rice	0.1	0.1	0.1	-0.4	0.4	2.5
Vegetables, Fruits	0.4	-0.3	0.1	0.1	0.6	-1.0
Cattle	0.9	0.0	0.2	0.0	0.3	1.0
Other Animal Products	1.1	-0.1	0.1	0.1	-1.1	1.7
Raw Milk	-0.1	0.0	0.2	-0.3	0.2	2.3
Beef	1.0	13.6	0.1	1.1	0.0	1.0
Other Meat Products	2.0	2.8	-0.1	0.4	-2.1	1.7
Vegetable Oils and Fats	0.3	-3.5	-3.1	0.5	-1.9	13.7
Dairy Products	0.0	0.3	4.9	-1.0	1.2	2.7
Sugar	1.8	0.2	-1.9	-16.3	15.4	3.8
Other Food Products	0.1	2.1	0.0	-0.6	1.5	2.9
Beverages and Tobacco	-0.2	0.0	0.3	0.3	-1.1	0.4
Primary Products	-0.2	0.0	0.0	0.3	-0.4	0.0
Manufactures	-0.4	0.1	0.1	1.6	-1.4	-0.2
Services	0.0	0.0	0.0	0.1	-0.1	0.0

	JAP	FSU	SONEURO	SONAS	MEDNO	SONLA
Wheat	-59.8	3.2	-10.4	-0.7	-3.1	0.5
Other Crops	-8.2	3.8	0.1	0.6	0.4	0.1
Oil Seeds	-11.0	-1.2	-4.5	-3.3	-2.6	-0.9
Sugar Cane, Sugar Beet	-6.1	11.8	10.2	0.7	0.7	1.3
Rice	-3.3	1.3	14.0	1.2	-0.3	1.8
Vegetables, Fruits	-1.9	0.1	-5.2	-0.2	0.0	0.9
Cattle	-8.8	4.7	-4.6	-0.2	-3.1	0.6
Other Animal Products	-0.7	-0.8	7.6	-0.8	-2.0	-0.8
Raw Milk	-7.4	2.0	-18.2	0.0	-1.6	0.3
Beef	-3.8	5.1	0.2	-0.4	-5.3	1.2
Other Meat Products	-4.8	0.9	-10.3	0.2	-14.9	-1.0
Vegetable Oils and Fats	7.6	-1.6	42.0	-1.9	-4.2	0.0
Dairy Products	-8.9	5.7	-29.1	2.6	-4.9	0.6
Sugar	-6.5	14.8	11.8	0.7	2.5	1.6
Other Food Products	-1.6	1.6	20.9	1.3	-1.1	1.3
Beverages and Tobacco	0.7	-0.8	6.8	0.4	0.7	-0.2
Primary Products	0.0	-0.1	-0.2	-0.1	0.2	-0.1
Manufactures	0.3	-0.3	-0.5	-0.2	0.6	-0.3
Services	0.0	0.0	-0.2	-0.1	-0.1	-0.1

Source: Authors' own calculations.

Table A6. Changes in output in Experiment 2 (Harbinson 1½ proposal, EBA adopted by developed countries) (%)

	EU27	USA	CAN	OZE	INDO	MAL
Wheat	-1.9	3.4	8.4	-0.5	-3.0	-3.0
Other Crops	-6.3	1.6	3.9	6.3	1.5	1.5
Oil Seeds	1.6	1.0	-0.2	0.7	4.8	4.8
Sugar Cane, Sugar Beet	-0.1	-8.1	13.3	2.1	0.8	0.8
Rice	-12.8	5.7	0.1	11.4	0.9	0.9
Vegetables, Fruits	-0.5	-1.2	-1.5	-1.4	-3.4	-3.4
Cattle	-3.6	2.1	-0.2	6.5	4.2	4.2
Other Animal Products	0.5	0.2	-4.9	-4.8	0.9	0.9
Raw Milk	0.0	-0.6	-4.1	15.3	7.0	7.0
Beef	-5.9	1.8	1.0	14.5	2.0	2.0
Other Meat Products	-0.5	1.8	-3.8	0.8	-1.2	-1.2
Vegetable Oils and Fats	-0.9	-0.2	-0.6	-1.9	6.4	6.4
Dairy Products	-0.2	-0.6	-5.7	17.6	7.6	7.6
Sugar	0.0	-8.4	24.7	2.2	0.0	0.0
Other Food Products	-2.7	0.7	1.6	1.9	1.5	1.5
Beverages and Tobacco	0.6	-0.3	-0.5	-1.4	0.0	0.0
Primary Products	0.1	0.0	0.0	-0.7	-0.2	-0.2
Manufactures	0.1	-0.1	-0.4	-2.0	0.4	0.4
Services	0.0	0.0	0.0	0.0	-0.3	-0.3

	BRA	INDIEN	CHINA	EBA	AAKP	HICAS
Wheat	0.2	0.3	-4.4	1.1	1.6	4.8
Other Crops	0.4	-0.1	-0.7	0.0	-0.3	-21.0
Oil Seeds	1.7	0.0	-5.3	-0.3	0.9	-8.1
Sugar Cane, Sugar Beet	1.2	-0.1	-0.5	-6.1	9.0	3.4
Rice	0.1	0.1	0.1	0.0	0.4	2.5
Vegetables, Fruits	0.3	-0.3	0.1	0.5	0.5	-1.0
Cattle	0.9	0.0	0.2	0.2	0.3	1.0
Other Animal Products	1.1	-0.1	0.1	-0.1	-1.1	1.7
Raw Milk	-0.1	0.0	0.2	-0.2	0.3	2.3
Beef	1.0	13.5	0.2	0.4	0.0	1.0
Other Meat Products	2.0	2.7	-0.1	0.0	-2.0	1.7
Vegetable Oils and Fats	0.3	-3.5	-3.1	-1.5	-1.9	13.8
Dairy Products	0.0	0.3	4.9	-0.3	1.3	2.7
Sugar	2.1	0.2	-1.8	-16.3	15.0	3.7
Other Food Products	0.1	2.1	0.0	-0.3	1.5	2.9
Beverages and Tobacco	-0.2	0.0	0.3	0.0	-1.0	0.4
Primary Products	-0.2	0.1	0.1	-0.2	-0.4	0.0
Manufactures	-0.4	0.1	0.1	1.8	-1.4	-0.2
Services	0.0	0.0	0.0	-0.1	-0.1	0.0

	JAP	FSU	SONEURO	SONAS	MEDNO	SONLA
Wheat	-59.8	3.1	-10.3	-0.7	-3.2	0.5
Other Crops	-8.2	3.7	0.0	0.6	0.3	0.1
Oil Seeds	-11.2	-1.2	-3.7	-3.2	-2.6	-0.8
Sugar Cane, Sugar Beet	-6.2	12.0	9.4	0.7	0.7	1.2
Rice	-3.6	1.2	13.5	1.1	-0.2	1.7
Vegetables, Fruits	-2.0	0.1	-5.6	-0.2	0.1	0.8
Cattle	-8.8	4.7	-4.6	-0.2	-3.1	0.6
Other Animal Products	-0.7	-0.8	7.7	-0.8	-2.0	-0.8
Raw Milk	-7.4	2.0	-18.2	0.0	-1.6	0.3
Beef	-3.8	5.1	0.2	-0.4	-5.3	1.2
Other Meat Products	-4.8	0.8	-10.3	0.3	-14.9	-1.0
Vegetable Oils and Fats	7.7	-1.7	42.2	-1.9	-4.3	0.1
Dairy Products	-8.9	5.7	-29.1	2.6	-4.9	0.6
Sugar	-6.5	15.0	11.0	0.7	2.5	1.6
Other Food Products	-1.8	1.6	21.1	1.3	-1.1	1.3
Beverages and Tobacco	0.7	-0.8	6.9	0.4	0.7	-0.2
Primary Products	0.0	0.0	-0.2	0.0	0.2	0.0
Manufactures	0.3	-0.3	-0.5	-0.2	0.5	-0.3
Services	0.0	0.0	-0.2	-0.1	-0.1	0.0

Source: Authors' own calculations.

Table A7. Changes in output in Experiment 3 (Swiss formula, 33) (%)

	EU27	USA	CAN	OZE	INDO	MAL
Wheat	-0.7	6.5	16.8	-1.6	-13.1	-13.1
Other Crops	-5.4	0.0	7.4	17.0	5.1	5.1
Oil Seeds	2.5	3.1	-2.1	5.9	9.4	9.4
Sugar Cane, Sugar Beet	-0.3	-9.4	26.3	1.9	2.3	2.3
Rice	-16.7	13.2	-1.5	36.4	2.5	2.5
Vegetables, Fruits	0.0	-0.5	-4.8	-3.6	-8.9	-8.9
Cattle	-4.5	3.6	-1.3	9.7	8.2	8.2
Other Animal Products	0.8	-0.3	-9.4	-10.1	2.1	2.1
Raw Milk	0.0	0.1	-10.3	25.8	11.8	11.8
Beef	-8.5	3.2	1.5	22.1	0.6	0.6
Other Meat Products	-0.2	3.3	-7.2	0.2	-3.1	-3.1
Vegetable Oils and Fats	0.2	-1.0	-1.8	-3.6	7.1	7.1
Dairy Products	0.0	0.1	-14.3	29.8	12.6	12.6
Sugar	0.0	-9.7	48.5	2.1	1.7	1.7
Other Food Products	-2.5	0.8	-0.2	2.1	4.2	4.2
Beverages and Tobacco	0.9	-0.6	-0.7	-2.4	0.5	0.5
Primary Products	0.0	-0.1	-0.1	-1.2	-0.5	-0.5
Manufactures	0.0	-0.2	-0.3	-3.1	1.5	1.5
Services	0.0	0.0	0.0	0.0	-0.6	-0.6

	BRA	INDIEN	CHINA	EBA	AAKP	HICAS
Wheat	0.6	0.5	-13.2	3.4	2.0	9.9
Other Crops	0.4	-0.2	-0.2	0.2	-0.8	-51.8
Oil Seeds	3.8	-0.1	-12.7	-0.8	2.3	-20.0
Sugar Cane, Sugar Beet	0.5	-0.1	-1.0	-9.9	14.9	4.8
Rice	-0.1	0.1	0.2	-0.5	0.5	5.5
Vegetables, Fruits	0.1	-0.6	0.2	0.2	0.3	-1.9
Cattle	1.7	0.1	0.4	0.1	0.3	2.0
Other Animal Products	1.6	-0.1	0.6	0.2	-1.4	3.8
Raw Milk	-0.5	0.0	0.5	-0.4	0.0	3.0
Beef	1.9	29.0	0.6	1.7	-0.6	1.9
Other Meat Products	2.9	6.2	0.0	0.7	-2.7	3.0
Vegetable Oils and Fats	-0.7	-6.7	-5.3	0.0	-1.9	37.5
Dairy Products	-0.1	0.5	7.3	0.9	0.3	3.4
Sugar	0.7	0.6	-3.8	-26.2	24.6	5.3
Other Food Products	-0.1	-0.7	-0.2	-0.7	0.4	6.5
Beverages and Tobacco	-0.3	0.1	0.6	0.5	-1.3	1.1
Primary Products	-0.2	0.1	0.1	0.5	-0.5	0.0
Manufactures	-0.5	0.2	0.2	2.3	-1.6	-0.4
Services	0.0	0.0	0.1	0.1	-0.1	-0.1

	JAP	FSU	SONEURO	SONAS	MEDNO	SONLA
Wheat	-83.0	3.0	-37.5	0.2	-6.9	0.6
Other Crops	-4.1	3.8	-5.7	0.8	-1.1	0.2
Oil Seeds	-11.8	-1.9	-5.5	-5.6	-4.5	-0.7
Sugar Cane, Sugar Beet	-8.3	32.5	10.6	0.6	-0.3	2.3
Rice	-5.6	0.3	24.6	1.6	-1.3	2.3
Vegetables, Fruits	-1.7	-0.7	-7.0	-0.6	-1.2	1.0
Cattle	-11.1	4.2	-6.9	0.4	-7.6	1.1
Other Animal Products	0.4	-4.2	10.2	-1.1	-3.1	-1.7
Raw Milk	-13.5	2.4	-23.4	-0.2	-5.3	0.3
Beef	-2.9	4.6	0.8	-0.6	-16.6	2.3
Other Meat Products	-6.6	-2.9	-18.8	-0.6	-33.7	-2.5
Vegetable Oils and Fats	12.0	-6.0	63.9	-4.7	-6.7	-1.3
Dairy Products	-16.6	8.5	-37.6	3.5	-17.5	0.5
Sugar	-8.7	41.8	13.2	0.5	1.7	3.1
Other Food Products	-1.6	0.2	31.2	1.7	-4.1	0.5
Beverages and Tobacco	0.8	-0.9	9.9	0.9	2.6	-0.3
Primary Products	0.0	-0.1	-0.3	-0.1	0.5	-0.1
Manufactures	0.4	-0.3	-0.6	-0.2	2.1	-0.3
Services	-0.1	0.0	-0.3	-0.1	-0.1	-0.1

Source: Authors' own calculations.

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