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ALTERNATIVE MARKET ACCESS SCENARIOS IN THE AGRICULTURAL TRADE NEGOTIATIONS OF THE DOHA ROUND*

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***ABSTRACT**:* The paper explores an important issue in multilateral agricultural trade negotiations, namely the approach taken to reduce tariffs, simulating possible liberalization scenarios. The analysis is based on the model of the Global Trade Analysis Project (GTAP), and on the related version 6.0 database. Scenarios are run on a 2013 baseline, built by taking into account a number of events that have affected (and will further affect) world agricultural markets up to that period, focusing on the effects that are specifically attributable to further trade liberalization in the Doha Round. The policy strategies analyzed are two hypothetical liberalization scenarios in terms of market access and export competition, plus a free agricultural trade benchmark scenario. More specifically, in terms of market access we compare proportional cuts in tariffs with a Swiss-formula approach. Over the range of formula parameters considered here, we find that the impacts are not greatly influenced by the extent to which higher tariffs face bigger cuts. Results indicate that welfare gains could be reaped both by developed and developing countries, but only the possibility of inter-country compensations would allow, at least in principle, an agreement to be reached.

Jel code: F13 (Commercial Policy; Protection; Promotion; Trade Negotiations), Q17 (Agriculture in International Trade)

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1. INTRODUCTION

The November 2001 declaration of the 4th Ministerial Conference in Doha provides the mandate for negotiations on a range of subjects, including agriculture. Negotiations on this topic began in early 2000, but after years of intensive negotiations the Cancún Ministerial Meeting was unsuccessful in finding consensus on the agricultural component, although the lack of success may have reflected other issues that are cross-linked through the 'single undertaking' ("nothing is agreed until all is agreed"). However, the General Council's decision on the Doha Agenda work programme (the "July Package"), agreed on 1 August 2004, provided at least a framework to focus the ongoing negotiations.

A large number of governments have submitted negotiating proposals and, besides aspects like special and differential treatment for developing countries and non-trade concerns, the classical themes like market access, export subsidies and domestic support are high on the agenda. This study provides insights into the nature and magnitude of the possible impacts of an agricultural agreement for international trade and the resulting welfare improvements. The analysis focuses on trade liberalization scenarios on the basis of a set of simulations run with the global general equilibrium model of the Global Trade Analysis Project (GTAP) (Hertel, 1997).

While the United States (US) and the European Union (EU) used to be the major players in the Uruguay Round, in the present round other countries are also major participants in trade negotiations, especially among the developing countries. The objective of the empirical analysis is twofold. Firstly, the effects on prices, trade flows and welfare are considered for individual countries and regions and for the main country groups. Secondly, we provide a quantitative assessment of the trade-offs between non-linear approaches such as the Swiss formula, and approaches such as the proportional cuts approach that are less targeted to reducing peak tariffs.

The paper is organized as follows: section 2 briefly presents the model. Since full impact of possible WTO outcomes is expected to take place in 2013, section 3 deals with the construction of the baseline including projections based on external forecasts on macroeconomic developments. This baseline takes into account events such as the 2003 Fischler reform of the Common Agricultural Policy (CAP) of the EU, the 2002 *FSRI Act* reform of the US agricultural policy, the enlargement of the EU to 25 States, and the "Everything But Arms" (EBA) initiative of the EU. Despite its limitations, such efforts to develop a "realistic" baseline allow the effects that are specifically attributable only to further trade liberalization in the Doha Round to be estimated.

The contents of a possible agreement on agriculture are impossible to forecast at this stage, but the main subjects under negotiations are defined: section 4 presents two possible liberalization scenarios in terms of market access and export competition. Both of them are broadly consistent with the provisions of the "July Package" stating that tariff reductions will be made from bound rates through a tiered formula that takes into account Members' different tariff structures, as well as the elimination of all forms of export subsidies. The first of these scenarios is an adaptation of the "Draft Agreement" (hereafter referred to as *Draft*) prepared by the Chairman of the Agriculture Committee Harbinson in March 2003 (WTO, 2003a and 2003b). The second one replaces the linear reductions in each of the band of the first scenario with a non-linear type of tariff reduction commitment. It is based on a "Swiss"- type harmonizing formula (in which the coefficient of reduction is depending on the initial average rate) inspired by a text originally put forward by the Chairman of the WTO Negotiating Group on Market Access on non-agricultural products Girard (WTO, 2003c). These are analyzed together with a third scenario, which is meant to constitute a benchmark, implying

the elimination of all trade measures for agricultural products. It should be recalled that the specific modalities of tariff reductions are at least as important as the overall average reduction (Bureau and Salvatici, 2004). In order to take this into account, the modelling of tariff reduction scenarios is carried out for several countries at the most detailed level of existing information (Harmonized System, 6 digits) in the World Integrated Trade Solution (WITS) database (http://wits.worldbank.org).

Section 5 presents the simulation results, highlighting the impact of trade liberalization scenarios on prices, trade flows and welfare. Concluding remarks appear in section 6.

2. THE MODEL

This work is based on a modified version of the model provided by the GTAP. This is a perfectly competitive comparative static general equilibrium computable framework (Hertel, 1997). The structure of demand and supply, which is homogeneous across regions and products, is built upon the Social Accounting Matrices of individual countries and regions, while parameters are mostly drawn from the literature and calibrated on the reference database period.

The model assumes the presence of representative consumers and producers together with a government sector, and all incomes are assumed to accrue to a single "regional" household. Therefore, all distributional aspects are overlooked, and all consumers are assumed to purchase all goods. By the same token, government costs and revenues do not need to balance, as it is assumed that any discrepancy accrues directly to the households (i.e. the single "regional" household). Government's consumption behaviour is endogenous, while policies are exogenous (Hertel, 1997).

Substitutability among primary factors and with intermediate consumption is modelled through a set of nested Constant Elasticity of Substitution systems, while the production of final goods is aggregated through a fixed coefficient function of the Leontiev type. On the demand side the representative agent allocates his income among savings, government and private consumption through a *Cobb-Douglas* utility function, while allocation within different private goods is modelled through a Constant Difference of Elasticity demand system (Hanoch, 1975).

Bilateral trade flows are modelled through product differentiation on the demand side, with the assumption of imperfect substitutability between similar goods produced in different countries and regions (Armington, 1969). Transaction costs are also accounted for in the model, as transport services are explicitly considered among the activities in the economy.

The standard GTAP model adopts the Walrasian closure rule, by which investment at the global level is adjusted to global saving, and the balance of payments is endogenous in individual countries and regions.

The most recent publicly available database version – known as version 6 – includes data on up to a maximum of 87 regions and countries, 57 industries and 5 endowments, and is referred to 2001 as a base period. In general, there are two groups of data which are of particular relevance for global models: those on border protection, and those on bilateral trade flows. The GTAP database is built from the COMTRADE data, supplied by the United Nations Statistical Office, through an *ad hoc* reconciliation procedure based on a reliability indicator of the information supplied by each importing and exporting country. Trade policy data are retrieved from the MacMaps database (Bouët *et al.*, 2001), while data on domestic

support in agriculture is based on the OECD and USDA Producer Support Estimates (PSE). Export subsidies are directly derived from countries' notifications to the WTO.

Ad valorem tariffs are the only trade policy measure directly represented in the model, ignoring tariff rate quotas as well as several other types of measure which are still applied in agricultural markets despite the "tariffication" process brought about by the 1994 URAA. Particularly, concerning the CAP, the model does not consider the existing variability in the tariffs applied to cereals and rice, and the seasonal duties applied to imports of fruits and vegetables. Also for this reason, the assessment of the impact of trade liberalization may not be accurate.

It is also worth recalling that even if all existing trade policy measures were *ad valorem* tariffs, their modelling within a framework like the GTAP would still create conceptual problems, due to the need to aggregate tariffs across product: no model could ever include products at the level of detail at which tariff lines are specified. This work attempts to partly overcome this limitation, by calculating for some of the most important WTO member countries the result of the reduction commitment envisaged under different reform scenarios starting from the most detailed available data (see section 4).

3. THE 2013 BASELINE

Version 6 of the database was adjusted for this application to include 47 regions, 15 products and 5 endowments (Table 1). The attempt was made to maximize the number of WTO member countries explicitly included in the analysis. The Central and Eastern European Countries (CEECs) aggregate includes all the ten countries which became EU members in 2004. Lack of consistent data forced to include eight residual areas plus a wider and even more heterogeneous "rest of the world". Products were chosen with an evident emphasis on agriculture and food, attempting also to strike a balance between those more directly of interest for the major agricultural economies and to the low and middle income countries. Products for which data is available at different processing stages were also included separately; this is the case of rice, sugar, oilseeds, and dairy (Table 1).

Being the database referred to year 2001, the construction of the 2013 baseline required a number of shocks. Particularly, two different types of shocks were introduced. Firstly, exogenous variables were shocked up to the levels projected for year 2013. These are

- GDP, whose projections are those of the World Bank World Development Indicators, adjusted by the USDA/ERS with the projections of the Oxford Economic Forecasting, DRI-WEFA, and of the Project Link;
- population, whose projections are retrieved from the United Nations;
- agricultural labour force, whose projections are retrieved from the FAOSTAT;
- total factor productivity, whose projections are those proposed by Hertel and Martin (2000) on the basis of a number of studies on the topic.

Secondly, a number of policy shocks were introduced, accounting for some of the most important changes occurred in the agricultural and agricultural trade policy frameworks between 2001 and today.

Particular consideration was given to the CAP, which has undergone significant modifications over this period: the residual implementation of the "Agenda 2000" reform, and the Fischler reform of 2003. Moreover, the enlargement of the EU, and the related extension of the CAP to ten new members was taken into account. Finally, a set of shocks was introduced into the

model to take into account the change in the preferential policy pursued with the EBA framework, allowing all imports from the LDC countries to access the EU market duty free from 2009.

Several papers have recently introduced changes in the basic GTAP model aimed at improving policy representation, with special reference to the CAP (Bach *et al*, 2000; Frandsen and Jensen, 2001; Brockmeier *et al.*, 2001; van Meijl and van Tongeren, 2002). The policy specification adopted here partly draws on these contributions (Table 2).

The CAP direct payments are modelled as *ad valorem* subsidies to factor use, particularly on land use for cereals and oilseeds, and on capital use for livestock. The level of such payments can be reduced if actual cultivation exceeds a reference ("base") area, and if the livestock inventory exceeds a maximum reference size. In fact, there is a financial stabilization mechanism aimed at discouraging farmers from over investing in the activities for which the payments are granted, and at limiting the effects of such subsidies in terms of market distortion. In order to introduce such a mechanism into the model, we added a condition by which the expenditure in each crop specific payment is exogenously fixed to the level of the base period, while the unit (*ad valorem*) subsidy is endogenously adjusted on the basis of the changes in output. Moreover, since payments are determined in nominal terms, they were deflated at a 2 percent per year rate, in order to take into account their reduction in real terms.

Concerning intervention prices, their changes for rice, cereals, and dairy products were approximated through changes in the corresponding import taxes. Land set-aside programs, instead, were not considered, as they did not change significantly after 2001. For dairy products, output quotas were modelled by setting production exogenously at the level of the base period, and checking after each step undertaken in building the 2013 baseline, that this limit was effectively binding.[1] This simplified modelling captures one of the main objectives of this measure in the EU – preventing output growth – while it disregards the presence of the rent accruing to producers.

The EU enlargement included the removal of all import tariffs between the EU and the CEECs, and the alignment of all export, output and input subsidies and taxes reported in the database. Concerning the extension of direct payments, they were fully introduced in the CEECs in at the same level of the Eu 15 in year 2013, as envisaged by the CAP[2].

Some of the elements of the 2003 Fischler reform of the CAP were also considered in the construction of the baseline. Given the model's characteristics, of this reform package it was possible to consider the decoupling of direct payments, i.e. their switch to non-crop-specific payments, and the change in the support to EU rice producers. Particularly, the shocks introduced refer to: (i) the 50 percent reduction of intervention price of rice, which was implemented as shown in Table 2; (ii) the increase in direct payments to rice producers, from 63 EUR/hectare to 177 EUR/hectare; (ii) the decoupling of direct payments granted to cereals, oilseeds and bovine meat producers. This last measure, which is considered the most important among those introduced by the 2003 reform, is represented in the model through a homogeneous subsidy to land use, captured by an additional variable, whose level is determined endogenously on the basis of the expenditure arising in the baseline from the granting of crop-specific subsidies. Such subsidies are eliminated, while the expenditure that they generate in the baseline is transformed into a homogeneous subsidy to land employed

[1] This prevents the quota from acting as a minimum rather than a maximum constraint on output.

[2] The calculation of the equivalent subsidy in *ad valorem* terms was approximated on the basis of data from FAO, Commodities and Trade database, and on the GTAP databases.

solely in agricultural activities.[3] Though the Commission left member countries room to decide the extent to which some particular payments have to be de-coupled, it was assumed that all countries would choose full decoupling, as this appears to be so far the decision taken by most countries for the vast majority of payments.

Several important parts of the 2003 reform were not taken into account, particularly the modulation of direct payments, the environmental cross compliance elements introduced, and the provision for rural development. The reason for this choice is that any meaningful modelling of such measures is logically incompatible with the representative agent assumption of the GTAP model, as all of them require some differentiation among different types of farmers (Al Mekki *et al.*, 2000).

Given the intricacies of the CAP, the modelling of its instruments which is proposed here is simplified in many respects; there are three main limitations that are worth highlighting. Firstly, the modelling of changes in intervention prices assumes a one-to-one transmission of such changes on market prices. As has been shown in more than one case (van Meijl and van Tongeren, 2002) this simplification may overstate the effect of lowering intervention prices. The second is the mentioned lack of consideration of the rent generated by production quotas, particularly in the dairy sector. Thirdly, the impossibility of accounting for the exclusion of land employed for the cultivation of fruits from among those on which the decoupled payment can be claimed.

The EBA agreement, which is simply introduced as the elimination of import tariffs on all products exported by the LDCs into the EU and the CEECs was also included in the database.

Concerning other countries' policies, some of the provisions of the FSRI Act, which was implemented in the US in 2002, were included in the baseline. Policy shocks were introduced following mostly Bouët *et al.* (2004). A reduction in land productivity was introduced to take into account the increase in the acreage conservation program. Output subsidies were increased for cereals - taking into account a 3% increase for coarse grains and a 6% increase for wheat - and for dairy products, by 3%. A 4% decrease was implemented for soybeans.

Also the decoupled payments of the PROCAMPO program in Mexico have been increased in 2004, by 3% and by 9% respectively for farmers with more and less than five hectares of land (FAO, 2005). A weighted average increase has been considered, based on work by Eastwood *et al.* (2004). Finally, the recent introduction of direct payments in China was also taken into account, by considering a reference of about US$ 36 per hectare in 13 provinces, which are among the most important for grains production (FAO, 2005). An *ad valorem* subsidy to land use in cereals, rice, and oilseeds was introduced, taking into account the share of the 13 provinces in total arable land.

4. THE DOHA AGENDA AND THE TRADE POLICY REFORM SCENARIOS

4.1 Trade negotiations and simulation scenarios

The purpose of this section is to outline the status of the WTO agricultural negotiations on market access and the scenarios that are going to be simulated. In 2001, WTO members agreed in Doha to launch a new round of trade negotiations, encompassing the agricultural negotiations already started in 2000 according to the so-called built-in agenda. The reform in

[3] It is worth recalling that at its November 2002 meeting in Brussels, the European Council decided that the overall expenditure for direct payments should not grow in nominal terms more than 1 percent per year until year 2013; this provision was assumed to correspond to zero growth of the expenditure in real terms.

each of the three main areas of the agricultural negotiations - market access; export competition, and domestic support – has formed since then a key elements of the Doha Development Agenda. The agricultural sector, as a matter of fact, has higher tariffs on average than any other sector and it is the only sector for which the WTO rules permit the use of export subsidies.

Negotiators missed the 31 March 2003 deadline for producing "modalities" (i.e., numerical targets and formulas) for countries' commitments, and the most recent Ministerial meeting of the WTO, held at Cancun in Mexico in September 2003, ended in deadlock. After Cancun, there were efforts to put the negotiations and the rest of the work programme back on track. The outcome was the agreement reached at the end of July 2004 on a package of framework agreements (the "July Package") on moving forward the Doha round of trade negotiations.

Out of the three main issues under negotiation, in our simulation scenarios we focus on the two main components: market access and export competition. Even if domestic support has been so far one of the most contentious issues, it does not seem likely that the US and the EU will be willing to accept an agreement that would disrupt the ongoing process towards the "decoupling" of agricultural support (Jensen et Yu, 2005). Moreover, there is some evidence that trade expansion and welfare gains can be achieved, even when domestic support is excluded from the multilateral agreement (Anderson et al., 2005; Conforti, 2005; Rae and Strutt, 2003).

The Doha mandate calls for "reductions of, with a view to phasing out all forms of export subsidies". In the July Package, Members have agreed to establish detailed modalities ensuring the parallel elimination of all forms of export subsidies and disciplines on all export measures with equivalent effect by a credible end date. Accordingly, all our simulation scenarios provide for the abolishment of export subsidies.

The Doha mandate commits WTO members to "substantially improve market access". Two major approaches have emerged for tariff reductions in general. One would copy the formula of the URAA, which used an average reduction over all products, allowing some variations for individual products provided a minimum reduction was met. The fundamental problem with this approach is that it provides no reward for cutting a high tariff rather than a low one, and hence allows policymakers to avoid dealing with tariff peaks and escalation.

The other approach envisages "non-linear" reductions on higher tariffs, for example using a "Swiss formula"[4] or similar, which would produce much steeper cuts on higher tariffs and would also have the effect of establishing a maximum tariff level. Critics say this would be too complicated, because it would require converting specific tariffs into *ad valorem* tariffs. Supporters say a Swiss formula or something similar is needed in order to deal with extra tariffs ("tariff peaks"), and to narrow the gaps between tariffs on finished products and raw materials ("tariff escalation").

According to the July Package, farm tariffs will be cut according to a single, tiered approach: the higher the tariff, the higher the tariff cut will be. However, the agreement caters for several developed countries' concern to address "sensitive products", as well as developing countries' concern to benefit from a special and differential treatment across the board, e.g. lower tariff cuts and special treatment on market opening for so-called "special products". Meetings held since August 2004 confirmed the differences in approach on the formula to be used for tariff reduction. Some countries argue strongly for a non-linear, Swiss formula to be applied in each of the band of the tiered approach to making tariff reduction. This is

[4] The Swiss formula was first proposed by Switzerland in the Tokyo Round negotiations in the 1970s, and was used for negotiations on industrial tariffs.

vigorously objected by other countries, proposing instead average linear reductions (Uruguay Round-style) in each band of the tiered formula.

We focus on two liberalization scenarios, which may be summarized as follows:

1. *Harbinson approach - no export subsidies*. In the March 2003 draft modalities, the formulas in each band use the Uruguay Round approach (average cuts subject to minimums). According to the experience of the previous round, many governments would be tempted to reduce tariffs by only a small percentage on certain specific commodities, with larger (percentage) reductions concentrated on products with small tariffs. However, since it would be arbitrary to assume a specific pattern of cut allocations, our scenario provides for a uniform reduction in each band. That is, we implement a simple proportional cut, frequently described as a linear cut in policy discussions:

$$T_1 = cT_0 \tag{1}$$

Where T_0 is the initial (bound) tariff, T_1 the rate after application of the formula and c is the constant proportion of their original rate to which tariffs are to be reduced. For developed countries this scenario implies:

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

The reduction is much less severe for developing countries:

- 40% reduction if tariffs are greater than 120%;
- 35% reduction if tariffs are equal or smaller than 120% and greater than 60%;
- 30% reduction if tariffs are equal or smaller than 60% and greater than 20%;
- 25% reduction if tariffs are equal or smaller than 20%.

2. *Girard approach - no export subsidies*. Also this scenario is based on the bands identified in the *Draft*, but the formulas in each band are based on the "Swiss"- type harmonizing formula put forward by the Chairman of the WTO Negotiating Group on Market Access on non-agricultural products. The new rate T_1 is given by:

$$T_1 = \frac{t_a \cdot T_0}{t_a + T_o} \tag{2}$$

where $\underline{t_a}$ is the national average of the bound rates within each band, and T_0 the initial rate. Therefore, the national average bound rates become the maximum within each band: different values of the coefficients for each country allow to build more flexibility into the formula, compensating for the steep tariff reductions required by the Swiss approach. In this scenario, given the high degree of differentiation of the commitments for each country, we do not introduce any further elements of special and differential treatment for developing countries.

In both cases, tariff cuts are implemented at the most detailed level allowed by the WITS database (6 digit of the Harmonized System). We then compare the reduced bound rate with the applied one: if the former is lower than the latter, these are the new tariffs which are aggregated up to the GTAP sectors level through weighted averages. Otherwise, presently applied rates are used.

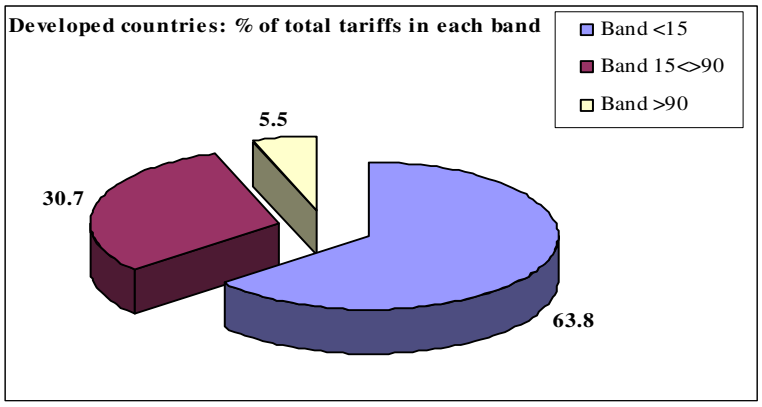
In the previous scenarios we were not able to take into account relevant issues, such as the treatment of sensitive and special products. Lack of progress in the negotiations, as a matter of fact, did not provide any hints on possible criteria to be used for the identification of these products.

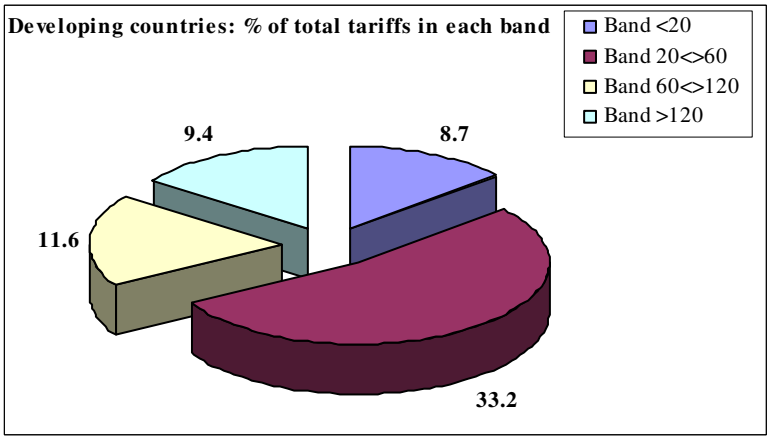
Finally, it is worth recalling that the tiered approach requires the calculation of *ad valorem* equivalents of specific tariffs. Since products are categorized by height of starting tariff, without this calculation it would not be possible to put products charged specific duties into their appropriate categories (the "tiers"). For purposes of calculation, then, we used the *ad valorem* equivalents provided by the WITS database. It should be noted though, that in actual negotiation what could be considered a purely technical exercise has become a very sensitive and highly politicized issue.

4.2 Some practical issues

Several practical issues arise in the implementation of formula cuts described above. These include the distribution of national tariffs in terms of the bands; the implications of different degrees of concavity in tariff-reduction formula; the comparison between theoretical (i.e., based on bound rates) and effective (i.e., based on applied rates) cuts.

The actual modalities – the number of bands, threshold for defining bands and type of tariff reductions within each band – remain subject to negotiation. As a consequence, we decided to rely upon the only official proposal including tariff bands, namely the Harbinson proposal. The following figures provides information on the share of tariffs included in each band for developed and developing countries.





Apparently, the number of tariff lines falling in each band is quite different. This is unavoidable, if the thresholds are to be the same across countries; but there could be a political problem, if a configuration were chosen where in the highest band only a small number of Members would end up with most of their tariffs. In the same vein, there could be a "ghetto issue" if a limited number of tariff lines were grouped in a band: political economy considerations suggest that it could be easier to accept substantial cuts if a specific industry does not find itself cornered in the highest band.

In order to get the same share of tariff lines in each band, an alternative approach would take for each country the universe of all agricultural *ad valorem* tariffs (including the *ad valorem* equivalents) and rank them in ascending order. Depending on the number of bands agreed, corresponding "tiles" (e.g. tertiles, quartiles or quintiles) of this universe would then determine the boundaries of the bands. Advantages of this approach included (i) that it was an objective/automatic method based on real tariff data, (ii) that it therefore helped to take out political steam of this matter, and (iii) its simplicity in application. However, it should be noted that such a method would need different thresholds for each country.

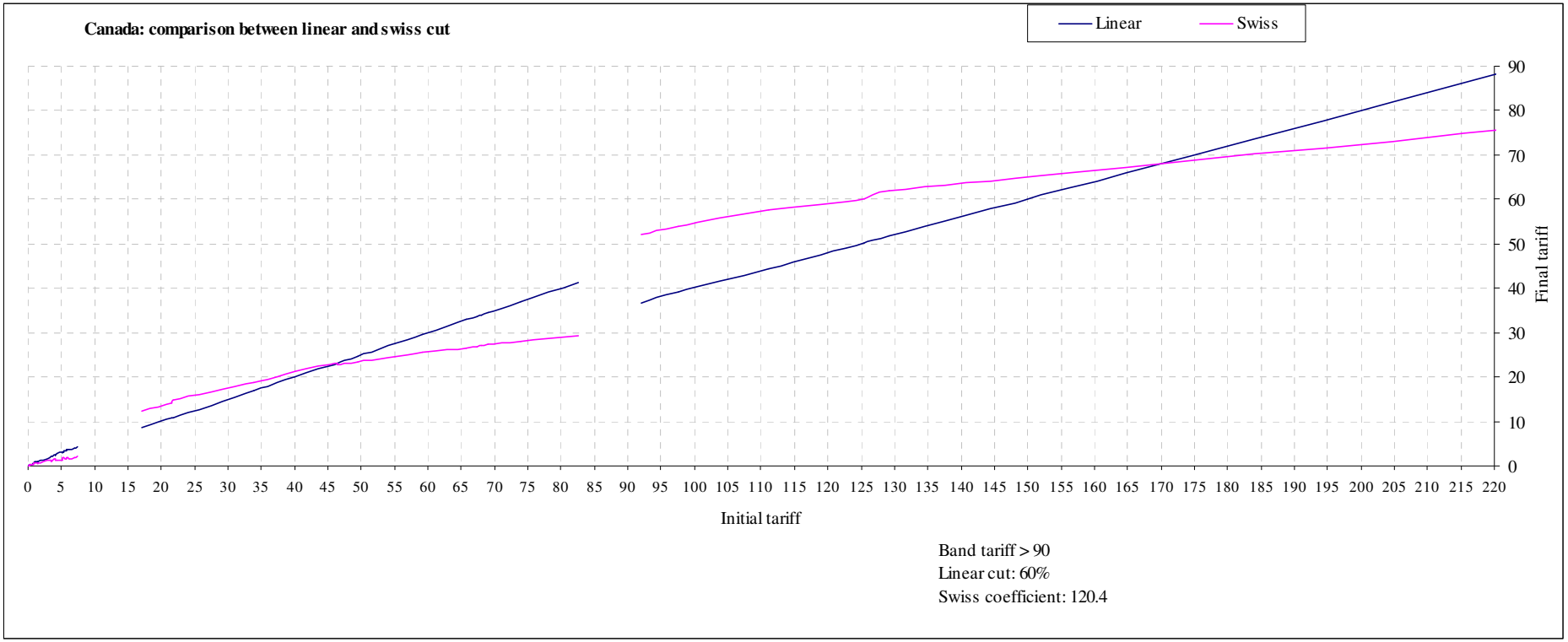
The July Package provides for "progressivity" to be achieved through deeper cuts in higher tariffs. The Harbinson proposal, with larger reduction rates for the highest tiers, achieves harmonization across bands, but does not imply deeper cuts for higher tariffs within bands. In order to get some harmonization within bands, we couple the "Harbinson bands" with a non-linear formula, the so-called Swiss formula.

Economic principles suggest that formulas for tariff reduction should focus on reducing the highest tariffs by the largest amount. Unfortunately, the use of non-linear formulas makes the negotiation more difficult, since approaches that reduce high tariffs by more than low have different effects on average tariffs in different countries. In order to balance the ambitions for reducing high tariffs more than others with the desire for broad equality of "sacrifice" we resorted to a proposal advanced within the negotiations on non-agricultural market access.

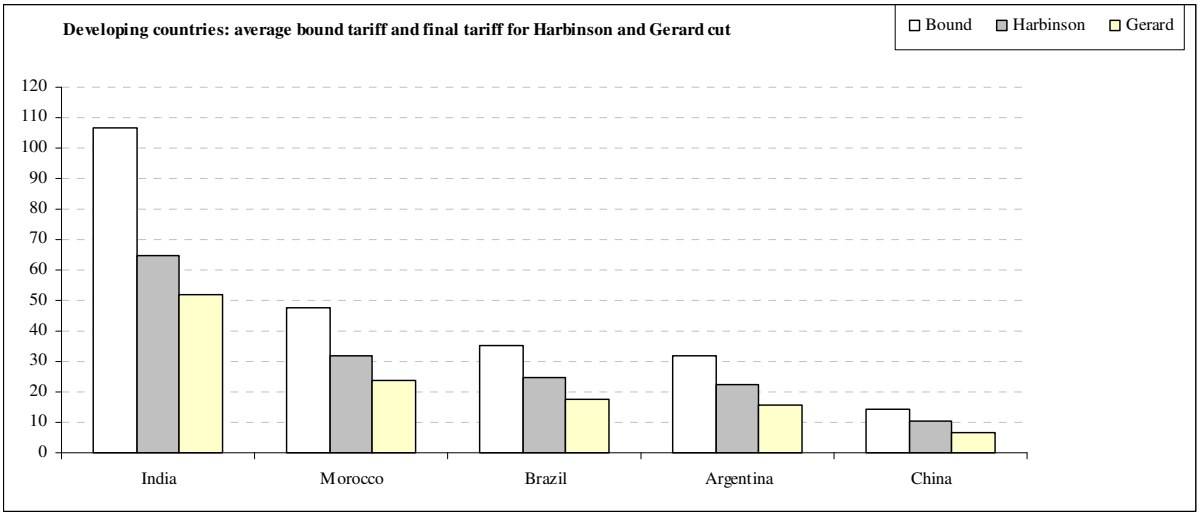
The Girard proposal has a number of desirable features for tariff negotiations. Firstly, it would have the "special and differential treatment" built in the formula, since the variable (and country-specific) coefficient of the Swiss-formula would take into account the differences in tariff structures between developed and developing country Members. On the contrary, in the case of the Harbinson proposal special and differential treatment in favour of developing countries takes the form of different thresholds and lower cuts.

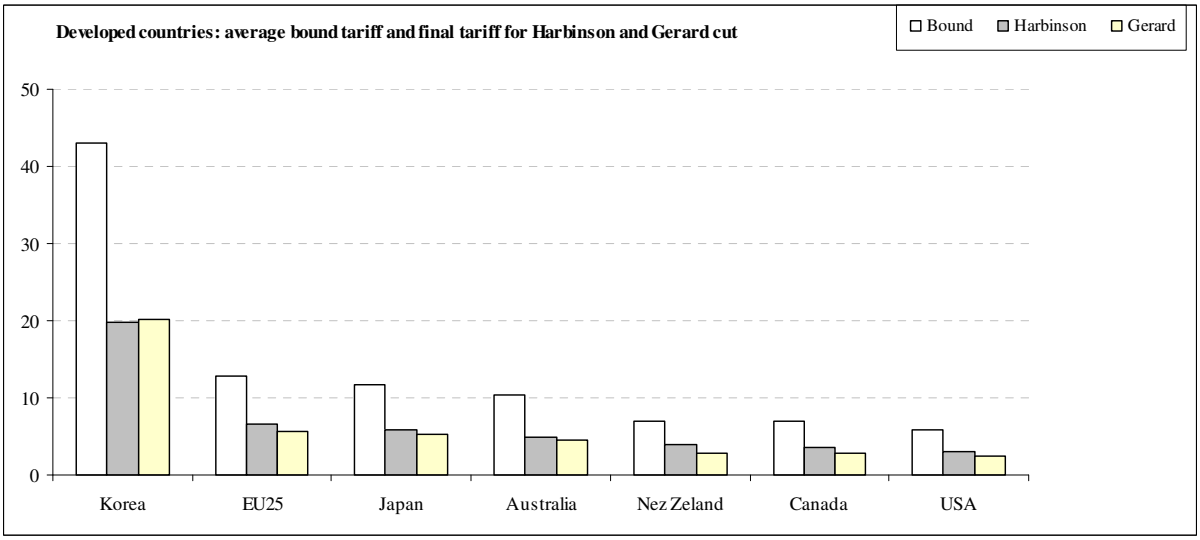
Secondly, in the Harbinson scenario a situation could arise where the cut of a tariff in the higher band would result in a final tariff that would be lower than the cut of a tariff in the lower band ("overlap issue"). On the contrary, this never happens in the other scenario.[5] The following graph shows the overlapping taking place for the Canadian tariffs in the close neighbourhood of the second and third bands.

[5] As it is well-known, the overlapping issue is of paramount importance in the case of progressive income tax methods. In that case, several possible approaches have been suggested (and actually implemented) to address the problem.


Canada: comparison between linear and swiss cut
Linear
Swiss
Final tariff
Initial tariff
Band tariff > 90
Linear cut: 60%
Swiss coefficient: 120.4

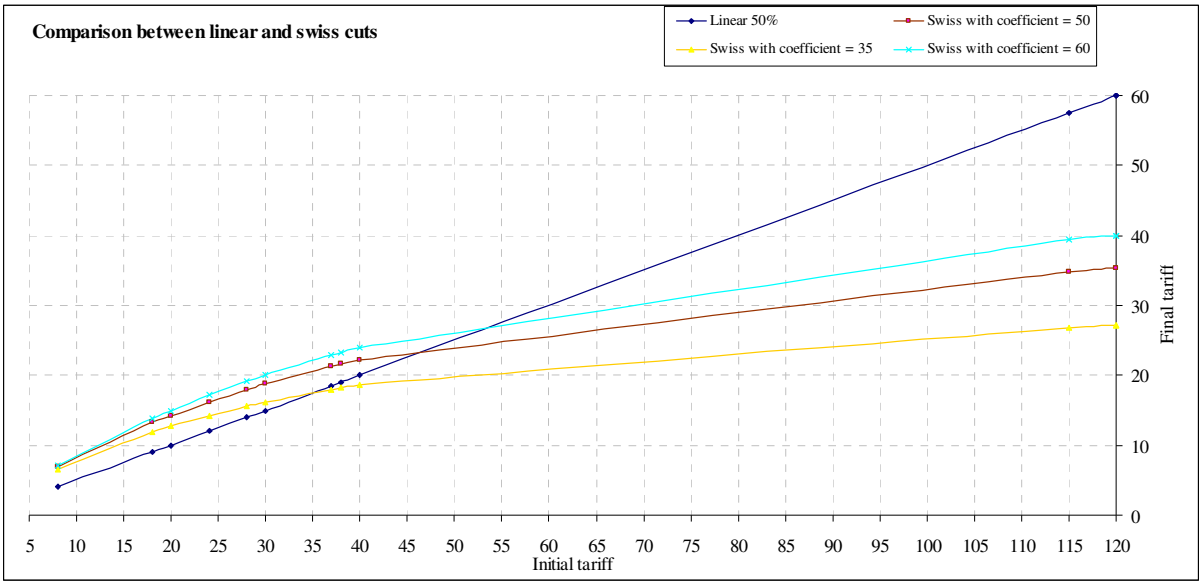
However, even if the potential benefit from use of a non-linear formula are large, the following diagrams make clear that our two scenarios do not differ significantly in the extent to which they reduce average tariffs.





To understand the reason why this is the case, it is useful to consider some numerical examples. For an extremely small initial tariff, say one tenth of one percent, the coefficient by which T_0 is multiplied in equation (2) $(t_a /(t_a + T_0))$ is very close to one, so there is essentially no reduction in the tariff. For an initial tariff rate of t_a, the final tariff rate is a half of t_a, implying a 50 percent reduction from the initial tariff. For a very high initial tariff, $T_0/(t_a + T_0)$ approaches one and the tariff rate is effectively reduced to t_a.

A stylized comparison of the proportional tariff cut of 0.5, required by the Harbinson scenario for the middle band in the case of developed countries, with a Swiss Formula using different parameters t_a is given in the following figure.

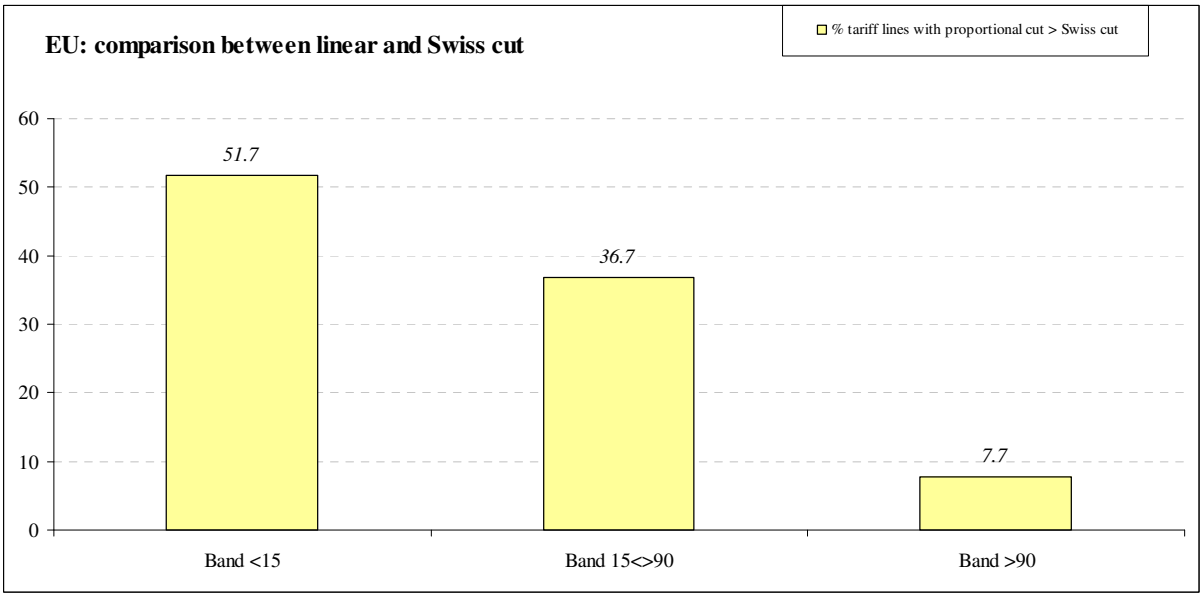


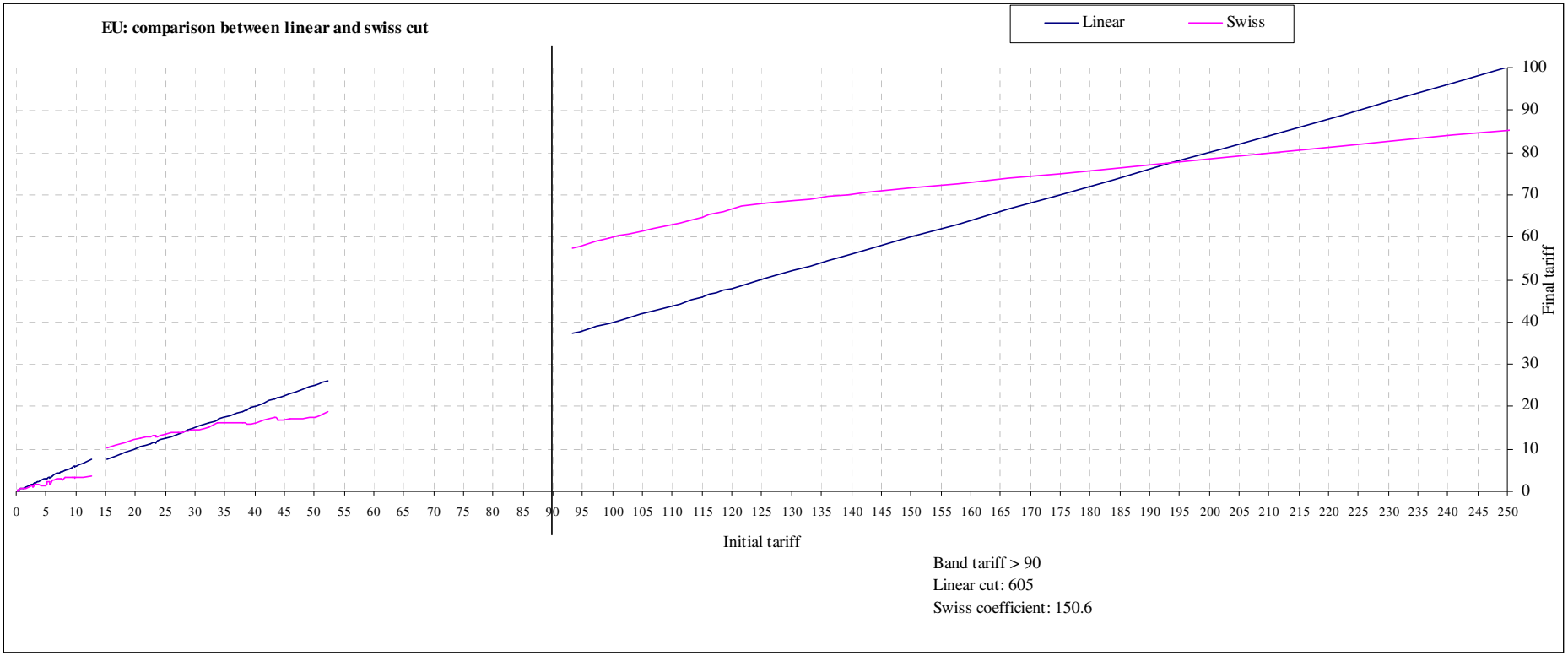
The figure shows that cuts in the highest tariffs are larger using the Swiss formula than using the proportional cut formula, but that cuts for tariffs below a "switching point" (τ) are smaller with the Swiss formula. The bottom line is that more strongly concave formulas reduce higher tariffs more sharply, but lower tariffs less strongly than linear reduction formulas. Formally, the threshold can be computed equating the new tariffs resulting from (1) and (2)

$$c\tau = \frac{t_a \tau}{t_a + \tau} \Rightarrow \tau = \frac{t_a (1-c)}{c}$$

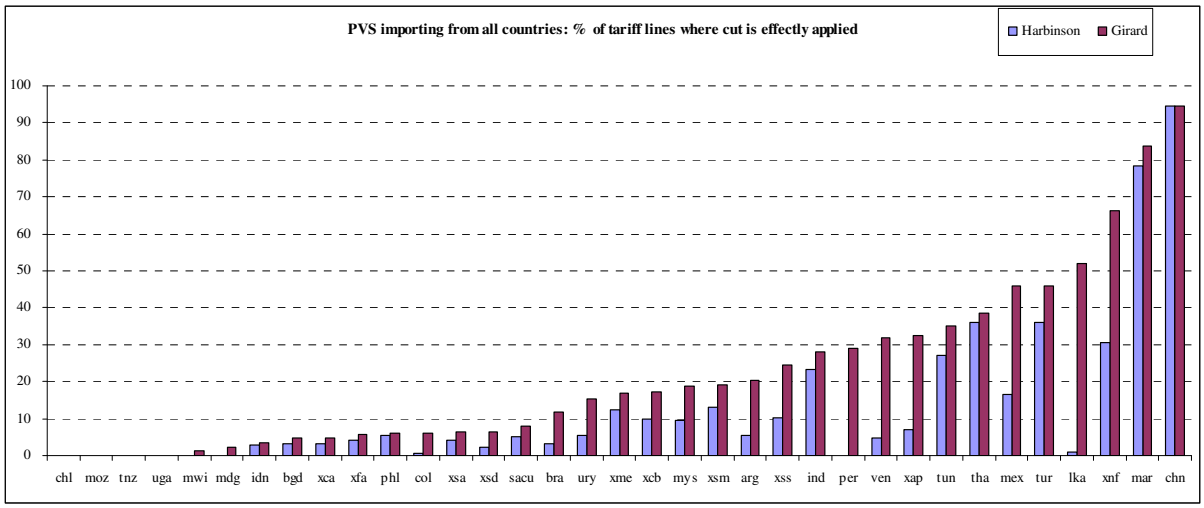
(3).

This confirms the intuition of the graph, that τ is inversely related to the proportional reduction and directly related with the (simple) average within the band. As a consequence, the Harbinson scenario is more likely to get an higher number of larger cuts in the lower bands (since they present lower values for *c*) and in the case of tariff structures characterized by a few large tariffs within the band. The following diagrams compares the cuts obtained in the two scenarios for the EU.




EU: comparison between linear and swiss cut
Linear
Swiss
Final tariff
Initial tariff
Band tariff > 90
Linear cut: 605
Swiss coefficient: 150.6

The inclusion of preferential and/or applied tariffs is one of the major improvements of Version 6 GTAP data base. Many developing countries apply MFN tariffs that are lower than their bound tariffs, reflecting a combination of relatively high initial bindings, and the subsequent sharp wave of reductions in applied rates (Francois, Martin and Manole, 2005). The difference between bound and applied tariffs is usually referred to as "water": the larger the amount of water in the tariffs, the less likely is that the reduction of the bound tariffs imply an actual improvement in market access. The following figure provides information on the share of agricultural tariffs where the cut is effectively implemented, since the difference between the old and new bound rate is larger than the tariff overhang. The figure refers to the developing countries, but it worth recalling that also the applied tariffs of developed countries are much lower than their bound tariffs under preferential agreements.[6]



5. SIMULATION RESULTS

The results confirm two basic intuitions. Firstly, that the degree of tariff and export subsidy reduction in agricultural products is positively related to the potential gains in terms of economic welfare; as a matter of fact, the more tariff reduction scenarios imply substantial cuts, the more market price changes reflect comparative advantages. Secondly, there are very small differences in the results between the Harbinson and the Girard scenarios. Hence, the sequel will mostly deal only with the first of these two scenarios, in comparison with the free trade scenario.

Geographically, the simulations show that trade policy reform would imply mostly market prices decreases in the major economies of Asia, in the Mediterranean region, in Sub Saharan Africa, and in Europe; whereas in Oceania, and throughout North, Central and South America, market prices would increase in most countries. With few exceptions in Japan and South Korea, most price changes range up to a maximum of 15 percent, but remain below 10 percent in most instances.

Considering specific countries, under the "Harbinson" reform scenario prices would increase in Australia, New Zealand and Thailand (Figure 1) especially for dairy products, sugar and

[6] The EU is a good example. More than one third of the value of imports of agricultural and food products enters the EU within preferential agreements, at a much lower rate than the bound tariff, and only 9 countries export food products to the US without access to some tariff preferences (Bureau and Salvatici, 2004).

cereals in the first two cases, while paddy and processed rice prices would show the relatively higher increase in the case of Thailand and Australia. In Asia, both India and China would experience price changes under the "Harbinson" scenario up to a maximum of 10 percent for Chinese vegetable oils (Figure 2); for these products, the database reports a high tariff, particularly on imports from Brazil and Argentina, that is significantly reduced in the simulations. Prices would also decrease in Bangladesh and Pakistan – the latter is by far the most important component of the "Rest of Asia" region – reflecting mainly the reduction of high import tariffs.

For the US, Canada, and Central America prices show mostly an increase under the reform scenarios, and especially for rice, cereals, oilseeds, and for fruits and vegetables especially in Central America. This does not apply to dairy products for Canada, whereas sugar price grows in Central America only (Figure 3). Agricultural prices would remain pretty stable in Mexico, while most of the rest of Latin America would experience significant price increases, particularly Uruguay for dairy, livestock and cereals production; together with Argentina and Brazil, especially for oilseeds and cereals, including rice and for livestock (Figure 4).

Most agricultural prices decrease in Europe and in the Russian Federation (Figure 5), despite the reduction in support brought about by the CAP reform process that was taken into account in the construction of the baseline. The EU 15 would experience substantial price reductions, especially for sugar, livestock and dairy products, while less pronounced decreases take place in the CEECs, due to the lower level of domestic support in this latter area. The Russian Federation - for which scenarios do not imply trade reform since the country is not a member of the WTO - would show a generalized and marked price decrease, with the exception of sugar.

In the Mediterranean region, prices grow for more than one products only in Turkey and in Morocco while the two residual regions show a generalized reduction (Figure 6). Also in Sub Saharan Africa, agricultural prices show a generalized decrease under the trade reform scenarios, particularly pronounced for rice, livestock and dairy products (Figure 7); in Southern Africa, Malawi would experience a significant price decreases, for virtually all products, while South Africa shows an increase especially for rice, fruits and vegetables and oilseeds and the plant-based fibres (Figure 8).

An interesting result is also the change that the model projects in the real returns to land, a primary factor which is assumed to be employed exclusively in agriculture. Evidence is generally consistent with the observed behaviour of agricultural prices, although percentage changes do not always increase to the extent of tariff and export subsidies reductions (Figure 9). Negative changes are spread across East Asia, South East Asia, Africa, the Middle East and Europe, while positive outcomes would follow especially for large producers in Latin America and Oceania, and also for may exporters in Asia and Africa, and also for Turkey, Morocco and Tunisia. Across Africa, land returns increase for some of the least developed countries (LDCs), such as Malawi, and in the Southern African Customs Union (SACU) (Figure 9).

The real returns to labour appears, instead, less directly related to agriculture. The markets for skilled and unskilled labour market behave similarly, and show significant increases also in many of those countries in which agricultural prices and agricultural supply decrease after the reduction hypothesised in border protection. Improved resource allocation, following from reducing import tariffs and export subsidies, drives up the remuneration of this primary factor, both where the economy was more distorted by policies in the baseline, and in the countries benefiting from improved world price conditions. Therefore, with very few exceptions

changes are substantial in most countries (Figure 10), and especially in Malaysia, Japan and the Republic of Korea, but also in the Mediterranean regions and across Africa.

In order to understand changes in trade patterns following from policy reform, it is useful to look at the changes in the total terms of trade faced by each country and region. Simulations indicate that the major agricultural economies around the world would be those experiencing the more substantial improvements, and that such improvements are positively related to the extent of policy reform. Therefore, South American countries, together with Australia, New Zealand, Morocco and Tunisia, would see major improvements in their terms of trade (Figure 11). At the same time, changes in this variable are not so significant for some of the major industrialized economies, like the US, Canada, and the EU, due to the smaller relative importance of agricultural trade in total trade, that dampens both positive and negative effects. This same difference in weight also explains why the effect on total terms of trade is so negative for some countries and regions – like South Asia and some African countries – in which agricultural trade is a substantial portion of total trade.

The Equivalent Variation (EV) associated in each county with the simulation scenarios as a measure of welfare change was considered here both as total variation, and in its components arising from the changes in the terms of trade and resources allocation, following the decomposition proposed by Huff and Hertel (2000). As anticipated, total potential benefits are increasing with the extent of the reform, though they are certainly far from impressive: as an order of magnitude, they range from 0.04 percent of world GDP of the Harbinson scenario, to the 0.08 percent of the Girard scenario, up to the 0.12 percent of world GDP in the free trade scenario.[7]

Looking at individual countries (Table 3), there are few negative signs, more frequent among developing countries, and especially in Sub Saharan Africa and among the Least developed countries. Here, the negative sign of total welfare change arises mostly from small or even negative allocation effects, coupled with negative terms of trade effect. This is also the case of other countries such as Venezuela, the Philippines and the Rest of North Africa. The large emerging agricultural economies such as China, India, Brazil and Argentina would mostly gain, either due to wide allocation effects more than offsetting negative terms in the terms of trade, as in the case of China and India, or to large favourable terms of trade effects, as it is the case for the Latin American countries.

The changes in the terms of trade shown before, appear as a direct consequence of a more competitive international environment, in which comparative advantages in the different agricultural production sectors play an increased role in shaping agricultural trade and prices. This being the case, losses may easily arise in countries with less diversified economies, where there are fewer possibilities of recovering international competitiveness in different production sectors when the support to those activities which are now protected is reduced. In other words, this result tells that relatively poor economies may have less comparative advantages to resort to if protection is reduced in agriculture, as they have fewer activities other than their present agricultural sectors.

Along the same lines, the grouping of countries shows that the LDCs are those less likely to benefit from trade liberalization; this supports the notion that these countries may require *ad hoc* measures to counteract potential losses. The same applies also to some of the Net Food-Importing Developing Countries (NFIDCs), such as Venezuela or the Rest of North Africa, in

[7] The GDP employed in this comparison is the one reported in the GTAP database.

which, however there may also be substantial gains, together with a net aggregated benefit.[8] At the opposite extreme, OECD countries are those for which benefits for individual economies may be more substantial, together with the Cairns group.[9] The proxy adopted for the G-20 shows the heterogeneity of this group, in which there are substantial potential beneficiaries, such as Argentina, Brazil and Thailand, together with major losers, like Indonesia and Mexico.

Welfare results have been further elaborated by grouping countries into two broad entities – the developed and the developing countries –to study the interactions between their respective possible strategies on the basis of game theory, and to search for mutually advantageous agreements to be compared with actual agreement hypotheses in the negotiations.

A two-player, normal-form, non-cooperative game nested in the model described above is employed here to search for the presence of a Nash equilibrium within a single period game. In order to achieve an agreement in which both countries are made at least as well off as prior to negotiations, the settlement must lie within the agreement action space, i.e. the set of all agreement actions (Kennedy, von Witzke and Roe, 1996). The policy strategies analysed are the two liberalization scenarios described in section 4, plus the agricultural free trade scenario. Each player *i* has strategy choices which are:

- the status quo of the baseline (*sq*);
- the "weaker" liberalization scenario described in the previous section (*w*);
- the "stronger" liberalization scenario described in the previous section (*s*);
- the "free trade" in all agricultural commodities (*ft*).

Let $S_i = \left(a_i^{sq}, a_i^h, a_i^g, a_i^{ft}\right)$ represent the set of all possible strategies, which can be employed by agent *i*. Each player *i* chooses some strategy $a_i \in S_i$ in order to maximise its payoff given the strategy of the other. A similar set of strategies, S_{i+}, exists for the other main player (denoted by $i+$). In modelling the negotiating process of interdependent (groups of) countries, a Nash equilibrium occurs where each country (or group of countries) chooses policies that maximise its (their) EV, given the policy choice of the other (group). This equilibrium is defined using a best response correspondence. For a given a_{i+}, government i chooses a_i^*, one possible best response to a_{i+}, such that $EV_i\left(a_i^*, a_{i+}\right) \geq EV_i\left(a_i, a_{i+}\right)$, for all $a_i \in S_i$. A Nash equilibrium is defined as the set of strategies (a_i^*, a_{i+}^*) where a_i^* is a best response of a_{i+}^* for country (or group) *i*, and a_{i+}^* is a best response to a_i^* for country $i+$.

We model national governments as if they would focus on domestic welfare. The payoffs, as a matter of fact, are money metric measures of utility change from a base period. The model allows EVs attributed to various policy scenarios to be computed. The difference in EVs under alternative scenarios versus those in the baseline are used to determine the amount of money available for compensation across countries.

[8] Particular caution should be applied in considering this evidence, since the accuracy in representing the group is particularly poor: Central America and the Caribbean is included as a single region, as is the "rest of North Africa".

[9] Also for this group, representation in the database is very poor, as many individual participants are not available as individual countries.

The base solution to the non-cooperative game is presented in Table 4. Here all the results are positive, implying that within each group it is possible to make each country no worse off than in the status quo. By inspection, the combination (a_{DC}^{g} and a_{DG}^{g}) is the unique Nash equilibrium. The "Girard scenario", then, is a symmetric strategy which is dominant both for developed and developing countries.

Since we are dealing with two large groups of countries, the EV results incorporate the provision of inter-country compensatory payments. Without compensations, the agreement action space would be empty, since there are always some DGs which are worse off (the number of countries/regions presenting negative results is shown in brackets). Inter-country compensation, when required, is given up to the point where the compensating country's EV declines or the compensated country's EV increases to status quo levels, whichever comes first. Although the game defined here involves, at least in principle, monetary compensation for trade liberalization, in practice compensations might involve other forms, such as the preferential reduction (within each group) of trade obstacles in sectors different from agriculture. The previous game shows that both groups of countries should be willing (in principle) to reduce agricultural protection significantly.

In conclusion, the "tiered Girard proposal" seems to be a possible compromise, but we are fully aware that our results are not fully realistic. Inter-country compensations and side-payments are subject to negotiations, and economic efficiency is not certainly the (only) criterion motivating government behaviour. The final outcome of negotiations, then, cannot be explained only on the basis of classical welfare analysis which would predict the implementation of quite a radical liberalization scenario due to efficiency gains and the existence of some form of compensation between winners and losers.

6. CONCLUDING REMARKS

The analysis proposed in this paper is based on a baseline referred to year 2013. We build a "realistic" setting, allowing insulation of the effects of trade liberalization from those of the other major policy changes which are affecting and will affect world markets within the time horizon of the supposed implementation of any agreement eventually reached in the Doha Round.

The key parameters of the tiered approach to market access are still to be addressed. It is not clear whether two or three tiers coupled with an ambitious non-linear formula within the tiers will be established, or a larger number of tiers coupled with a linear rate of cut within tiers will be preferred.[10] In any case, the wide divergences between the broad approaches to tariff reduction initially proposed by different participants are going to carry over in the present phase of negotiations.

Although some countries, for example EU, Switzerland and Japan, would prefer an Uruguay Round approach to tariff reduction, it is very difficult to model commitments allowing discretion in assigning tariff cuts at the individual tariff-line level. As a consequence, in order to avoid arbitrary choices we focused on formulas implemented on a line-by-line basis, avoiding policy-makers' discretion at the individual product level.

We also examine the possible benefits of using more sharply concave tariff-cutting formulas. However, given the distribution of tariffs within the bands, we did not find significant differences with respect to the 2003 Harbinson proposal. An important message from our

[10] In principle, the type of cut within the tiers could vary across the tiers.

analysis appears then to be that the critical feature of a formula approach for welfare in the importing countries is not so much its willingness to go soft on peak tariffs, but rather the impact in terms of the average rate. In other words, as long as a reduction in the average is still met, moving closer to linear tariff cuts may not greatly change the final outcome.

Results are consistent with economists' expectations about the effects of a reduction in border protection, and for many countries confirm the notion that liberalization is positively related to the overall potential economic benefits that should arise from the increased role played by comparative advantages in shaping market prices and returns to primary factors.

The geography of the possible effects shows that several countries across Europe, the Americas and Asia may finally gain from improving their resource allocation after agricultural tariffs and export subsidies reductions by changing their agricultural production mix, or by moving labour and capital outside the primary sector. The same, however, does not apply to a number of African, to some Southern Asian, and to (few) Latin American countries, whose possibilities to benefit from incentives toward relocating resources inside and outside agriculture are limited by the extent and the diversification of the economy; and whose terms of trade may deteriorate in a more liberalized environment.

The analysis of the interaction between the strategies of the two main country groups - developed and developing countries –shows that there seems to be no reason, from an economic point of view, for confrontation within the multilateral negotiations of the Doha round: in terms of expected total economic benefits, a rather strong trade liberalization would be the dominant strategy for both groups. At the same time, this result highlights the extent to which the analyses that assume a "neutral" government are ineffective for understanding countries' behaviour in the negotiations. This seems to be true even using more accurate protection data, reflecting trade policies actually implemented. Apparently, there are other variables that explain governments' behaviour, such as sensitivity to agricultural lobbies, and the attempts to maintain long standing protection.

The general equilibrium approach adopted here highlighted the difficulties for poorer and the less diversified economies to capture the opportunities arising from a more liberal trade environment. Potential losses arising from changes in the terms of trade for some of the more fragile economies considered here, imply the presence in these countries of far more limited possibilities to switch toward competitive activities. As mentioned, this calls for *ad hoc* measures to counteract negative effects for these countries, although such measures should be designed in such a way as to minimize interference with ongoing efforts toward increasing the ability of such economies to exploit the opportunities arising from the more liberalized world trade environment; therefore their design is not straightforward, and should most probably not be based on simple border protection.

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Table 1 - Countries, regions, products and endowments

Countrie/regions	Products	Endowments
Australia	Paddy rice	Land
New Zealand	Cereals	Skilled labour
China	Vegetables, fruit and nuts	Unskilled labour
Japan	Oil seeds	Capital
Republic of Korea (South Korea)	Plant based fibers	Natural resources
Taiwan	Other primary products	
Indonesia	Livestock and meat	
Malaysia	Raw milk	
Philippines	Vegetable oils and fats	
Thailand	Dairy products	
Vietnam	Processed rice	
Bangladesh	Sugar	
India	Other food products	
Sri Lanka	Manufacturing	
Rest of South Asia	Services	
Canada		
United States		
Mexico		
Central America		
Colombia		
Peru		
Venezuela		
Rest of Andean Pact		
Argentina		
Brazil		
Chile		
Uruguay		
Rest of South America		
Caricom		
Rest of Caribbean countries		
European Union (EU15)		
CEEC		
Russian Federation		
Turkey		
Rest of Middle East		
Morocco		
Tunisia		
Rest of North Africa		
Malawi		
Mozambique		
Tanzania		
Madagascar		
South Africa Custom Union		
Uganda		
Rest of Southern Africa		
Rest of Sub-Saharan Africa		
Rest of World		

Table 2 - Policies shocks in the 2013 baseline

policy measure	shock introduced	sources of shock calculations
increase in the (semi-decoupled) payment per hectare to cereals producers (residual Agenda 2000 reform)	increase in the subsidy on land use	+5%, from 54 to 63 Euro/ton
reduction in the cereals intervention price (residual Agenda 2000 reform)	import tariff reduction	corresponding to market price reduction as a % of intervention price reduction inVan Meijil and Van Tongeren (2002)
reduction in the intervention price of butter and smp (Fischler reform)	import tariff reduction	-22% as trade weighted average of butter and smp
reduction in the intervention price of rice (Fischler reform)	import tariff reduction	-50% tariff on rice
increase in direct payment to rice producers (Fischler reform)	increases in subsidies to output and to input use	+37% in output subsidy; +96% increase in subsidy to land use
free-trade between the EU15 and CEEC (enlargement)	abatement of bilateral tariff and export subsidies between the EU15 and CEEC	-100% tariffs and subsidies
extension of the PAC to CEEC (enlargement)	equalization of all input and output subsidies between EU15 and CEEC; equalization of all bilateral tariffs and export subsidies toward the rest of the world	
introduction of decoupling of direct payment in EU25 (Fischler reform)	abatement of crop specific subsidies to land and capital use; introduction of a homogenous subsidy to land use	
FSRI act	increase in output subsidies to cereals	weight avarage of 6% for wheat and 3% for coarse grains (Bouet et al, 2005)
FSRI act	reduction in the output subsidy to soybeans	-4% (Bouet et al, 2005)
FSRI act	increase in output subsidies to dairy	3% (Bouet et al, 2005)
FSRI act	increased land set aside	-5% reduction in the productivity of land for wheat (Bouet et al, 2005)
direct payment to cereals and oilseeds in China	subsidy to land use	13% (FAO data and GTAP database)
increase in direct payment to land use in Mexico	subsidy to land use	7% (eatswood et al, 2004)
Everything But Arms policy (EBA)	abatement of bilateral tariff between EU25 and countries involved in the EBA	-100% tariffs

Table 3 - Total welfare effect for (proxies of) countries and regions groups ($ US million)

	allocative efficiency		terms of trade		total	
	Harbinson	free trade	Harbinson	free trade	Harbinson	free trade
proy for the ***G-20***						
China	2,570	2,387	-222	-382	1,947	1,779
Indonesia	55	3	-27	98	26	-1
Philippines	166	220	-76	-212	61	-36
Thailand	274	-27	706	1,180	904	1,080
India	595	1,798	-202	-604	400	1,246
Rest of South Asia	386	372	163	114	515	464
Mexico	431	425	-397	-477	3	-68
Central America	149	139	143	317	320	522
Rest of Caribbean	32	43	-16	38	17	130
Colombia	41	44	17	60	58	110
Peru	48	111	256	464	317	601
Venezuela	2	-2	-95	-131	-98	-136
Argentina	258	275	1,296	1,497	1,681	1,898
Brazil	261	263	3,377	3,736	4,557	5,006
Chile	-13	-16	278	331	198	245
Rest of Andean Pact	14	24	183	348	213	400
Tanzania	7	8	-26	-26	-35	-30
SACU	218	218	362	387	552	579
Total	*5,493*	*6,284*	*5,720*	*6,739*	*11,634*	*13,790*
proxy for the ***Least Developed countries***						
Bangladesh	63	83	-78	-101	-47	-51
Mozambique	7	5	-16	-11	-12	-7
Tanzania	7	8	-26	-26	-35	-30
Madagascar	0	0	-4	-4	-14	-12
Malawi	-12	-4	-49	-8	-63	-13
Uganda	-1	0	-10	-8	-32	-18
Rest of S-Sahar.Africa	492	438	-563	-729	-213	-411
Rest of Sth. Africa	69	-87	-746	-586	-700	-690
Total	623	444	-1,492	-1,474	-1,114	-1,232
proxy for the ***Net Food Importing Developing countries***						
Sri Lanka	30	52	-26	127	4	177
Rest of South Asia	386	372	163	114	515	464
Central America	149	139	143	317	320	522
Rest of Caribbean	32	43	-16	38	17	130
Peru	48	111	256	464	317	601
Venezuela	2	-2	-95	-131	-98	-136
Morocco	294	355	51	-29	346	328
Tunisia	303	377	95	350	424	810
Rest of North Africa	194	121	-291	-463	-151	-373
Total	*1,437*	*1,568*	*281*	*787*	*1,692*	*2,524*
proxy for ***developed countries***						
Australia	-110	-113	777	1,238	609	1,051
New Zealand	24	48	353	1,111	336	1,050
Japan	27,076	27,071	-3,853	-4,031	23,990	23,835
South Korea	4,162	3,975	-472	-482	3,507	3,328
Canada	1,207	1,002	-304	-2	881	976
United States	-1,135	-1,079	1,816	1,394	594	247
EU-15	7,486	8,527	-1,735	-3,665	5,452	4,262
CEEC	-406	267	439	345	86	472
Total	*38,303*	*39,699*	*-2,978*	*-4,091*	*35,456*	*35,221*
proxy for the ***Cairns Group***						
Argentina	258	275	1,296	1,497	1,681	1,898
Australia	-110	-113	777	1,238	609	1,051
Brazil	261	263	3,377	3,736	4,557	5,006
Canada	1,207	1,002	-304	-2	881	976
Chile	-13	-16	278	331	198	245
Colombia	41	44	17	60	58	110
Indonesia	55	3	-27	98	26	-1
Malaysia	1,664	1,444	-379	70	1,145	1,331
New Zealand	24	48	353	1,111	336	1,050
Philippines	166	220	-76	-212	61	-36
SACU	218	218	362	387	552	579
Uruguay	96	138	300	488	461	727
Total	*3,866*	*3,526*	*5,974*	*8,804*	*10,563*	*12,935*
Other countries						
Taiwan	-38	239	24	-162	-9	100
Vietnam	-5	-8	-102	-96	-201	-180
Rest of South America	67	71	257	312	304	359
Turkey	323	444	241	234	568	685
Russian Federation	131	109	-294	-204	-147	-65
Rest of Middle East	530	167	-883	-798	-432	-672
Rest of World	3,221	3,202	-370	-1,271	2,793	1,823
Total	*4,230*	*4,225*	*-1,126*	*-1,985*	*2,875*	*2,049*
Grand total	**53,953**	**55,745**	**6,379**	**8,779**	**61,105**	**65,286**

source: own calculation

Table 4 - Welfare results from game simulations ($ US million)

*DGs\ DCs**	**STATUS QUO**	**HARBINSON**	**GIRARD**	**FREE TRADE**
STATUS QUO	0; 0	7023; 50788 (17; 0)	7260; 52665 (17; 0)	7375; 50115 (17; 0)
HARBINSON	4930; 230 (15; 4)	14223; 52251 (14; 0)	14463; 54104 (13; 0)	14569; 51526 (15;0)
GIRARD	5550; 618 (15; 3)	14847; 52648 (14; 0)	15072; 54390 ** (13; 0)	15194; 51925 (15; 0)
FREE TRADE	5402; 1206 (18; 5)	14603; 53486 (15; 0)	14835; 55347 (15; 0)	14939; 52782 (15; 0)
In parethesis the number of countries experiencing a loss in each group				

*Developed countries (DCs) include: Australia, New Zealand, Japan, Korea, US, Canada, EU-25 (including EU-15 and CEEC) and ROW; other countries and regions listed in Table 1 are included in the Developing Countries (DGs) group.

** Nash Equilibrium

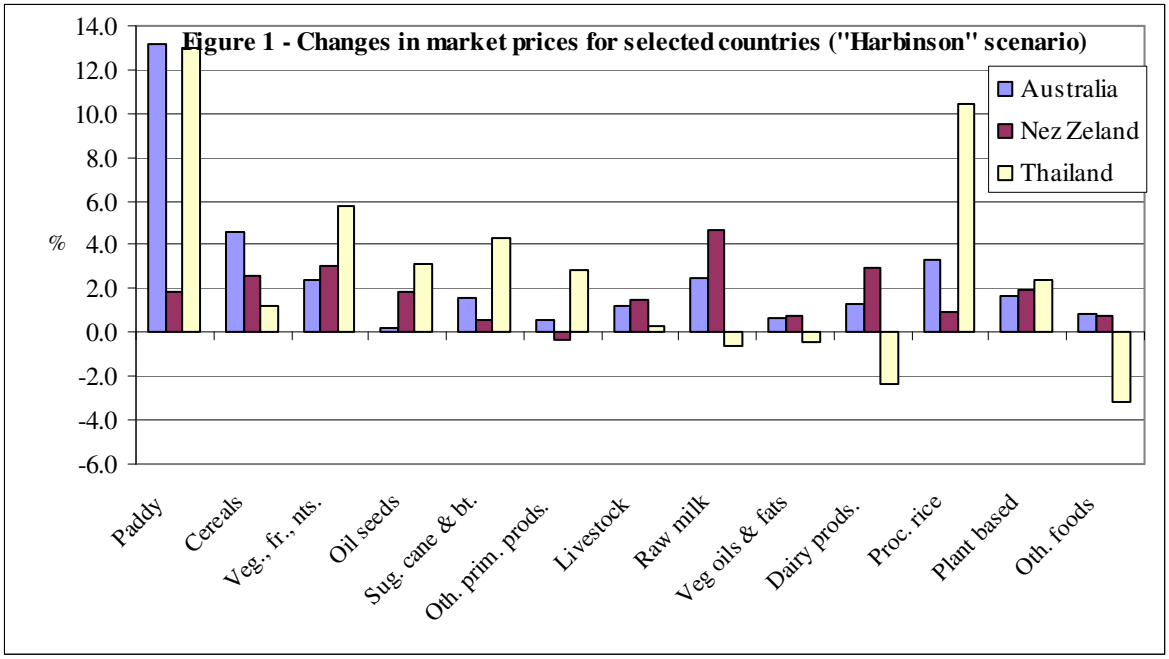
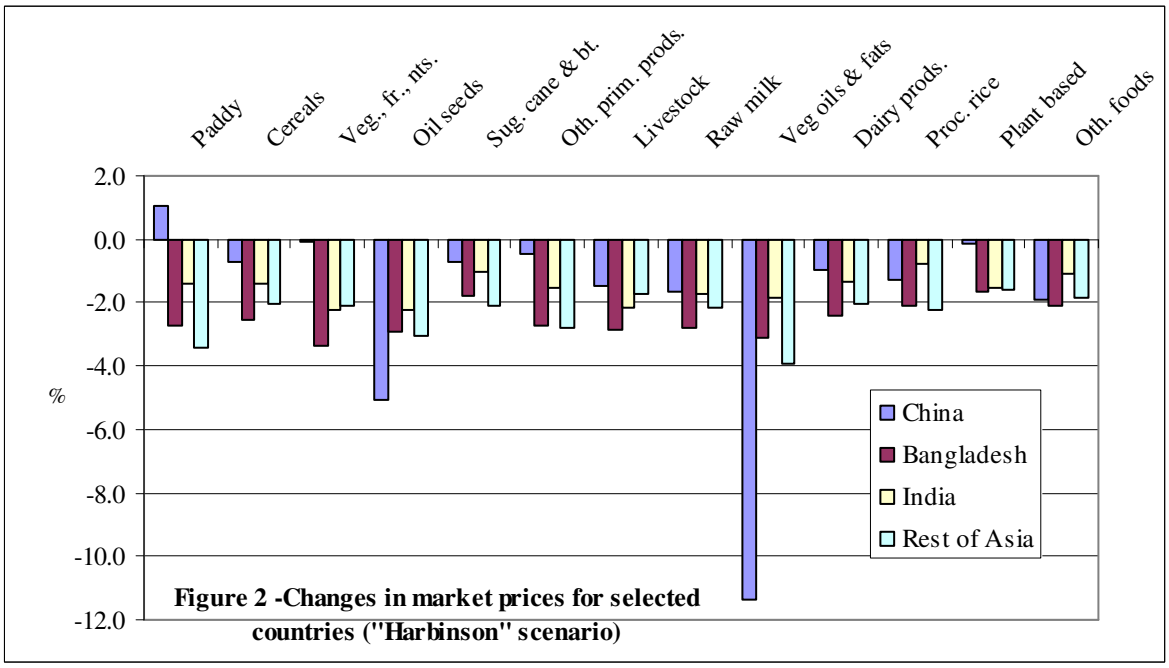


Figure 1 - Changes in market prices for selected countries ("Harbinson" scenario)
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
-6.0
%
Australia
Nez Zeland
Thailand
Paddy
Cereals
Veg., fr., nts.
Oil seeds
Sug. cane & bt.
Oth. prim. prods.
Livestock
Raw milk
Veg oils & fats
Dairy prods.
Proc. rice
Plant based
Oth. foods


Paddy
Cereals
Veg., fr., nts.
Oil seeds
Sug. cane & bt.
Oth. prim. prods.
Livestock
Raw milk
Veg oils & fats
Dairy prods.
Proc. rice
Plant based
Oth. foods
2.0
0.0
-2.0
-4.0
-6.0
-8.0
-10.0
-12.0
%
China
Bangladesh
India
Rest of Asia
Figure 2 -Changes in market prices for selected countries ("Harbinson" scenario)

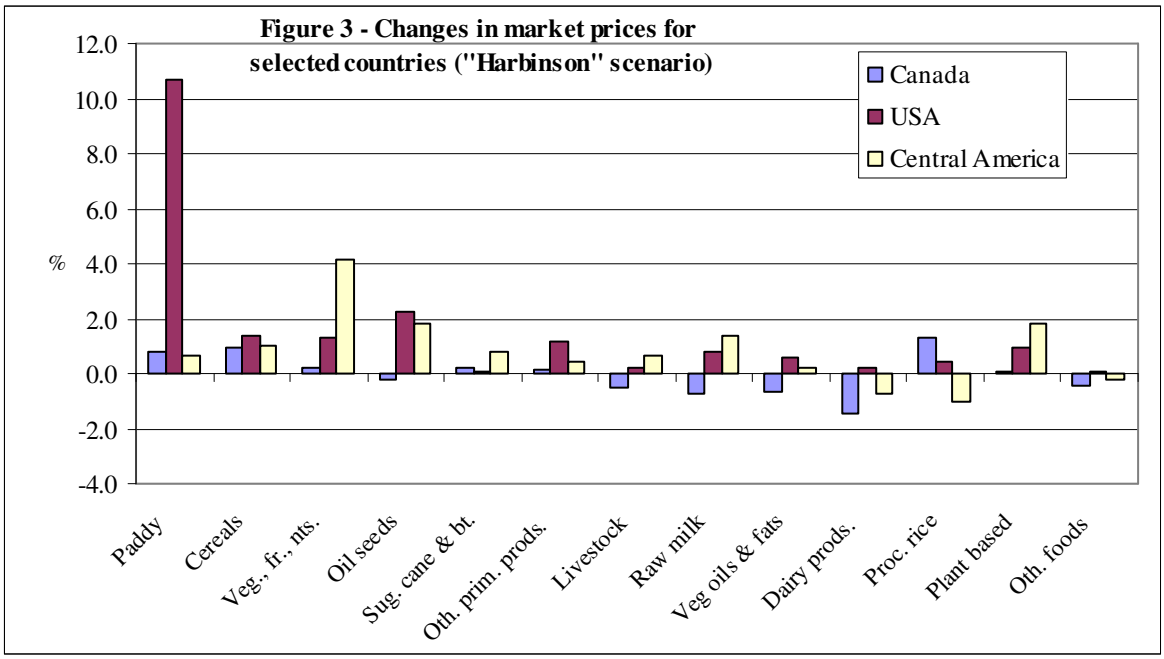


Figure 3 - Changes in market prices for selected countries ("Harbinson" scenario)
Canada
USA
Central America
%
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
-4.0
Paddy
Cereals
Veg., fr., nts.
Oil seeds
Sug. cane & bt.
Oth. prim. prods.
Livestock
Raw milk
Veg oils & fats
Dairy prods.
Proc. rice
Plant based
Oth. foods

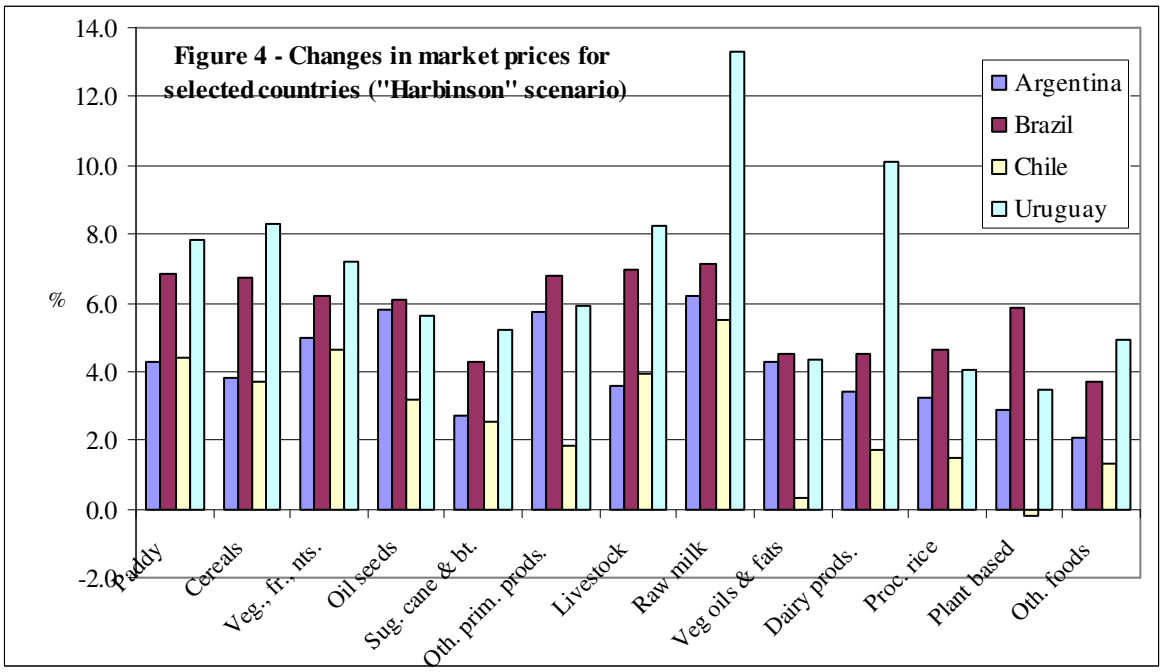


Figure 4 - Changes in market prices for selected countries ("Harbinson" scenario)
Argentina
Brazil
Chile
Uruguay
%
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
-2.0
Paddy
Cereals
Veg., fr., nts.
Oil seeds
Sug. cane & bt.
Oth. prim. prods.
Livestock
Raw milk
Veg oils & fats
Dairy prods.
Proc. rice
Plant based
Oth. foods

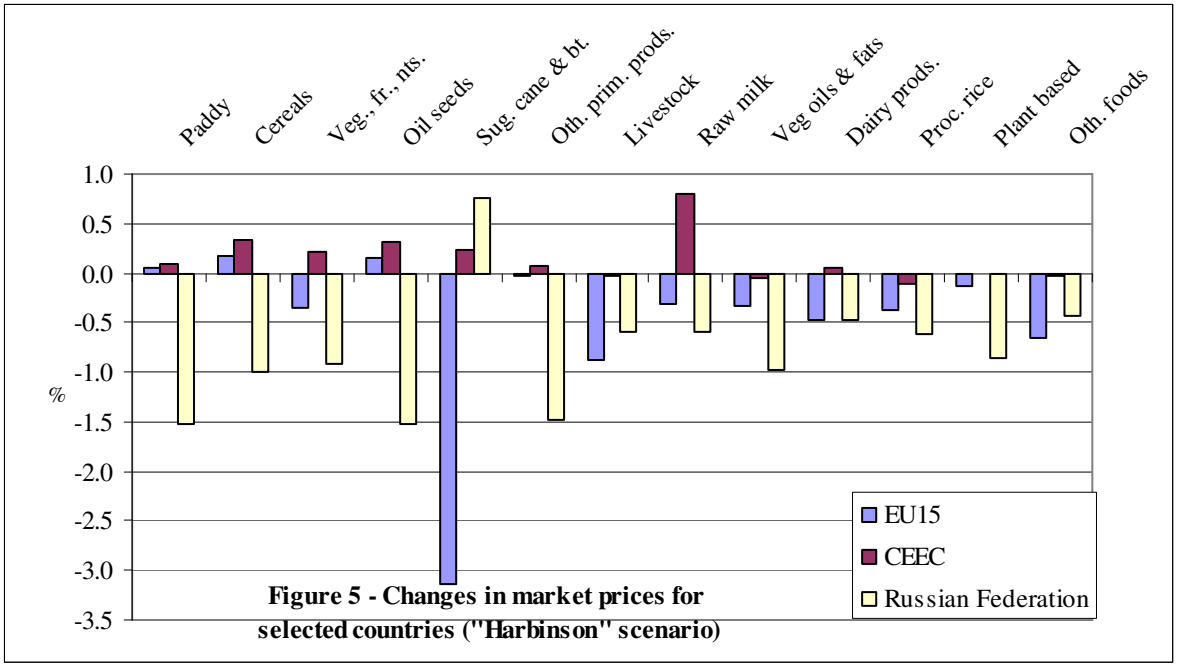


Figure 5 - Changes in market prices for selected countries ("Harbinson" scenario)

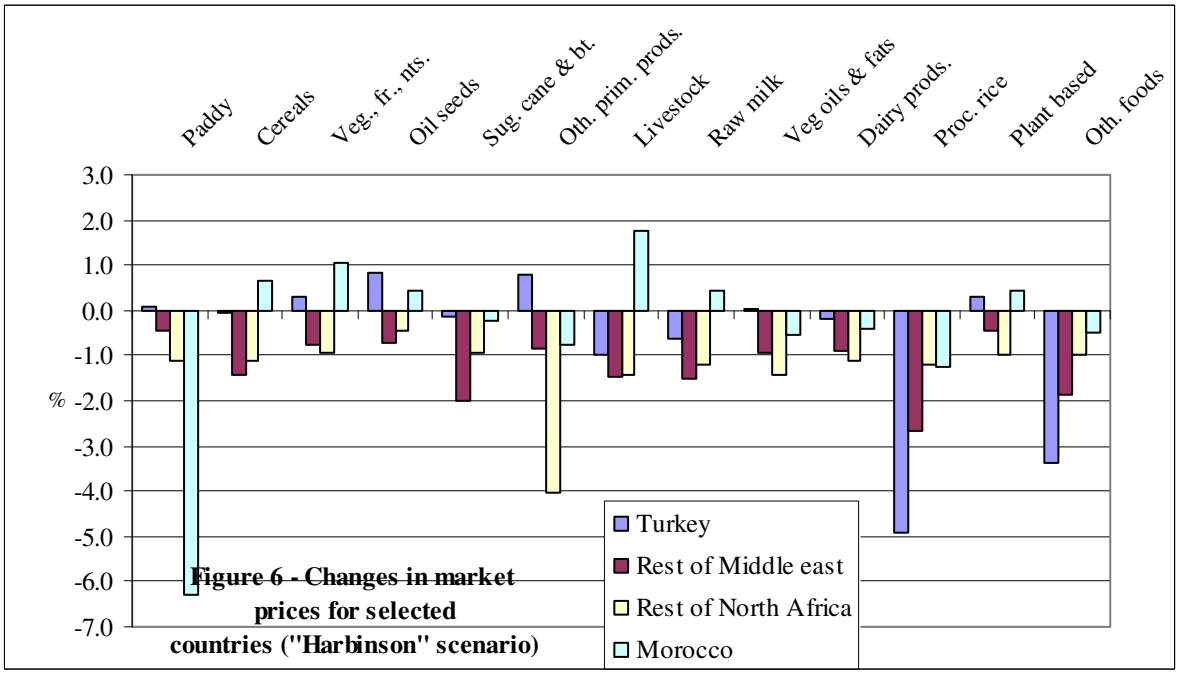


Figure 6 - Changes in market prices for selected countries ("Harbinson" scenario)

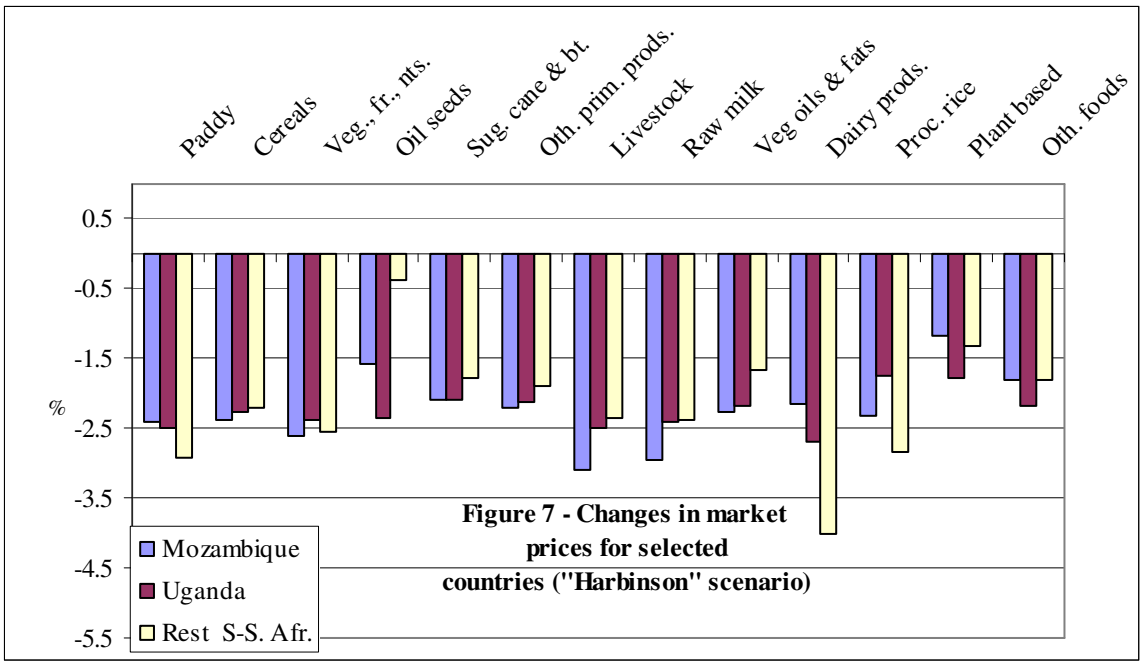


Figure 7 - Changes in market prices for selected countries ("Harbinson" scenario)

Figure 8 - Changes in market prices for selected countries ("Harbinson" scenario)

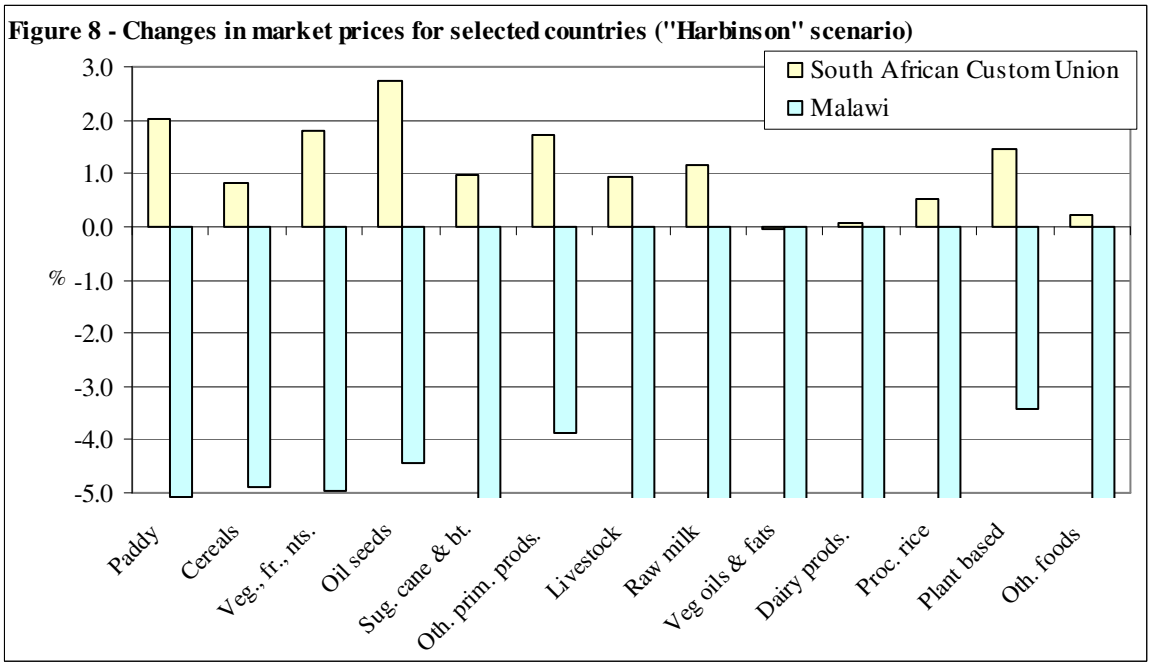


Figure 9 - Percentage change in real return to land

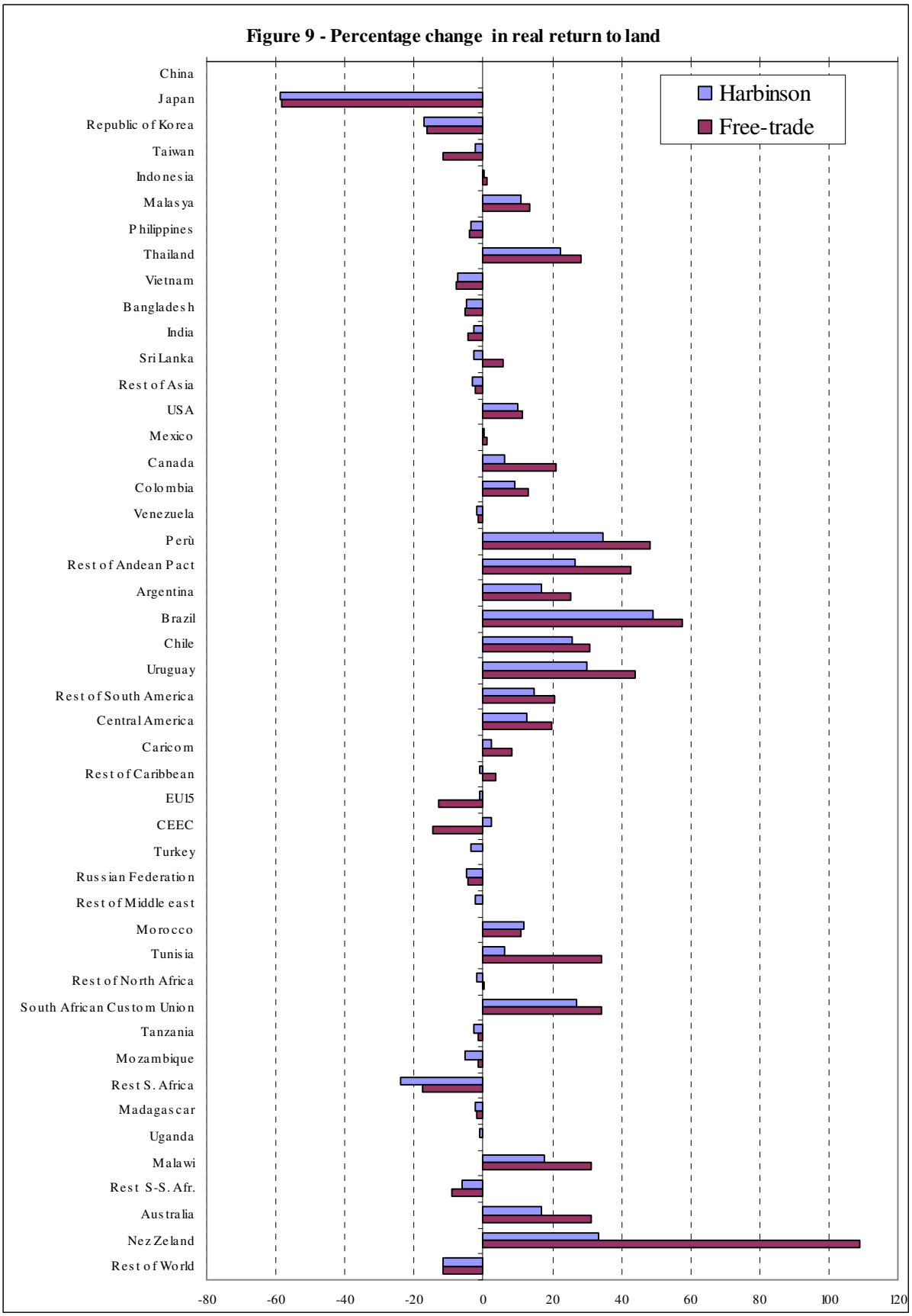


Figure 10 - Percentage change in real return to skilled labour

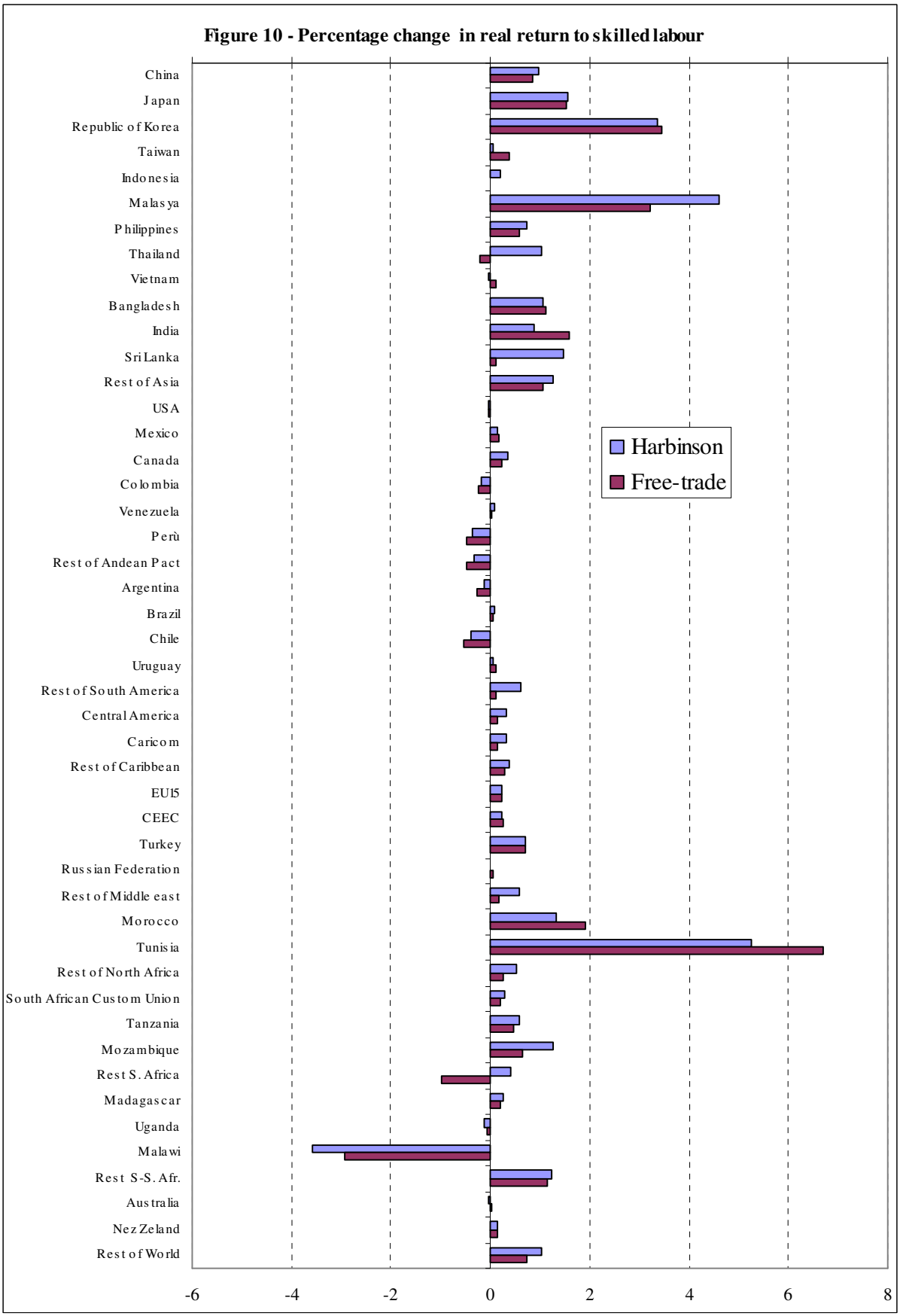


Figure 11 - Percentage changes in the terms of trade