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Doha Merchandise Trade Reform and Developing Countries: What's at Stake?

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Abstract

This paper provides new estimates of the global gains from multilateral trade reform and their distribution, in the presence of trade preferences, among developing countries. Particular attention is given to agriculture, as farmers constitute the poorest households in developing countries but the most protected in rich countries. The latest GTAP database (Version 6.04) and the World Bank's LINKAGE model of the global economy are employed to examine the impact first of current merchandise trade barriers and agricultural subsidies, and then of possible outcomes from the WTO's Doha round. The results suggest moving to free global merchandise trade would boost real incomes in Sub-Saharan Africa proportionately more than in other developing countries or high-income countries, despite a terms of trade loss in parts of that region. Farm employment, the real value of agricultural output and exports, the real returns to farm land and unskilled labor, and real net farm incomes would all rise substantially in that and other developing country regions, thereby alleviating rural poverty. A Doha partial liberalization could take it some way towards those desirable outcomes, but more so the more developing countries themselves cut applied tariffs, particularly on agricultural imports.

JEL codes: C68, D58, F13, F17, O55, Q17

Key words: Trade policy reform, WTO, multilateral negotiations, computable general equilibrium, developing countries

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Introduction

The aims of this paper are threefold: to summarize the costs of current merchandise trade distortions to developing and other economies; to examine some scenarios that might emerge as part of an eventual Doha Development Agenda agreement, particularly with respect to agriculture; and to draw out implications for the strategies developing countries might adopt in the WTO's Doha round of multilateral trade negotiations.

More specifically, the paper shows what the world economy would look in 2015 without and with a successful conclusion to Doha, how far Doha could take the world towards where it would be in the absence of all distortions to merchandise trade, and what contribution could be made by the various elements of a Doha package. For present purposes we make use of the World Bank's recursive dynamic model known as LINKAGE (see van der Mensbrugghe 2004b), in part because it has formed the basis for the World Bank's standard decade-long projections and trade analysis work.[1] The distinction is made in our results between effects on developing countries as compared with more advanced economies, but in doing so it is necessary to take into account not only the World Bank's country classification based on income level but also the self-nominated one practiced in the WTO (in which even customs territories as advanced as Hong Kong, Singapore, South Korea and Taiwan claim developing country status and so are eligible for Special and Differential Treatment (SDT) including lesser tariff cuts and longer phase-in periods than what is eventually agreed for developed countries under Doha).

Our analysis suggests there would be little agricultural reform globally under Doha, especially by developing countries, unless WTO Members are willing to make very substantial cuts to their bound tariff rates. Without that, the huge gap between agricultural and manufacturing protection is likely to widen, as is the gap between developed and developing country protection rates, thereby limiting the welfare gains from reform to a small number of more-advanced economies. We therefore explore the effects of a more ambitious agricultural reform package, and of developing countries participating more fully in the Doha round rather invoking SDT to avoid reform. In both respects we show how much closer the world could get to exploiting the full benefits of trade if these more-ambitious reform commitments were to be made and implemented over the next decade.

The paper is structured as follows. It begins with an overview of the key elements of a prospective Doha agreement, focusing especially on the agricultural elements. It then describes the model of the global economy to be used to analyze the consequences of such an agreement and of alternative, more-ambitious reforms including a move to complete free trade (which provides a helpful benchmark). The estimates of protection and subsidy rates for each region are

[1] See World Bank (2002, 2004), for example.

a crucial part of the data in the global model, and so they are discussed in some detail before turning to the key results of the simulations. After discussing some qualifications, the paper concludes by highlighting the key messages and drawing out implications for developing countries in particular.

Key elements of a prospective Doha agreement

To what extent are reform commitments likely to emerge from the Doha round? In addressing that question, it needs to be kept in mind from the outset that WTO trade negotiators are seeking agreement on reductions not to the applied tariffs and subsidies but rather to members' legally bound import tariffs, agricultural export subsidies and bound commitments on domestic support to farmers. These bound rates are higher than applied rates in nearly all countries, but especially so in most developing countries. Hence if cuts to bound rates are sufficiently small, or the gap between bound and applied rates sufficiently large, no actual reform need take place from an agreed set of bound rate reductions.

The Doha round was launched at the WTO Trade Ministerial meeting in Doha in late 2001, but the following Ministerial meeting, in Cancun in September 2003, ended with acrimony and without an agreement on how to proceed. At Cancun developing countries made it abundantly clear that further progress would not be possible without a commitment by developed countries to significantly lower their agricultural subsidies (including importantly for cotton, despite its relatively minor role in developed country agriculture – see Sumner 2005). An intense period of consultations in July 2004 ended in the early hours of 1 August with a Decision on how the Doha Work Programme should proceed (WTO 2004). The so-called July Framework agreement that emerged from that Decision reiterates the importance of keeping development at the heart of the Doha agenda, and it particularly stresses agricultural reform as key to that. In its Annexes, the Decision provides guidance as to how a Doha agreement might be structured, with frameworks for establishing modalities for agriculture and for non-agricultural market access, as well as providing recommendations for trade in services. We begin by summarizing what emerged with respect to the three agricultural pillars.

Agricultural market access

Jean, Laborde and Martin (2005) examine the consequences of different tariff-cutting formulae, bearing in mind the TRQs described in the paper by de Gorter and Klauga (2005), the prevalence of preferences for developing countries as described in Fontagné and Jean (2005), the need to accommodate sensitive products and special products, and the Special and Differential Treatment outlined in the July Framework as discussed by Josling (2005). For present purposes, tariff cutting is implemented at the 6-digit HS level and involves a detailed comparison of each country's bound tariff, which is what negotiators focus on, with the applied MFN tariff on a given bilateral trade flow, which is what modelers need to deal with. The gap between bound and applied MFN tariffs is the so-called binding overhang, and it can blunt significantly the impact of any negotiated outcome – so much so that in some scenarios countries are not required to change their applied tariffs at all. Once the detailed tariff analysis was conducted, the results were aggregated up to the GTAP and Linkage models' regions and sector levels by the CEPII staff in Paris (with special thanks to David Laborde). Note that the applied tariff cuts vary not only by sector, but also by trading partner – and may involve smaller cuts on imports from those

developing countries currently enjoying non-reciprocal preferential access to richer countries' markets (under EBA, AGOA, CBI, etc.).

Jean et al. evaluate the consequences for 2001 applied rates of different approaches to liberalization, and particularly different degrees of tops-down progressivity in the bound tariff cuts, as well as different degrees to which developing countries participate in reform. They look first at a proposal similar to the Harbinson progressive reduction formula (see WTO 2003b), with marginal tariff rate reductions of 35% for tariffs below 15 percent, 65% for tariffs above 90 percent and 60% for tariffs within the 15-90 percent bracket.[2] Developing country tariff cuts also follow the progressive-tax-style tiered formula, but for them Harbinson suggested four rather than three brackets, with inflexion points placed at tariff levels of 20, 60 and 120 percent, so as to be consistent with Harbinson's criterion of cutting by an average of 25%, 30%, 40% and 45%, respectively, in those four brackets.

That set of cuts, it turns out, would lead to very little import liberalization, because bound tariffs in many countries exceed applied rates by such large margins. As a result, Jean et al. focus on a set of reforms that involve cuts in applied agricultural protection rates that are at least 10 percentage points greater, namely a 45%, 70% and 75% bound rate cutting rule for developed countries and a 35%, 40%, 50% and 60% cutting rule for developing countries. Consistent with the Framework, least developed countries[3] make no reduction commitments in either of these two cases.

Jean et al. then:

- examine the consequences of including "Sensitive Products" assuming countries would take into account the importance of the commodity, the height of the existing tariff, and the gap between the tariff binding and the applied rate in deciding which products to grant such treatment, comparing situations in which countries are allowed to treat 2 percent (in Doha Scenario 2) and 5 percent (in Doha Scenario 3) of tariff lines as sensitive and so subject to just a 15 percent tariff cut;
- examine also the consequences of including "Special Products" for developing countries, by adding another 2 percent (in Doha Scenario 2) and 5 percent (in Doha Scenario 3) of tariff lines as special and so subject to just a 15 percent tariff cut;
- explore a proportional cut formula that brings about the same reduction in average tariffs in industrial countries as a group, and developing countries as a group, as the tiered formulas used; and
- consider the effects of adding a tariff cap of 200 percent, consistent with the suggestion in paragraph 30 of the Framework that the role of a tariff cap be explored.

Agricultural domestic support

Reductions in domestic support have been a particular concern of developing countries. This reflects the fact that the developed countries are the major providers of such assistance, and many developing countries are concerned about the ability of their producers to compete with developed country producers receiving large amounts of domestic support. While the marked

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[2] This approach provides cuts in average tariffs -- without the discontinuities created by the proportional cuts involved in the Harbinson formula -- that are more or less comparable with those generated by Harbinson's proportional reductions of 25%, 30% and 60%, because the larger cuts on higher tariffs apply only on the portion of the tariff above 15 or 90 percent, respectively.

[3] The so-called least developed countries (LDCs) is a special classification of 50 developing countries defined by the United Nations (http://www.unctad.org/Templates/WebFlyer.asp?intItemID=2161&lang=1).

asymmetry between industrial and developing countries is a concern, there is evidence, from Hertel and Keeney (2005) and from Hoekman, Ng and Olarreaga (2004), that the benefits to developing countries from reductions in domestic support may be substantially smaller than the potential gains from reductions in market access barriers. None the less, disciplining such support is crucial not just to prevent policy reversals but also to ensure that when tariffs are lowered, import protection is not simply replaced by equally trade-distorting domestic measures.

The base from which reductions in domestic support will take place is the commitment on the total bound Aggregate Measure of Support (AMS) agreed under Article 6 of the Uruguay Round Agreement on Agriculture. The July Framework proposes tiered reductions in the total bound AMS, with larger reductions by Members with higher initial AMS levels. How much would actual distorting support need to be reduced under various degrees of reduction in each country's total *bound* AMS? It turns out that extraordinarily large reductions in bound AMS are required before any reductions in actual support would occur – an outcome required by paragraph 9 of the Framework. If all countries with AMS notifications above 20 percent of the value of production cut their bound protection by 75%, and all others by 60%, only four members would have to cut applied rates as of 2001: the US by 28%, Norway by 18%, the EU15 by 16%, and Australia by 10%. Since the EU and Australia have already made cuts beyond that amount, the only significant country that would be affected is the US. Clearly, the offer of an initial reduction of 20% in bound AMS (see Paragraph 7 of Annex A of the July Framework, in WTO (2004)) is likely to have no direct impact.

Agricultural export subsidies

As Hoekman and Messerlin (2005) make clear, farm export subsidies are inconsistent with GATT rules, so for that reason alone they deserve to be eliminated. The empirical analysis summarized in Hertel and Keeney (2005) shows that they are now only a small part of agricultural support programs. That is true even when implicit subsidies in the form of food aid and export credits are included. A gradual phasing out over the next decade of both explicit and implicit forms of farm export subsidies should therefore be a politically feasible component of a comprehensive Doha agreement. Their elimination in isolation could harm a few food-importing and aid-dependent developing countries, but the poor net buyers of food in those countries can be assisted in far more efficient ways than via these measures.

Non-agricultural market access

Negotiations in the area of non-agricultural tariffs have been lagging those on farm products. There has been a clear indication that developing countries wish to make lesser tariff cuts than developed countries and that least-developed countries expect to not have to make any cut commitments. A Doha round is unlikely to involve all non-agricultural bound tariffs being cut by more than 50 percent, so we assume that degree of cut by developed countries and 33 percent by developing countries other than least-developed ones (from whom no cuts are being demanded). However, since that bound cut may lead to very little reform by developing countries, given their high tariff bindings relative to their applied tariffs, a more ambitious scenario may see them prepared to commit to more reform in order to entice further cuts in developed countries' agricultural and textiles tariffs. Perhaps the most optimistic possibility is that developing countries agree to cut non-agricultural bound tariffs as much as developed countries (that is, by the 50 percent we assume). Especially if that were coupled by more-ambitious cuts in agricultural tariffs, developed countries could well respond with larger

commitments themselves not only in trade but also with development aid. Indeed the experience of earlier multilateral trade negotiations has shown that developing countries tended to receive only to the extent they are willing to give 'concessions' themselves, such is the reciprocal nature of these negotiations.[4]

Services trade

To date WTO members have been very slow in coming forward with Doha proposals to reform services trade. At this stage it seems likely that, as with the Uruguay Round, countries will make few meaningful commitments to open up their services sectors during the Doha round. For that reason, and because services trade is less-adequately represented in trade models than is goods trade, we have chosen to assume there will be no barrier reductions in this sector resulting from the Doha round – despite the fact that, as indicated in Hertel and Keeney (2005) and Winters et al. (2003), gains from services reform could well be enormous, including for developing countries.

The global LINKAGE model for assessing effects of future trade reform

The model used for this analysis is the World Bank's global dynamic computable general equilibrium (CGE) model, known as LINKAGE (van der Mensbrugghe 2004b). It is a relatively straightforward CGE model but with some characteristics that distinguish it from standard comparative static models such as the GTAP model. A key difference is that it is recursive dynamic, so while it starts with 2001 as its base year it can be solved annually through to 2015. The dynamics are driven by exogenous population and labor supply growth, savings-driven capital accumulation, and labor-augmenting technological progress (as assumed for the World Bank's *Global Economic Prospects* exercise in 2004).[5] In any given year, factor stocks are fixed. Producers minimize costs subject to constant returns to scale production technology, consumers maximize utility, and all markets – including for labor – are cleared with flexible prices. There are three types of production structures. Crop sectors reflect the substitution possibility between extensive and intensive farming. Livestock sectors reflect the substitution possibility between ranch versus range feeding. And all other sectors reflect the standard capital/labor substitution (with two types of labor: skilled and unskilled). There is a single representative household per modeled region, allocating income to consumption using the extended linear expenditure system. Trade is modeled using a nested Armington structure in which aggregate import demand is the outcome of allocating domestic absorption between domestic goods and aggregate imports, and then aggregate import demand is allocated across source countries to determine the bilateral trade flows.

There are six sources of protection in the model. The most important involves the bilateral tariffs. There are also bilateral export subsidies. Domestically, there are subsidies only in agriculture, where they apply to intermediate goods, outputs, and payments to capital and land.

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[4] See Finger (1974, 1976) for results from the Dillon and Kennedy rounds, respectively, and Finger and Schuknecht (2001) for Uruguay Round results.

[5] In the Appendix the results are compared with those from a comparative static version similar to the GTAP model, to show how key model specifications can affect the results.

Three closure rules are used. First, government fiscal balances are fixed in any given year.[6] The fiscal objective is met by changing the level of lump sum taxes on households. This implies that losses of tariff revenues are replaced by higher direct taxes on households. Second, the current account balance is fixed. Given that other external financial flows are fixed, this implies that ex ante changes to the trade balance are reflected in ex post changes to the real exchange rate. For example, if import tariffs are reduced, the propensity to import increases. Additional imports are financed by increasing export revenues and this is typically achieved by a real exchange rate depreciation. Finally, investment is savings driven. With fixed public and foreign saving, investment will be driven by two factors: changes in the savings behavior of households, and changes in the unit cost of investment. The latter can play an important role in a dynamic model if imported capital goods are taxed. Because the capital account is exogenous, rates of return across countries can differ over time and across simulations. The model only solves for relative prices. The numéraire, or price anchor, in the model is given by the export price index of manufactured exports from high-income countries. This price is fixed at unity in the base year and throughout time.

The newest version of the LINKAGE model, Version 6.0, is based on the latest release of the GTAP dataset, Release 6.05.[7] Compared with Version 5 of the GTAP dataset, Version 6 has a 2001 base year instead of 1997, updated national and trade data and, importantly, a new source for the protection data. The new protection data come from a joint CEPII (Paris)/ITC (Geneva) project. The product of this joint effort, known as MAcMaps, is a tariff level detailed database on bilateral protection that integrates trade preferences, specific tariffs and a partial evaluation of non-tariff barriers (NTBs), for example tariff rate quotas (TRQs).[8] In summary, the new GTAP database has lower tariffs than the previous database because of the inclusion of bilateral trade preferences and of major reforms between 1997 and 2001 such as continued implementation of the Uruguay Round Agreement, especially the elimination of quotas on textile and clothing trade, and China's progress towards WTO accession (which contributed to the ratio of global exports plus imports to GDP rising from 44 to 46 percent over those four years).

The version of the LINKAGE model used for this study is comprised of a 27-region, 25-sector aggregation of the GTAP data set. There is a heavy emphasis on agriculture and food, comprising 13 of the 25 sectors, and a focus on the largest commodity exporters and importers.

The subsidies and import protection dataset

The main source of protection resides in tariffs or border barriers, although some countries – particularly high-income countries – also have significant agricultural production and export subsidies. The average import tariff for agriculture and food is 16.0 percent for high-income countries and 17.7 percent for developing countries, while for manufactures other than

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6 For the sake of simplicity they are fixed in US$ terms at their base year level, minimizing potential sustainability problems; but this implies they decrease as a percentage of GDP for expanding economies.

7 The Global Trade Analysis Project, otherwise known as GTAP, is an international consortium of trade researchers from universities, research institutions and national and international agencies. It is based at Purdue University. The GTAP Center provides an integrated and consistent international database for trade policy analysis. The current version is composed of 87 country/region groupings and 57 economic sectors. It also provides a publicly available global trade model, known as the GTAP model. (N.B. The LINKAGE model is distinct from the GTAP model, although it uses the same underlying database.)

8 More information on the MAcMaps database is available in Bouët et al. (2004) and at http://www.cepii.fr/anglaisgraph/bdd/macmap.htm.

textiles and clothing it is 8.3 percent for developing countries and just 1.3 percent for high-income countries. The averages of course obscure large variations across countries and commodities. For example, if high-income tariffs on temperate farm products were at a prohibitive 100 percent, but zero on tropical products such as coffee, the import-weighted average agricultural tariff could be quite low. Even at a relatively aggregate level, the variations can be quite sharp. For example, India has an average tariff in agriculture and food of 82 percent on imports from East Asia, but only 20 percent on imports from Sub-Saharan Africa. Tariff data are not reliable for assessing the importance of preferences because of composition effects, but for high-income countries it is the case that agricultural tariffs on goods from low-income countries are lower than on imports from the high- and middle-income countries. In the other sectors there is less evidence of preferences at this level of aggregation. On the contrary, imports of textiles and clothing – and indeed of all merchandise – from low-income countries face a higher average tariff than imports from middle-income or high-income countries.

Welfare impact of current protection policies

The LINKAGE model provides a baseline projection of the world economy first to 2005 (following accession to WTO by China and Taiwan, EU expansion eastwards which added ten more countries to the EU15 in 2004, and the end of textile and clothing quotas) and then to 2015 assuming no other policy changes. Deviations from that baseline in 2015, due to phased partial or total liberalization from 2005, are then examined.

One benchmark against which to measure the benefits of Doha is that which would come from freeing merchandise trade completely over the 2005-2010 period. That leads to global gains by 2015 of $287 billion per year, according to the LINKAGE model. Another benchmark is the reform incorporated in the pre-simulation experiment for the period from 2001 to 2005, due to the final stages of Uruguay Round implementation including the phase-out of the MFA, the accession of China and Taiwan to the WTO, and the eastern enlargement of the EU from 15 to 25 members. The impacts of those reforms on import tariffs are non-trivial. Had those three reforms not been implemented, the dynamic gains in 2015 from freeing global merchandise trade would have been $351 billion instead of $287 billion, or an extra $64 billion. Nearly half of that difference is due to the removal of MFA quotas and hence should be considered part of the Uruguay Round's legacy – assuming safeguards by high-income countries or export taxes by China do not replace textile and clothing quotas from 2005.

Table 1 reports the distribution across regions of the standard economic welfare or real income (equivalent variation) effects of removing all merchandise trade barriers and agricultural subsidies globally. Of the $287 billion gain in income that reform would generate for the global economy in 2015, two-thirds would accrue to the high-income countries. However, as a share of income, developing countries (as self-defined by WTO members) do twice as well, with an average increase of 1.2 percent compared to 0.6 percent for high-income countries. The results vary widely across developing countries, ranging from little impact in the case of Bangladesh and Mexico to 4 or 5 percent increases in parts of East Asia. The second column of numbers in that table show the amount of that welfare gain due to changes in the international terms of trade for each country. For developing countries as a group the terms of trade effect is negative, reducing somewhat the gains from improved efficiency of domestic resource use (especially in China and India). That effect would dissipate over time, however, as developing countries diversify their exports in the course of their industrialization.

There are several ways to decompose the real income gains from global trade reform so as to better understand the sources of the gains for each region. One way is to assess the impacts of developing country liberalization versus industrial country liberalization in different economic sectors; another is to decompose by policy instrument. The latter gave results very similar to those reported in Hertel and Keeney (2005), who estimate that market access barriers explain 93 percent of the welfare effects of agricultural policies, with domestic support and export subsidy removal playing only contributing 5 and 2 percentage points, respectively.[9]

Our results when decomposed by sector are provided in Table 2. They suggest global liberalization of agriculture and food yields 63 percent of the total global gains (similar to Hertel and Keeney's 66 per cent). This is consistent with the high tariffs in agriculture and food (17 percent global average) versus other sectors, but is nonetheless remarkable given the low shares of agriculture in global GDP (4 percent) and global merchandise trade (9 percent). Seven-tenths of those gains are accounted for by the farm policies of high-income countries, and those policies also account for the majority of the gains to high-income countries. For developing countries, as much of their gain from farm reform would come from South-South agricultural liberalization as from developing countries' getting unrestricted access to high-income country markets. That is almost equally true in manufacturing in aggregate, despite the big gains from textiles and clothing reform ($14 billion from market access in high-income countries compared with $9 billion due to South-South textiles trade growth). In other words, reform by developing countries is equally as important in terms of economic welfare gains to the South as reform by high-income countries. It is clear that reforming agricultural policies in both sets of countries is crucial for developing countries. Notice also that their gains from high-income country reform only half as large from textiles as from agricultural policies.

Politicians have an eye also on what happens to their country's volume of output and exports in sectors whose protection is cut, and on earnings of constituents. Contrary to much rhetoric from protectionist groups, the full liberalization results suggest little change in the high-income countries' shares of global output and exports of processed food, beverage and tobacco, and of Other Manufactures. Only for primary agriculture are the changes noticeable: the export share falls by more than one-quarter, from 53 to 38 percent (including intra-EU trade) – but the output share falls by only one-sixth, from 30 to 25 percent (Table 3). In absolute terms, agricultural and food output in high-income countries would decline only by 0.1 percent per year over the projection period to 2015 following a move to free trade in all merchandise, instead of rising by 1.6 percent per year. The impact of full reform on agricultural and food output and trade is shown for each country/region in Table 4, where it is clear that exports are enhanced much more than output. As a consequence, the global share of agricultural and food production exported rises, from 9.5 to 13.2 percent (or from 7 to 12 percent when intra-EU trade is excluded).

Also of interest is what happens to exports net of imports by sector. Table 5 shows that for agricultural products and processed food, for textiles and clothing and for other manufactures. The baseline data in that table shows the extent to which comparative advantages are projected to change for different countries/regions over the 2001-2015 period in the absence of further trade reform, and how much different that would look if all merchandise trade was freed over the next decade. The expected continued decline in net imports of food and

[9] Hoekman, Ng and Olarreago (2004) reached a similar conclusion from estimating the effects of halving all agricultural distortions, in their case using partial equilibrium analysis.

agricultural products by middle-income countries as a group in 2015 would be dramatically reversed, for example, while for low-income countries its net exports of those goods would grow only a little faster – while its net exports of textiles and clothing would increase dramatically. Net exports of other manufactures by developing countries, by contrast, would fall to nearly zero.

What impact would the removal of cotton trade distortions and subsidies (which raise producer prices by more than 50 percent in the US and even more in the EU) have in this context of freeing all merchandise trade and agricultural subsidies? The price of cotton in international markets is estimated to be considerably higher in 2015, including for US exports because its subsidies no longer depress that price. However, the volume of US cotton exports shrinks when those subsidies are removed, raising the price for other countries' exports. The price rise would not apply equally to all exporters however, because of product differentiation as captured in the Armington elasticities. For Brazil and Australia, the rise is 8 percent, while for Sub-Saharan Africa it averages less than 2 percent (relative to the numéraire which is the average price of exports of manufactures by developed countries). However, cotton exports from Sub-Saharan Africa would be a huge 73 percent larger under this full reform scenario. The share of all developing countries in global exports would be 85 percent instead of 56 percent in 2015, vindicating their efforts to ensure cotton receives specific attention in the Doha negotiations (see Sumner 2005 and Baffes 2005).

The relatively small percentage changes in net national economic welfare hide the fact that redistributions of welfare among groups within each country following trade reform can be much larger. This is clear from the impacts on real rewards to labor, capital and land that are reported in Table 6. The results also strongly support the expectation from trade theory that returns to unskilled labor rise substantially in developing countries, and by more than wages of skilled workers, which in turn rise more than earnings of capitalists. This reform therefore would be likely to improve equity and reduce poverty in those countries, given that the vast majority of their poor are unskilled laborers (including as farmers). For high-income countries, again consistent with standard trade theory, skilled workers gain more than unskilled workers. Those European and Northeast Asian farmers renting agricultural land would benefit from a large fall in rental costs, more or less offsetting the fall in prices for their output, while owners of land in those countries would lose if uncompensated.

The above results are for full trade liberalization. Smaller changes can be expected to result from partial reforms of the sort being negotiated currently under the Doha Development Agenda. It is to those that attention now turns.

Some prospective overall Doha scenarios: estimating their consequences

The scenarios

What will the Doha package ultimately contain? So as to focus on the agricultural component in particular, we assume no reform in services. We also assume agricultural export subsidies are eliminated, and that domestic support for agriculture is cut in just four economies: by an average of 28 percent for the U.S., 18 percent for Norway, 16 percent for the EU and 10 percent for Australia (as mentioned earlier). More difficult to determine are the likely nature and extent of reductions in market access barriers, so a number of scenarios are considered initially for agricultural and food products in isolation of non-agricultural tariff cuts, before incorporating

some non-agricultural market access.[10] Throughout this section, the WTO usage of the term 'developing countries' applies when allocating Special and Differential Treatment (SDT) in the form of lesser commitments to reform, which means Hong Kong, Korea, Singapore and Taiwan are all able to enjoy SDT despite their high-income status.

The experiments begin for ***Scenario 1*** with a progressive or tiered reduction formula with marginal agricultural tariff rate reductions of 45%, 70% and 75% within each of the three bands defined by the Harbinson (WTO 2003b) inflection points of tariff rates of 15 and 90 percent for developed countries (that is, for low agricultural tariffs the marginal rate of reduction is 45%, for medium-level tariffs it is 70%, and for the highest tariffs it is 75%), and for developing countries the reductions are 35%, 40%, 50% and 60% within each of their four bands (and least-developed-countries are not required to undertake any reduction commitments). These cuts are greater than those proposed in the Harbinson draft because we found its cuts were too light to have much impact. They would lead to the average agricultural and food tariff falling in 2015 from 15.9 to 8.4 percent for high-income countries and from 14.2 to 12.5 percent for developing countries.

Scenario 2 examines the consequences of including the "Sensitive Products" allowed for in the July Framework, with developed countries allowed to treat 2% of their HS6 agricultural tariff lines as sensitive and thereby subject to just a 15 percent tariff cut (as a substitute for the TRQ expansion mentioned in the Framework Agreement), and double those proportions of products for both developing and least developed countries, in part to incorporate also their "Special Products" demand.[11] This would lead to the average agricultural tariff falling only to 13.5 percent in both high-income and developing countries.

Scenario 3 considers the effects of adding to Scenario 2 a tariff cap of 200% such that any product with a bound tariff in excess of that limit will be subjected to a reduction down to that cap rate, which leads to average cuts in agricultural tariffs of 18 percent for both developed and developing countries. This would lead to the average agricultural tariff falling in 2015 considerably more for high-income countries (to 11.5 percent) and but only very slightly more (to 13.3 percent) for developing countries.

Scenario 4 adds to Scenario 1 the cuts in non-agricultural tariff bindings of 50 percent in developed countries, 33 percent in developing countries, and zero in least-developed countries. That lowers the average tariff on all merchandise from 2.9 to 1.6 percent for high-income countries and from 8.4 to 7.5 percent for developing countries.

Finally, ***Scenario 5*** makes developing (including least-developed) countries full participants in the round, undertaking the same reductions in bound (but not necessarily applied) tariffs as the developed countries in Scenario 4. That lowers the average tariff on all merchandise for developing countries from 8.4 to 6.8 instead of 7.5 percent, a cut of almost one-fifth instead of just one-ninth.

Table 7 summarizes these scenarios.

Estimated welfare and trade effects of those scenarios as of 2015

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[10] As suggested in the Girard Text (see WTO 2003a), we assume that in the absence of a bound tariff on a good it is considered to be double the applied MFN rate.

[11] As described in Jean, Laborde and Martin (2005), "Sensitive Products" are chosen for each country by taking into account the importance of the product, the height of its existing tariff, and the gap between its bound and applied tariffs in that country.

The welfare consequences of implementing these various reforms over the 2005-2010 period and allowing the global economy to adjust to 2015 are summarized in Table 8(a) in dollar terms and in Table 8(b) as percentage changes in real income in 2015.

Column 1 of Table 8(a) suggests that agricultural liberalization using the harmonizing formula (Scenario 1) would generate a global gain of $75 billion even without the inclusion of non-agricultural tariff reform. But almost all those benefits accrue to the reforming high-income countries (with whom we include protective Korea and Taiwan) such that developing countries would gain only $9 billion because their bound tariffs are so high as to lead to almost no reform by them. Were the high-income countries allowed to exclude from cuts even just 2% of their "Sensitive Products" (and developing countries 4%), those global gains would shrink to just $18 billion. In both cases developing countries as a group would be worse off (Scenario 2).[12] If such exceptions are to be made, it would be important to exploit the opportunity – provided for in the July 2004 Framework – to put a cap on bound tariffs. Scenario 3 shows that even if the cap was as high as 200%, that would restore at least half of the welfare gain foregone by allowing such exceptional treatment for sensitive and special products.

The final two scenarios add non-agricultural tariff cuts to the agricultural reforms in the preceding scenarios. In scenario 4, lesser cuts are provided for developing countries' non-agricultural tariffs, as is the case for all the preceding agricultural cut scenarios. Even so, the gain to developing countries by adding these non-farm reforms doubles relative to Scenario 1 where only agriculture is cut, contributing one-third of the extra boost to global welfare ($7.1 billion out of the $21.6 billion difference between the global gains from Scenarios 1 and 4). In Scenario 5, the developing (including least-developed) countries fully engage in the reform process, foregoing the lesser cuts provided for in Scenarios 1 and 4. That boosts theirs and global welfare substantially, because their cuts to bound tariff lead to considerably larger cuts to applied tariffs. Nonetheless, the global average tariff for merchandise hardly changes for just agricultural reform, whereas it falls by almost one-third or 1.5 percentage points once manufacturing is included.

Retaining lesser cuts for developing countries as in Scenario 4 would yield a global gain of $96 billion from Doha merchandise liberalization, which is a sizable one-third of what is on the table (the potential welfare gain from full liberalization of $287 billion, reported in Table 2). But for developing countries the gain would be only $16 billion, which is less than one-fifth of that group's potential gain shown in Table 2 of $86 billion. If they forego the option of reforming less than developed countries, that raises their gain by 42 percent, or an extra $7 billion. Much of those gains go to the largest developing economies, but note that in percentage terms Sub-Saharan Africa also gains substantially if it liberalizes more – contrary to the presumptions of many commentators. By contrast, in Scenario 4 those Sub-Saharan African countries simply are not liberalizing enough to get sufficient efficiency gains to offset the terms of trade losses suffered either as net food importers, or as recipients of tariff preferences that have eroded with

[12] Should the tiered formula be replaced by a straightforward proportional cut that brings about the same average agricultural tariff reduction in the high-income group, and in the developing country group, as the tiered formulas used in Scenario 1, the global gains are lower but not by much ($66 billion compared with Scenario 1's $75 billion). And the developing countries' share of that is even larger than in Scenario 1. Even if "Sensitive Products" and "Special Products" were allowed with the harmonized formula, the global gains would be no lower than under the tiered formula (Anderson, Martin and van der Mensbrugghe 2005a, Table 12.8). Together these scenarios suggest that the complexity of negotiating a tiered formula may simply not be worth the effort.

the decline in high-income countries' MFN tariffs, or because of the combined export growth from reforming economies with similar export compositions.

The aggregate global welfare consequences of Doha Scenario 4 (agricultural and manufacturing trade liberalization with lesser cuts for developing countries and no reform by least-developed countries) are hardly altered if agricultural domestic and export subsidies are not cut. The welfare effects on reforming countries and their significant trading partners are altered though. Table 9 shows the changes to the national welfare effects for Scenario 4 if first export subsidies are not cut and then if domestic subsidies also remain uncut. Not surprisingly, it is the exclusion of cuts to export subsidies that reduce the welfare gain most for the EU, while for the US it is the exclusion of cuts to domestic support. Recall that these welfare effects are altered because of changes not only in efficiency of resource use but also in terms of trade, with the latter altering because of other countries' as well as own reforms. Unprotected Latin America and Australia and New Zealand gain most from the progressive addition of subsidy cuts to the scenario.

How big would be the consequences of reform for farm output and employment growth over the implementation period post-2004? Table 10 shows what that annual growth to 2015 would be in the baseline (no policy changes post-2004), what it would be if all distortions to merchandise trade were removed, and what it would be under Doha Scenario 4. If there was completely free trade, farm output would decline (instead of growing slightly) in just the EU and Japan while growing slower in a few other highly protective countries – but, for most countries/regions shown in Table 10, farming activities would expand. The Doha Scenario 4 would involve much less reform than a move to free trade, and so involves a much slower loss of farm output for the EU and Japan – but also less output growth than under free trade for the vast majority of countries that would gain. A comparison of columns 1 and 3 of Table 10 reveals that for most of the protective economies, Doha Scenario 4 would simply slow the growth of farm output a little over the coming decade. This revelation contrasts with the rhetoric suggesting farm protection cuts would cause a major collapse of protected sectors.

The farm employment picture is somewhat different. Typically, economic growth leads to declines in not only the relative importance of agriculture (for reasons explained in Anderson 1987 and Martin and Warr 1993) but also in absolute numbers employed in farming once a country reaches middle-income status. Thus it is not surprising that numerous middle- and high-income countries are projected to lose farm jobs over the next decade in the baseline scenario of Table 10. For the most protected farm sectors, that rate of farm employment decline would more than double if the world were to move to completely free trade; but it would increase only slightly under Doha Scenario 4. For other economies, though, farm employment would grow a little faster under that Doha scenario as compared with the baseline, allowing developing countries to absorb more workers on their farms.[13]

How does this get reflected in agricultural net income (value added by the farming sector)? Not surprisingly, it would fall in those regions with the highest agricultural protection (Europe, Northeast Asia and to a lesser extent the US). However, in the Doha reform scenario none of the developing countries/regions shown in Table 11 would suffer a decline in agricultural net income, despite the lowering of their own agricultural tariffs. The reason for their farmers faring better than protected rich-country farmers – even though the average agricultural

[13] This finding of only small intersectoral labor movements in response to partial trade reform is consistent with econometric evidence of adjustments to past trade reforms (see, e.g., Wacziarg and Wallack 2003).

tariff in developing countries is nearly as high as that in high-income countries (14.2 percent compared with 15.9 percent in the baseline) – is because a much larger proportion of developing country agriculture is internationally competitive. This result has clear implications for poverty alleviation, given that perhaps as many as 70 percent of the world's poor are in farm households in developing countries.

The trade consequences of Doha Scenario 4 are summarized in Table 12. The first column shows that by 2015, annual developing country exports would be greater by $41 billion for agricultural products, $25 billion for textiles and clothing, and $12 billion for other manufactures. Their total of $78 billion is somewhat smaller than that for high-income countries ($135 billion), but that difference is less when expressed in percentage terms (2.6 percent, compared with 3.1 percent for high-income countries). This takes the world economy one-fifth the way to where it would be if the move was to completely free trade in merchandise. It also raises the share of agricultural and food production that is exported globally from 9.5 to 10.0 percent, which is one-seventh of the way towards its share of 13.2 percent under the free merchandise trade scenario. Table 13 shows that even in the protected countries this ratio rises a little or, in the case of Europe, falls only very slightly. This is because of farm resources moving from import-competing to more-competitive farming sub-sectors.

Of more interest to trade negotiators are the changes in *bilateral* trades: they want to see the extent to which such an exchange of market access would be 'balanced'. Not surprisingly, developing countries expand their exports of agricultural and textile products to high-income countries more than they expand their imports of those products from high-income countries. But the opposite is true of other manufactures, so that for merchandise trade in total the difference is not great: in f.o.b. terms developing countries in 2015 would sell $62 billion more to high-income countries and would buy $55 billion in return under Doha Scenario 4 (see columns 2 and 3 of Table 12). This small gap might be tolerated by high-income countries as a concession to development, but otherwise it could be narrowed by developing countries reforming more in goods or giving more than they get from high-income countries in terms of opening up services trade.

Caveats

Results such as those presented above are always dependent on the assumptions, data and parameters underlying them and so are subject to numerous qualifications. One that is particularly important to highlight has to do with the way preferences are treated in the Version 6 GTAP database. In previous versions of that database, only key *reciprocal* preferences were included (notably between members within the EU, NAFTA, ASEAN and Australia-New Zealand Closer Economic Relationship), whereas the new Version 6 added *non-reciprocal* tariff preferences provided by developed countries for their imports from developing countries under numerous arrangements such as the Generalized System of Preferences (GSP), the EU's provisions for former colonies under the Africa, Caribbean and Pacific (ACP) program and more recently for Least Developed Countries under the Everything But Arms (EBA) agreement, and likewise the US's Africa Growth and Opportunity Act (AGOA) and Caribbean Basin Initiative (CBI). We have made the assumption that there are no rules of origin (ROOs) or the like which discourage developing countries from taking full advantage of those preferences (even though we know ROOs often lead to underutilization); and we assume perfect competition between traders in the two sets of countries, which determines how rents from those preferences are

shared between the exporting and importing countries (even though we know the developed country importers often have more market power than the developing country exporters of standard commodities such that the latter receives a smaller share of the rents than our analysis generates).[14] We therefore overstate the extent of preference erosion that would occur for especially least-developed countries, and so understate their gains from trade reform. If instead those non-reciprocal preferences were excluded from the database, we would overestimate the preference-receiving countries' gains from developed country trade reform. So until we have a better way to incorporate these real-world aspects of preference schemes, the reader should simply be aware that the welfare gains would be higher (or losses less) for least-developed countries than indicated above.[15] The difference would not be great for Rest of Sub-Saharan Africa however, according to the results presented in Bouët, Fontagné and Jean (2005, Table 6.9).

Imports of agricultural products subject to tariff rate quotas (TRQs) are handled less than perfectly in the World Bank's LINKAGE model and the GTAP database, in two respects. First, in the Version 6 GTAP database the treatment of tariffs applied on TRQ commodities depends on the extent to which the quota is filled: if the quota is less than 90 percent filled, the in-quota tariff is assumed to apply on these commodities; if the quota is between 90 and 99 percent filled, the effective tariff is assumed to be the average of the in- and the out-of-quota tariff; and if the quota is more than 99 percent filled, then the out-of-quota tariff is applied. Second, where TRQs are non-binding and hence the in-quota tariff is used, and preferences are provided to developing countries, such a preference may well be illusory. If imports increased, for example, the out-of-quota tariff may kick in. Furthermore, de Gorter and Kliauga (2005) identify cases where the out-of-quota tariff has been applied at the margin even though the quota was not filled. This provides additional reasons to expect that we have overstated the benefits of preferences/costs of preference erosion.

Another important caveat worth stressing is that the above results do not incorporate the fact that trade reform typically boosts factor productivity.[16] If instead we were to assume productivity is positively related to changes in sectoral openness, as specified in World Bank (2002) and Anderson, Martin and van der Mensbrugghe (2005b, Table 17.3), then the estimated global gains from freeing merchandise trade increase by one-third.[17] More importantly, they increase by two-thirds for developing countries, because the initial protection rates are so much higher there. For this reason even more than because of our treatment of preferences, the welfare effects presented in this paper should be taken as very much lower-bound estimates.

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[14] Evidence that the preference margin is often eroded by complex rules of origin, and that the rent is shared between importing and exporting countries with the latter getting less the more trade is concentrated on standard commodities, can be found in Olarreaga and Ozden (2004) and Ozden and Sharma (2004). A recent partial equilibrium study found that in practice export revenue losses from preference erosion are likely to be limited to a small subset of countries, primarily small island economies dependent on exports of sugar, bananas and, to a far lesser extent, textiles (Alexandraki and Lankes 2004).

[15] A further complication is that the ACP non-reciprocal preference scheme is to be replaced from 2008 with reciprocal Economic Partnership Agreements (EPAs) between those countries and the EU.

[16] For recent reviews of the literature on the links between trade liberalization and economic growth, see for example Winters (2004), Dollar and Kraay (2004) and Anderson (2004).

[17] The trade-related productivity increase is limited to the manufacturing sectors in this simulation, unlike World Bank (2002) where agricultural productivity was also allowed to respond to changes in openness.

The above analysis does not include costs of adjustment to reform, but these are typically far less than commonly assumed.[18] Indeed, the structural changes that take place over time in the normal course of economic growth are shown above to be typically very much larger than the small changes that would accompany gradual and partial trade liberalization. Furthermore, adjustment assistance scheme (financed by foreign aid in the case of low-income countries) are a way to help fund adjustment to tariff and subsidy cuts – and they are just one-off payments, whereas the benefits of reform continue into the future.

Lessons and implications

To summarize the above findings, we provide the following as the key messages that emerge from our analysis:

- The potential gains from further global trade reform are large;
- Developing countries could gain disproportionately from further global trade reform;
- Benefits could be as much from South-South as from South-North trade reform;
- Agriculture is where cuts are needed most;
- Large cuts in both agricultural tariffs and domestic support commitments are needed to erase binding overhang;
- Even large cuts in agricultural tariffs do little if "Sensitive" and "Special" Products are allowed, unless a cap applies;
- Expanding non-agricultural market access would add substantially to the gains from agricultural reform, and help balance the exchange of North-South "concessions";
- Some poor countries may lose slightly from Doha, although that is less likely the more they reform themselves; and
- Farm output, farm employment and net farm income would all increase in developing countries under Doha relative to the baseline.

Among the numerous policy implications that can be drawn from our analysis, several are worth highlighting. First, with gains of the order of $290 billion per year at stake from implementing the July Framework Agreement, even if no reforms are forthcoming in services, and even if the counterfactual would be the status quo rather than protectionist backsliding, the political will needs to be found to bring the round to a successful conclusion, and the sooner the better. Multilateral cuts in tariff bindings are helpful also because they can lock in previous unilateral trade liberalizations that otherwise would remain unbound and hence vulnerable to backsliding; and they can be used as an opportunity to multilateralize previously agreed preferential trade agreements and thereby reduce the risk of trade diversion from those bilateral or regional arrangements.

Second, agricultural reforms need to be significant if the Doha agreement is to be pro-development and pro-poor. Outlawing agricultural export subsidies is the obvious first step. That will bring agriculture into line with the basic GATT rule against such measures, and in the process help to limit the extent to which governments encourage agricultural production by other means (since it would raise the cost of surplus disposal). Concurrently, domestic support bindings must be cut very substantially to reduce binding overhang. In so doing, the highest-subsidizing countries need to reduce their support, not just for the sake of their own economies but also to encourage developing countries to reciprocate by opening their markets as a quid pro

[18] For a review of the empirical literature supporting this view, see Anderson (2004, pp. 560-62).

quo. An initial installment of a 20 percent cut in domestic support is nothing more than a start towards getting rid of that overhang. Even more importantly, agricultural tariff bindings must be cut hugely so that some genuine market opening can occur. Exempting even just a few "Sensitive" and "Special" Products is undesirable as it would reduce hugely the gains from reform. If it turns out to be politically impossible not to designate some products as "Sensitive" and "Special", it would be crucial to impose a cap such that any product with a bound tariff in excess of, say, 100 percent had to reduce it to that cap rate.

Third, expanding non-agricultural market access at the same time as reforming agriculture is essential. A balanced exchange of concession is impossible without adding other sectors, and it needs to be more than just textiles and clothing (which also benefit developing countries disproportionately) even though they are the other highly distorted sector. With other merchandise and services included, the trade expansion could be many times greater for both rich and poor countries.

Fourth, South-South "concessions" also are needed, especially for developing countries as that is where half their potential benefits lie. That means reconsidering the extent to which developing countries liberalize. Since developing countries are trading so much more with each other now, they are the major beneficiaries of reforms within their own regions. Even least developed countries should consider reducing their tariff binding overhang at least, since doing that in the context of Doha gives them more scope to demand "concessions" (or compensation for preference erosion or other contributors to terms of trade deterioration) from richer countries than if they hang on to their opportunity not to engage in reform.

The good news in this paper is that there is a great deal to be gained from liberalizing merchandise – and especially agricultural – trade under Doha, with a disproportionately high share of that potential gain available for developing countries (relative to their share of the global economy). Moreover, it is the poorest people in developing countries that appear to be most likely to gain from global trade liberalization, namely farmers and unskilled laborers in developing countries. To realize that potential gain, it is in agriculture that by far the greatest cuts in bound tariffs and subsidies are required. However, the political sensitivity of farm support programs, coupled with the complexities of the measures introduced in the Uruguay Round Agreement on Agriculture and of the modalities set out in the Doha Framework Agreement of July 2004, ensure the devil will be in the details of the final Doha agreement. It is for that reason that ex ante empirical analysis of the sort provided above is a prerequisite for countries engaged in the Doha round of negotiations.

What emerges from that analysis is that developing countries would not *have* to reform very much under Doha, because of the large gaps between their tariff bindings and applied rates. That is even truer if they exercise their right (as laid out in the July Framework Agreement) to undertake lesser tariff cuts than developed countries. In that case, they gain little in terms of improved efficiency of national resource use. Yet, as Panagariya (2004) and others have warned, for a non-trivial number of low-income countries their terms of trade could deteriorate. For some that is because they would lose tariff preferences on their exports. For others it is because they are net food importers and so would face higher prices for their imports of temperate foods. To realize more of their potential gains from trade, developing and least developed countries would need to commit to additional trade (and complementary domestic) reforms, and to invest more in trade facilitation. High-income countries could encourage them to do so by being willing to open up their own markets more to developing country exports and by providing more targeted aid.

To that end, a new proposal has been put forward to reward developing country commitments to greater trade reform with an expansion of trade-facilitating aid, to be provided by a major expansion of the current Integrated Framework which is operated by a consortium of international agencies for least developed countries (Hoekman 2005a,b). This may well provide an attractive path for developing countries seeking to trade their way out of poverty. As well, it is potentially a far more efficient way for developed countries to assist people in low-income countries than the current systems of tariff preferences.

In conclusion, the July Framework Agreement does not guarantee major gains from the Doha Development Agenda. On the one hand, even if an agreement is ultimately reached, it may be very modest. How modest depends on, among other things, the nature of the agricultural tariff-cutting formula, the size of the cuts, the extent to which exceptions for "Sensitive" and "Special" Products are allowed, whether a tariff cap is introduced, and the extent to which developing countries engage in terms of opening their markets. But what is equally clear, on the other hand, is that major gains are possible, if only the political will to reform protectionist policies – especially in agriculture – can be mustered.

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Table 1: Impacts on real income from full liberalization of global merchandise trade, by country/region, 2015

(*Impacts in* 2015 *relative to the baseline, in 2001 dollars*)

	Real income gain ($billion)	**Gain due just to change in terms of trade** ($billion)	***as % of baseline income in 2015***
Australia and New Zealand	6.1	3.5	1.0
EU 25 plus EFTA	65.2	0.5	0.6
United States	16.2	10.7	0.1
Canada	3.8	-0.3	0.4
Japan	54.6	7.5	1.1
Korea and Taiwan	44.6	0.4	3.5
Hong Kong and Singapore	11.2	7.9	2.6
Argentina	4.9	1.2	1.2
Bangladesh	0.1	-1.1	0.2
Brazil	9.9	4.6	1.5
China	5.6	-8.3	0.2
India	3.4	-9.4	0.4
Indonesia	1.9	0.2	0.7
Thailand	7.7	0.7	3.8
Vietnam	3.0	-0.2	5.2
Russia	2.7	-2.7	0.6
Mexico	3.6	-3.6	0.4
South Africa	1.3	0.0	0.9
Turkey	3.3	0.2	1.3
Rest of South Asia	1.0	-0.8	0.5
Rest of East Asia	5.3	-0.9	1.9
Rest of LAC	10.3	0.0	1.2
Rest of ECA	1.0	-1.6	0.3
Middle East and North Africa	14.0	-6.4	1.2
Selected SSA countries	1.0	0.5	1.5
Rest of Sub Saharan Africa	2.5	-2.3	1.1
Rest of the World	3.4	0.1	1.5
High-income countries	**201.6**	**30.3**	**0.6**
Developing countries--WTO definition	**141.5**	**-21.4**	**1.2**
Developing countries	**85.7**	**-29.7**	**0.8**
Middle-income countries	69.5	-16.7	0.8
Low-income countries	16.2	-12.9	0.8
East Asia and Pacific	23.5	-8.5	0.7
South Asia	4.5	-11.2	0.4
Europe and Central Asia	7.0	-4.0	0.7
Middle East and North Africa	14.0	-6.4	1.2
Sub-Saharan Africa	4.8	-1.8	1.1
Latin America and the Caribbean	28.7	2.2	1.0
World total	**287.3**	**0.6**	**0.7**

Source: Authors' World Bank LINKAGE model simulations

Table 2: Regional and sectoral source of gains from full liberalization of global merchandise trade, developing and high-income countries, 2015

(*Change in real income in* 2015 *relative to baseline scenario*)

	Gains by region in $billion			Percent of regional gain		
	Devel-oping	*High-income*	*World*	*Devel-oping*	*High-income*	*World*
Developing countries liberalize:						
Agriculture and food	28	19	47	33	9	17
Textiles and clothing	9	14	23	10	7	8
Other merchandise	6	52	58	7	26	20
All sectors	43	85	128	50	42	45
High-income countries liberalize:						
Agriculture and food	26	109	135	30	54	47
Textiles and clothing	13	2	15	15	1	5
Other merchandise	4	5	9	5	2	3
All sectors	43	116	159	50	57	55
All countries liberalize:						
Agriculture and food	54	128	182	63	64	63
Textiles and clothing	22	16	38	25	8	14
Other merchandise	10	57	67	12	28	23
All sectors	86	201	287	100	100	100

[a] Small interaction effects are distributed proportionately and numbers are rounded to sum to 100 percent

Source: Authors' World Bank LINKAGE model simulations

Table 3: High-income countries' shares of global output and exports[a], by sector, 2015

(*baseline versus full global merchandise trade liberalization, percent*)

	Primary agriculture	Processed food, beverages and tobacco	Textiles and clothing	Other manufacturing
Output				
— baseline	30	60	38	65
— free trade	25	60	35	65
Exports				
— baseline	53	66	37	70
— free trade	38	60	33	68

[a] Including intra-EU trade

Source: Authors' World Bank LINKAGE model simulations

Table 4: Impacts of full global merchandise trade liberalization on agricultural and food gross exports and output, by country/region, 2015

(*Changes in* 2015 *relative to baseline*)

	$billion (in 2001 dollars)		Percent change relative to baseline	
	Exports	*Output*	*Exports*	*Output*
Australia and New Zealand	18.0	27.9	38.0	20.5
EU 25 plus EFTA	-21.7	-185.8	-10.8	-12.3
United States	18.4	30.7	11.6	0.0
Canada	14.6	7.2	40.2	4.8
Japan	2.8	-91.7	60.4	-18.4
Korea and Taiwan	33.2	-0.4	600.2	20.2
Hong Kong and Singapore	7.0	7.4	115.2	35.4
Argentina	10.4	12.2	44.2	11.5
Bangladesh	0.8	-2.5	60.9	0.8
Brazil	38.0	66.4	120.6	34.0
China	15.1	-9.9	145.6	-0.9
India	5.1	-23.8	53.2	-3.7
Indonesia	3.6	4.5	32.2	2.4
Thailand	5.6	5.3	29.2	4.7
Vietnam	1.2	-2.1	13.9	-13.3
Russia	0.7	-7.8	15.4	-5.4
Mexico	11.9	6.2	66.0	2.2
South Africa	2.4	1.4	55.9	4.9
Turkey	4.3	-0.1	109.4	0.5
Rest of South Asia	2.9	-1.5	57.1	-1.8
Rest of East Asia	9.4	7.4	61.7	6.8
Rest of LAC	36.0	37.0	68.1	11.7
Rest of ECA	9.2	-22.2	106.0	-1.6
Middle East and North Africa	13.2	-7.8	64.1	-1.2
Selected SSA countries	4.5	5.3	50.0	9.2
Rest of Sub Saharan Africa	9.5	-4.1	45.4	-0.6
Rest of the World	8.2	2.9	168.3	4.4
High-income countries	**115.8**	**-204.7**	**15.7**	**-5.3**
Developing countries	**191.9**	**66.8**	**67.4**	**2.2**
East Asia and Pacific	34.8	5.2	54.4	0.1
South Asia	8.9	-27.8	55.1	-3.0
Europe and Central Asia	14.2	-30.0	79.7	-1.9
Sub Saharan Africa	13.2	-7.8	64.1	-1.2
Latin America and the Caribbean	16.4	2.6	47.7	2.1
World total	**96.3**	**121.8**	**75.7**	**13.8**

Source: Authors' World Bank LINKAGE model simulations

Table 5: Impacts of full global merchandise trade liberalization on exports net of imports, by country/region, 2015

(*Net trade in $billion*[a])

	All agriculture and food			Textiles and clothing			Other manufacturing		
	Baseline		*Reform*[b]	*Baseline*		*Reform*[b]	*Baseline*		*Reform*[b]
	2001	2015	2015	2001	2015	2015	2001	2015	2015
Aust. & N. Zeal.	21.2	35.1	53.6	-3.3	-5.4	-7.3	-14.8	-23.1	-35.8
EU 25 plus EFTA	-13.9	-14.1	-106.5	-37.7	-91.4	-101.4	72.9	76.5	127.5
Canada	8.3	29.1	22.7	-79.7	-118.4	-145.1	-328.9	-315.6	-287.8
United States	7.6	17.1	20.1	-4.9	-8.9	-11.3	26.5	23.4	20.8
Japan	-37.7	-46.3	-78.6	-19.4	-19.7	-22.4	160.7	196.2	234.9
Korea and Taiwan	-10.5	-16.8	4.4	24.7	53.4	62.4	44.3	54.4	36.6
HKG & SGP	-8.1	-11.5	-5.8	-11.3	-22.2	-19.0	-66.0	-100.8	-99.7
Argentina	11.7	20.0	31.4	0.2	-0.8	-2.2	-4.4	-7.8	-16.6
Bangladesh	-1.3	-1.3	-0.8	4.1	6.3	6.1	-4.5	-7.3	-7.9
Brazil	12.7	22.5	61.2	2.3	3.0	-0.5	-12.6	-19.8	-49.4
China	2.9	-61.0	-67.5	71.8	151.5	183.9	55.9	89.0	70.1
India	2.7	1.8	-5.0	13.4	27.5	41.6	-12.1	-27.2	-37.6
Indonesia	3.2	2.9	4.9	9.7	15.0	18.6	20.7	24.3	20.6
Thailand	8.2	6.6	7.5	6.4	10.4	10.8	1.9	-4.4	-0.9
Vietnam	1.6	3.9	2.0	3.0	13.0	21.5	-6.7	-12.7	-14.3
Russia	-6.2	-13.4	-16.6	-4.3	-7.4	-9.2	50.5	69.0	72.9
Mexico	-2.3	3.0	7.5	3.7	-2.9	-9.8	23.0	21.7	25.1
South Africa	2.2	1.4	3.4	-0.3	-0.2	-1.4	8.7	8.4	8.0
Turkey	1.4	-0.7	0.0	8.7	4.2	3.1	-14.5	-16.3	-14.7
Rest of S. Asia	0.1	0.4	0.1	9.2	17.7	21.3	-9.4	-19.0	-22.3
Rest of East Asia	1.6	0.9	4.5	3.3	3.1	5.8	35.0	35.4	33.2
Rest of LAC	10.3	30.8	59.9	0.9	-8.1	-12.8	-30.1	-48.7	-70.8
Rest of ECA	0.5	-4.5	-3.5	2.1	-3.1	-7.4	-15.7	-11.1	-10.0
M. East & N. Afr.	-18.8	-22.2	-23.8	-3.9	-15.8	-23.0	31.6	39.1	48.6
Sel. SSA	2.1	6.0	9.6	**0.1**	**-0.5**	**-1.0**	**-1.6**	**-3.9**	**-6.5**
Rest Sub Sah. Afr.	1.6	11.4	13.8	**-1.8**	**-3.7**	**-6.1**	**-2.0**	**-9.3**	**-9.8**
Rest of the World	-1.1	-1.1	1.7	2.9	3.2	4.8	-8.3	-10.5	-14.3
High- income	**-33.1**	**-7.5**	**-90.1**	-131.6	-212.6	-244.0	-105.3	-89.0	-3.5
Developing	**33.1**	**7.5**	**90.1**	131.6	212.6	244.0	105.3	89.0	3.5
Middle-income	24.2	-16.6	63.9	91.0	134.0	137.2	129.3	154.6	95.6
Low-income	8.9	24.1	26.3	40.6	78.5	106.9	-24.0	-65.6	-92.1
East Asia and Pac.	17.5	-46.7	-48.6	94.1	193.0	240.6	106.8	131.6	108.7
South Asia	1.5	0.9	-5.7	26.7	51.5	69.0	-26.1	-53.5	-67.8
Europe & C. Asia	-4.3	-18.6	-20.2	6.6	-6.3	-13.5	20.2	41.6	48.2
M. East & N. Afr.	-18.8	-22.2	-23.8	-3.3	-5.4	-7.3	-14.8	-23.1	-35.8
Sub Saharan Afr.	5.9	18.8	26.8	-37.7	-91.4	-101.4	72.9	76.5	127.5
Lat. Am. & Carr.	32.4	76.4	160.0	-79.7	-118.4	-145.1	-328.9	-315.6	-287.8

[a] Net trade is measured at FOB prices, actual net trade would reflect CIF/FOB margins.
[b] The 'Reform' column refers to the net trade levels after full global merchandise trade liberalization
Source: Authors' World Bank LINKAGE model simulations

Table 6: Impacts of full global merchandise trade liberalization on real factor prices[a]

(*Percent change in real factor prices relative to the baseline in* 2015)

	Un-skilled wages	Skilled wages	Capital[b] user cost	Land[b] user cost	CPI
Australia and New Zealand	3.1	1.1	-0.3	17.4	1.2
EU 25 plus EFTA	0.0	1.3	0.7	-45.4	-1.3
United States	0.1	0.3	0.0	-11.0	-0.4
Canada	0.7	0.7	0.4	22.8	-0.9
Japan	1.3	2.2	1.1	-67.4	-0.1
Korea and Taiwan	6.5	7.1	3.8	-45.0	-0.7
Hong Kong and Singapore	3.2	1.6	0.3	4.4	1.1
Argentina	2.9	0.5	-0.7	21.3	0.3
Bangladesh	1.8	1.7	-0.2	1.8	-7.2
Brazil	2.7	1.4	1.6	32.4	2.2
China	2.2	2.2	2.8	-0.9	-0.4
India	2.8	4.6	1.8	-2.6	-6.0
Indonesia	3.3	1.5	0.9	1.0	0.5
Thailand	13.2	6.7	4.2	11.4	-0.6
Vietnam	25.3	17.6	11.0	6.8	-2.3
Russia	2.0	2.8	3.5	-2.2	-3.3
Mexico	2.0	1.6	0.5	2.8	-1.4
South Africa	2.8	2.5	1.8	5.7	-1.6
Turkey	1.3	3.4	1.1	-8.1	-0.3
Rest of South Asia	3.7	3.2	0.1	0.1	-2.7
Rest of East Asia	5.8	4.2	5.2	-0.9	-1.6
Rest of LAC	5.7	1.4	-0.4	17.8	-1.2
Rest of ECA	2.3	4.2	2.1	-0.3	-2.6
Middle East and North Africa	4.1	4.1	2.6	2.4	-3.1
Selected SSA countries	6.0	1.6	0.0	4.6	0.4
Rest of Sub Saharan Africa	8.2	6.5	2.2	5.2	-5.0
Rest of the World	4.4	2.7	1.1	6.3	-1.4
High-income countries	**0.6**	**1.1**	**0.5**	**-20.0**	**-0.6**
Developing countries	**3.5**	**3.0**	**1.9**	**0.9**	**-1.7**
Middle-income countries	3.2	2.6	1.9	2.2	-1.1
Low-income countries	4.2	3.9	1.9	-1.0	-4.0
World total	**1.2**	**1.5**	**0.8**	**-0.8**	**-0.8**

[a] Nominal factor prices deflated by the consumer price index (CPI).
[b] The user cost of capital and land represents the subsidy inclusive rental cost.
Source: Authors' World Bank LINKAGE model simulations.

Table 7: Summary of Doha partial liberalization scenarios considered

Pre-simulation	Amends 2001 protection measures by allowing EU eastward enlargement to 25 members, implementation of WTO accession commitments by China, and implementation of Uruguay Round commitments including abolition of quotas on textiles and clothing by end-2004, followed by normal global growth projection for ten more years to 2015 (baseline simulation)
Scenarios 1-5	All assume agricultural domestic support cuts in four developed country markets and the abolition of agricultural export subsidies, plus:
Scenario 1	Harmonizing formula for agricultural market access with lesser cuts for Developing Countries and none for Least Developed Countries
Scenario 2	Scenario 1 + Sensitive Products (2% for Developed Countries and 4% for Developing Countries)
Scenario 3	Scenario 2 + reductions in high tariffs down to a 200% tariff cap
Scenario 4	Scenario 1 plus 50 percent proportional cut in all tariffs on non-agricultural products for Developed, 33 percent for Developing, zero for Least Developed Countries
Scenario 5	Developed countries' Harmonizing formula cuts for agriculture, plus Developed Countries' 50 percent proportional cut in all non-agricultural tariffs, are also each applied in Developing and Least Developed Countries

Source: Authors' assumptions (see text)

Table 8: Change in real income in alternative Doha scenarios, 2015

(a) Dollar change *(in 2001 $billion compared to baseline scenario)*

	Scen. 1	Scen. 2	Scen. 3	Scen. 4	Scen. 5
Australia & New Zealand	2.0	1.1	1.2	2.4	2.8
EU 25 plus EFTA	29.5	10.7	10.9	31.4	35.7
United States	3.0	2.3	2.1	4.9	6.6
Canada	1.4	0.5	0.4	0.9	1.0
Japan	18.9	1.8	12.9	23.7	25.4
Korea and Taiwan	10.9	1.7	15.9	15.0	22.6
Hong Kong and Singapore	-0.1	-0.1	-0.2	1.5	2.2
Argentina	1.3	1.0	1.0	1.3	1.6
Bangladesh	0.0	0.0	0.0	-0.1	-0.1
Brazil	3.3	1.1	1.1	3.6	3.9
China	-0.5	-1.5	-1.1	1.7	1.6
India	0.2	0.2	0.2	2.2	3.5
Indonesia	0.1	0.2	0.0	1.0	1.2
Thailand	0.9	0.6	0.8	2.0	2.7
Vietnam	-0.1	0.0	-0.1	-0.5	-0.6
Russia	-0.3	-0.7	-0.7	0.8	1.5
Mexico	-0.2	-0.3	-0.3	-0.9	-0.2
South Africa	0.1	0.3	0.3	0.4	0.7
Turkey	0.6	0.0	0.0	0.7	1.4
Rest of South Asia	0.2	0.1	0.2	0.3	0.7
Rest of East Asia	0.1	0.0	1.0	0.3	0.6
Rest of LAC	3.7	0.5	0.4	3.9	4.0
Rest of ECA	-0.2	-0.3	-0.2	-0.6	-0.7
Middle East & N. Africa	-0.8	-1.2	-1.2	-0.6	0.1
Selected SSA countries	0.1	0.0	0.0	0.1	0.2
Rest Sub-Saharan Africa	0.0	-0.3	-0.3	-0.1	0.3
Rest of the World	0.4	0.0	0.0	0.6	0.6
High-income countries	**65.6**	**18.1**	**43.2**	**79.9**	**96.4**
WTO Dev. countries	**19.7**	**1.2**	**16.8**	**32.6**	**47.7**
Developing countries	**9.0**	**-0.4**	**1.1**	**16.1**	**22.9**
Middle-income countries	8.0	-0.5	1.0	12.5	17.1
Low-income countries	1.0	0.1	0.0	3.6	5.9
East Asia and Pacific	0.5	-0.8	0.6	4.5	5.5
South Asia	0.4	0.3	0.4	2.5	4.2
Europe and Central Asia	0.1	-0.9	-0.9	0.8	2.1
Middle East & N. Africa	-0.8	-1.2	-1.2	-0.6	0.1
Sub Saharan Africa	0.3	0.0	-0.1	0.4	1.2
Lat. America & the Carib.	8.1	2.3	2.1	7.9	9.2
World total	**74.5**	**17.7**	**44.3**	**96.1**	**119.3**

Table 8: Change in real income in alternative Doha scenarios, 2015 (continued)
(b) Percentage change compared with 2015 baseline

	Scen. 1	Scen. 2	Scen. 3	Scen. 4	Scen. 5
Australia & New Zealand	0.35	0.20	0.20	0.42	0.48
EU 25 plus EFTA	0.29	0.11	0.11	0.31	0.36
United States	0.02	0.02	0.01	0.03	0.05
Canada	0.15	0.05	0.05	0.10	0.11
Japan	0.38	0.04	0.26	0.48	0.51
Korea and Taiwan	0.86	0.13	1.26	1.19	1.79
Hong Kong and Singapore	-0.02	-0.03	-0.04	0.35	0.52
Argentina	0.32	0.26	0.26	0.34	0.39
Bangladesh	-0.06	-0.03	-0.04	-0.10	-0.09
Brazil	0.50	0.16	0.17	0.55	0.59
China	-0.02	-0.06	-0.04	0.07	0.06
India	0.02	0.03	0.02	0.25	0.40
Indonesia	0.05	0.07	0.01	0.37	0.44
Thailand	0.43	0.29	0.38	0.99	1.33
Vietnam	-0.20	-0.09	-0.16	-0.83	-0.97
Russia	-0.06	-0.16	-0.15	0.16	0.31
Mexico	-0.02	-0.04	-0.04	-0.11	-0.02
South Africa	0.06	0.17	0.17	0.25	0.49
Turkey	0.25	0.02	0.02	0.26	0.55
Rest of South Asia	0.13	0.05	0.14	0.17	0.39
Rest of East Asia	0.02	0.01	0.36	0.09	0.22
Rest of LAC	0.44	0.06	0.04	0.46	0.47
Rest of ECA	-0.06	-0.09	-0.08	-0.22	-0.26
Middle East & N. Africa	-0.07	-0.10	-0.10	-0.05	0.01
Selected SSA countries	0.21	-0.02	-0.05	0.19	0.26
Rest Sub-Saharan Africa	0.02	-0.13	-0.14	-0.02	0.13
Rest of the World	0.19	0.00	0.02	0.26	0.28
High-income countries	**0.20**	**0.06**	**0.13**	**0.25**	**0.30**
WTO Dev. countries	**0.17**	**0.01**	**0.14**	**0.27**	**0.40**
Developing countries	**0.09**	**0.00**	**0.01**	**0.16**	**0.22**
Middle-income countries	0.10	-0.01	0.01	0.15	0.21
Low-income countries	0.05	0.01	0.00	0.18	0.30
East Asia and Pacific	0.01	-0.02	0.02	0.13	0.16
South Asia	0.03	0.03	0.03	0.21	0.36
Europe and Central Asia	0.01	-0.09	-0.09	0.08	0.21
Middle East & N. Africa	-0.07	-0.10	-0.10	-0.05	0.01
Sub Saharan Africa	0.06	-0.01	-0.02	0.10	0.27
Lat. America & the Carib.	0.29	0.08	0.08	0.29	0.33
World total	**0.18**	**0.04**	**0.10**	**0.23**	**0.28**

Table 9: Impact of excluding cuts to agricultural export and domestic subsidies[a], 2015

	$ billion			percent		
	Scen. 4	Scen. 4 (MD)	Scen. 4 (M)	Scen. 4	Scen. 4 (MD)	Scen. 4 (M)
Australia & New Zealand	2.4	1.8	1.6	0.42	0.32	0.27
EU 25 plus EFTA	31.4	25.1	25.5	0.31	0.25	0.25
United States	4.9	5.3	3.3	0.03	0.04	0.02
Canada	0.9	1.0	0.8	0.10	0.11	0.09
Japan	23.7	24.8	25.5	0.48	0.50	0.51
Korea and Taiwan	15.0	15.2	15.6	1.19	1.20	1.23
Hong Kong and Singapore	1.5	1.7	1.9	0.35	0.39	0.43
Argentina	1.3	1.2	0.4	0.34	0.30	0.11
Bangladesh	-0.1	-0.1	-0.1	-0.10	-0.09	-0.09
Brazil	3.6	3.5	3.0	0.55	0.54	0.46
China	1.7	2.6	4.5	0.07	0.10	0.17
India	2.2	2.2	2.1	0.25	0.25	0.23
Indonesia	1.0	0.9	0.9	0.37	0.35	0.34
Thailand	2.0	2.0	1.9	0.99	0.99	0.96
Vietnam	-0.5	-0.5	-0.5	-0.83	-0.81	-0.88
Russia	0.8	2.0	2.1	0.16	0.42	0.44
Mexico	-0.9	-0.8	-0.5	-0.11	-0.09	-0.06
South Africa	0.4	0.3	0.3	0.25	0.22	0.23
Turkey	0.7	0.7	0.8	0.26	0.30	0.32
Rest of South Asia	0.3	0.3	0.2	0.17	0.18	0.12
Rest of East Asia	0.3	0.4	0.5	0.09	0.15	0.17
Rest of LAC	3.9	4.2	3.9	0.46	0.50	0.46
Rest of ECA	-0.6	-0.3	-0.3	-0.22	-0.09	-0.10
Middle East & N. Africa	-0.6	1.0	1.3	-0.05	0.08	0.10
Selected SSA countries	0.1	0.2	0.1	0.19	0.28	0.19
Rest of Sub-Saharan Africa	-0.1	0.5	0.3	-0.02	0.22	0.14
Rest of the World	0.6	0.6	0.6	0.26	0.28	0.27
High-income countries	**79.9**	**74.9**	**74.1**	**0.25**	**0.23**	**0.23**
WTO Dev. Countries	**32.6**	**38.0**	**39.0**	**0.27**	**0.32**	**0.33**
Developing countries	**16.1**	**21.1**	**21.6**	**0.16**	**0.21**	**0.21**
Middle-income countries	12.5	16.9	18.0	0.15	0.21	0.22
Low-income countries	3.6	4.2	3.6	0.18	0.21	0.18
East Asia and Pacific	4.5	5.5	7.3	0.13	0.16	0.21
South Asia	2.5	2.4	2.2	0.21	0.21	0.19
Europe and Central Asia	0.8	2.5	2.6	0.08	0.25	0.26
Middle East & N. Africa	-0.6	1.0	1.3	-0.05	0.08	0.10
Sub Saharan Africa	0.4	1.0	0.8	0.10	0.23	0.18
Lat. America & the Carib.	7.9	8.1	6.8	0.29	0.29	0.25
World total	**96.1**	**96.0**	**95.7**	**0.23**	**0.23**	**0.22**

[a] Scen. 7 (MD) is the same as Scen. 4 except export subsidies are not eliminated. Scen. 4 (M) is the same as 4 (MD) except domestic support is not cut. In other words, Scen. 4 (M) includes only cuts in import tariffs.

Source: Authors' World Bank LINKAGE model simulations

Table 10: Agricultural output and employment growth under three scenarios, 2005-2015
(*annual percent growth rate of agricultural output between* 2005 *and* 2015)

	Output growth			Employment growth		
	Baseline	Full global liberaliz'n	Scenario 4	Baseline	Full global liberaliz'n	Scenario 4
Australia & New Zealand	3.5	5.2	4.3	0.4	1.9	1.0
EU 25 plus EFTA	1.0	-1.5	-0.3	-1.8	-3.9	-2.8
United States	2.2	1.3	1.9	-0.8	-2.1	-1.2
Canada	3.5	5.2	4.0	0.2	1.9	0.6
Japan	0.5	-4.3	-1.4	-2.7	-6.5	-4.1
Korea and Taiwan	2.2	0.1	1.5	-1.3	-3.9	-2.1
Hong Kong and Singapore	2.8	3.3	2.9	0.0	0.2	0.0
Argentina	2.9	5.1	3.5	0.9	3.3	1.5
Bangladesh	4.2	4.4	4.2	1.1	1.2	1.2
Brazil	3.3	6.1	4.4	1.1	4.0	2.2
China	4.3	4.3	4.3	0.8	0.7	0.8
India	4.3	4.1	4.4	1.0	0.6	1.0
Indonesia	3.0	2.9	3.0	-0.7	-0.7	-0.6
Thailand	-0.1	1.3	0.4	-4.6	-3.7	-4.3
Vietnam	5.8	6.1	5.9	3.9	3.5	4.0
Russia	1.5	1.0	1.4	-2.3	-2.7	-2.4
Mexico	3.9	4.1	4.0	2.0	2.3	2.3
South Africa	2.5	3.3	2.6	0.0	0.8	0.1
Turkey	3.0	2.6	3.0	-0.5	-1.2	-0.5
Rest of South Asia	4.8	4.8	4.9	2.0	1.9	2.1
Rest of East Asia	3.7	3.5	3.8	0.2	-0.1	0.3
Rest of LAC	4.4	6.6	5.3	1.9	3.8	2.6
Rest of ECA	3.3	3.3	3.3	0.0	-0.1	0.0
Middle East & N. Africa	4.0	4.0	4.0	1.5	1.4	1.5
Selected SSA countries	5.3	5.7	5.4	3.0	3.3	3.0
Rest of Sub-Saharan Africa	4.6	4.8	4.8	2.2	2.5	2.3
Rest of the World	5.0	6.4	5.5	2.4	3.5	2.7
High-income countries	**1.6**	**-0.1**	**0.8**	**-1.5**	**-3.1**	**-2.2**
Developing countries	**3.9**	**4.2**	**4.1**	**1.0**	**1.2**	**1.1**
Middle-income countries	3.7	4.1	3.9	0.4	0.3	0.4
Low-income countries	4.4	4.5	4.5	1.2	0.9	1.2
East Asia and Pacific	4.0	4.0	4.0	-0.5	-0.8	-0.5
South Asia	4.4	4.2	4.4	1.5	1.4	1.5
Europe and Central Asia	3.0	2.9	3.1	2.3	2.6	2.4
Middle East and N. Africa	4.0	4.0	4.0	1.7	3.4	2.4
Sub Saharan Africa	4.5	4.9	4.7	**0.2**	**0.0**	**0.2**
Latin America and Carib.	3.8	5.8	4.6	0.4	1.9	1.0
World total	**3.2**	**2.9**	**3.0**	-1.8	-3.9	-2.8

Source: Authors' World Bank LINKAGE model simulations.

Table 11: Impact of reform scenarios on agricultural value added, 2015

(*Change in value added in* 2015 *relative to baseline*)

	$billion		**percent change**	
	Full global liberalization	Scenario 4	Full global liberalization	Scenario 4
Australia and New Zealand	6.4	2.4	25.6	9.8
EU 25 plus EFTA	-39.1	-20.4	-26.4	-13.8
United States	-18.2	-6.3	-15.0	-5.2
Canada	3.4	0.9	23.3	5.8
Japan	-17.7	-7.4	-39.5	-16.6
Korea and Taiwan	-9.5	-3.4	-33.3	-12.1
Hong Kong and Singapore	0.1	0.0	7.5	1.4
Argentina	6.1	1.7	33.8	9.4
Bangladesh	-0.5	0.0	-4.4	0.4
Brazil	15.1	5.5	46.3	16.7
China	0.3	1.8	0.1	0.4
India	-17.1	0.4	-8.1	0.2
Indonesia	0.8	0.5	2.7	1.7
Thailand	3.8	1.1	25.0	7.2
Vietnam	0.8	0.0	13.6	0.3
Russia	-1.4	-0.2	-6.5	-0.8
Mexico	0.9	1.2	2.5	3.2
South Africa	0.5	0.1	9.6	1.2
Turkey	-2.0	-0.1	-7.2	-0.3
Rest of South Asia	-0.6	0.8	-1.3	1.8
Rest of East Asia	-0.2	0.5	-0.7	1.9
Rest of LAC	22.9	8.4	30.2	11.1
Rest of ECA	-1.1	-0.1	-1.8	-0.2
Middle East and North Africa	0.3	1.0	0.3	0.9
Selected SSA countries	1.5	0.3	9.1	1.7
Rest of Sub Saharan Africa	2.3	0.8	5.4	1.9
Rest of the World	3.1	1.0	16.4	5.4
High-income countries	**-74.6**	**-34.2**	**-19.4**	**-8.9**
Developing countries	**35.6**	**24.8**	**2.9**	**2.0**
Middle-income countries	45.3	20.9	5.3	2.4
Low-income countries	-9.7	3.9	-2.5	1.0
East Asia and Pacific	5.5	3.9	1.1	0.8
South Asia	-18.1	1.2	-6.8	0.5
Europe and Central Asia	-4.5	-0.3	-4.0	-0.3
Middle East and North Africa	0.3	1.0	0.3	0.9
Sub Saharan Africa	4.3	1.1	6.7	1.8
Latin America and the Caribbean	45.0	16.7	27.4	10.2
World total	**-39.0**	**-9.5**	**-2.4**	**-0.6**

Source: Authors' World Bank LINKAGE model simulations

Table 12: Changes in bilateral trade flows from Doha Scenario 4 (agricultural reform plus non-agricultural tariff cuts)[a], 2015

(*Difference in bilateral trade flows at FOB prices in* 2015 *compared to the baseline, $billion*)

	Importer:		
	World	*High-income countries*	*Developing countries*
Exporter:	**Agriculture and food**		
World	56	46	9
High-income	15	15	-0
Developing	41	31	10
	Textiles and clothing		
World	41	28	12
High-income	16	5	11
Developing	25	23	2
	Other manufacturing		
World	117	68	49
High-income	105	60	44
Developing	12	8	5
	All merchandise trade		
World	213	142	71
High-income	135	80	55
Developing	78	62	16

[a] Aggregations exclude intra-EU trade

Source: Authors' World Bank LINKAGE model simulations

Table 13: Share of agricultural and food production exported, 2001 and 2015

(*percent export share of agriculture and food production*)

	Base-line **2001**	*Baseline*	*Full global liberaliz'n* **2015**	*Scenario47*
Australia & New Zealand	33.3	37.2	42.7	39.5
EU 25 plus EFTA	16.7	17.3	17.6	16.6
EU 25 plus EFTA (excl. intra-EU25)	4.0	5.1	7.7	5.0
United States	6.3	7.9	9.2	8.1
Canada	24.5	29.5	40.0	32.5
Japan	0.9	1.2	2.3	1.5
Korea and Taiwan	4.4	4.8	26.5	8.6
Hong Kong and Singapore	26.0	30.0	47.8	30.8
Argentina	21.6	25.2	32.5	26.9
Bangladesh	1.7	3.6	5.7	3.5
Brazil	15.3	17.3	28.9	21.7
China	3.3	0.9	2.2	1.0
India	3.5	3.0	4.7	3.3
Indonesia	11.9	10.0	12.9	9.9
Thailand	30.2	28.2	34.6	30.1
Vietnam	23.9	26.9	35.3	26.7
Russia	6.1	5.5	6.7	6.0
Mexico	5.6	7.8	13.2	8.5
South Africa	16.0	12.7	18.8	13.5
Turkey	9.6	6.0	12.4	7.0
Rest of South Asia	6.0	6.2	9.9	6.6
Rest of East Asia	16.1	14.6	22.1	14.9
Rest of LAC	13.9	18.1	27.1	20.7
Rest of ECA	2.4	1.7	3.7	1.9
Middle East & N. Africa	5.2	6.7	11.2	7.2
Selected SSA countries	13.2	18.1	25.4	19.2
Rest of Sub-Saharan Africa	11.2	15.8	23.3	16.5
Rest of the World	6.6	7.0	17.7	8.7
High-income countries	**5.8**	**7.5**	**11.6**	**8.2**
Developing countries	**7.5**	**6.9**	**11.6**	**7.8**
Middle-income countries	7.6	6.6	11.4	7.6
Low-income countries	7.3	7.9	12.4	8.4
East Asia and Pacific	7.2	4.1	6.5	4.3
South Asia	3.8	3.6	5.7	3.9
Europe and Central Asia	3.7	2.7	5.0	3.0
Middle East & N. Africa	5.2	6.7	11.2	7.2
Sub Saharan Africa	12.5	15.8	23.1	16.6
Lat. America & the Carib.	12.7	15.9	24.8	18.5
World total	**9.5**	**9.5**	**13.2**	**10.0**
World total (excl. intra-EU25)	6.6	7.2	11.6	8.0

Source: Authors' World Bank LINKAGE model simulations

Appendix A: Comparison of LINKAGE model results with those from the GTAP-AGR model

Using the same GTAP Version 6.0 2001 database, our analysis using the LINKAGE model provides considerably larger welfare gains from full trade liberalization than generated by Hertel and Keeney (2005) using a variant on the standard GTAP model called GTAP-AGR. To understand the reasons behind this difference, for this Appendix we altered the LINKAGE model so that it mimics the comparative static GTAP-AGR model as of 2001, and then we also altered assumptions about elasticities (see the differences in Table A1) and factor mobility to make them similar to those used by Hertel and Keeney.

Obtaining a comparative static version of the LINKAGE model involves only a few modifications to the recursive dynamic version. Specifically, the 'new' elasticities of substitution in production are imposed to mimic the long-term properties of the dynamic model, capital is assumed to be perfectly mobile, and adjustment costs are ignored. But the big difference between the comparative static and dynamic version results is the change in the structure of the global economy by 2015, due to growth in factor stocks and changes in the relative weights of countries and sectors in the global economy over those 14 years.

Table A2 reports what the LINKAGE model says is the welfare cost of global trade barriers and agricultural subsidies in 2001 under differing assumptions, as compared with their cost in 2015. First, by scaling the 2015 dynamic results back to 2001 by assuming the percentage effect on income in each region is the same in 2001 as in 2015 reduces the real global cost from $287 billion to $156 billion – simply because each regional economy is smaller. Second, when the dynamic effects themselves are removed, the global comparative static cost shrinks to $127 billion. Third, if

the long-run Armington elasticities[19] used in the LINKAGE model (which we believe are more appropriate for the long-run analysis being undertaken in the current study) are replaced be the medium-term ones used in Hertel and Keeney's GTAP-AGR model,[20] the real global cost shrinks further to $89 billion. In short, those three differences between the two models almost fully explain the different aggregate results, since that $89 billion is very close to Hertel and Keeney's $84 billion comparative static estimate of the gains from freeing merchandise trade globally. One other difference between the LINKAGE and GTAP models has to do with agricultural land: GTAP assumes a fixed supply of farm land and limited land mobility between farm sectors whereas the LINKAGE model assumes farm land supply in the long run is somewhat responsive to farm product prices and that there is complete mobility of that land among farming enterprises in the long run.[21] The final column of Table A2 shows that replacing those two assumptions with the ones adopted in the GTAP-AGR model further reduces the global cost of trade-distorting policies, to $78 billion.

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[19] These elasticities represent the top-level Armington elasticity, i.e. between domestic demand and aggregate import demand. The second-level Armington elasticity, i.e. across trading partners, is set at twice the top-level elasticity.

[20] The new GTAP elasticities are the outcome of significant econometric work and are higher than the standard Armington elasticities used in previous releases of GTAP. While recognizing the extensive work behind the new elasticities, the controversy underlying these key parameters continues. The new GTAP elasticities reflect a move towards mid-range Armington elasticities, but are still much lower than those used by some, notably Tarr and Rutherford and their associates. The LINKAGE model elasticities are above those in GTAP but still in the mid-range, and are the outcome of literature surveys, best guesses and adjustments that have been undertaken over a 15-year period since the inception of the LINKAGE model and its predecessors. The difference between these elasticities averages about one-third (Appendix Table A1).

[21] In the standard LINKAGE model, an upward-sloping supply function is implemented for land, with supply elasticities higher for land-abundant countries than for land-scarce countries. There is also perfect land mobility across farm enterprises. In the final simulation the supply elasticity is set to 0 and the land transformation elasticity is set to 1.

Table A1: Global average top-level Armington elasticities in the GTAP-AGR and LINKAGE models, by product[a]

	GTAP elasticities	LINKAGE elasticities	Percent difference
	(1)	(2)	((2) – (1))/(1)
Rice	3.20	4.45	39
Wheat	4.45	5.85	31
Other grains	1.30	4.93	279
Oil seeds	2.45	4.75	94
Sugar	2.70	5.91	119
Plant-based fibers	2.50	3.94	58
Vegetables and fruits	1.85	3.94	113
Other crops	3.25	3.94	21
Livestock	2.09	3.94	89
Other natural resources	1.21	2.80	131
Fossil fuels	5.70	4.93	-14
Processed meats	4.17	3.94	-6
Vegetable oils and fats	3.30	3.94	19
Dairy products	3.65	3.94	8
Other food, beverages and tobacco	1.74	3.94	126
Textiles	3.75	3.94	5
Wearing apparel	3.70	3.94	6
Leather	4.05	4.93	22
Chemicals rubber and plastics	3.30	3.94	19
Iron and steel	2.95	3.94	34
Motor vehicles and parts	2.80	4.93	76
Capital goods	4.21	3.94	-6
Other manufacturing	3.52	3.94	12
Construction	1.90	1.50	-21
Utilities and services	1.92	2.09	9
Agriculture	2.64	4.63	75
Processed foods	3.22	3.94	23
Textile and wearing apparel	3.83	4.27	11
Other manufacturing	3.38	4.06	20
Merchandise trade	3.12	4.29	37
Total	**3.03**	**4.09**	**35**

[a] For convergence the Armington elasticity for rice in Japan has been set at 2 in all simulations

Sources: van der Mensbrugghe (2004b) and Keeney and Hertel (2005)

Table A2: Impacts on real incomes of full liberalization of global merchandise trade, by country/region[a], base case in 2015 versus comparative static cases in 2001

(*Change in real income, $billion*)

	2015	2001			
	Base case	Scaled dynamics	Comparative static	GTAP elasticities	GTAP elas+fixed land
Australia and New Zealand	6.1	3.5	2.2	1.8	1.7
EU 25 plus EFTA	65.2	45.3	44.0	32.9	30.2
United States	16.2	9.8	4.1	4.5	5.2
Canada	3.8	2.5	2.1	1.0	0.8
Japan	54.6	28.0	30.8	25.1	25.3
Korea and Taiwan	44.6	14.3	16.1	8.9	9.1
Hong Kong and Singapore	11.2	5.6	4.3	3.7	3.6
Argentina	4.9	2.9	1.7	1.1	0.8
Bangladesh	0.1	0.1	-0.2	-0.3	-0.4
Brazil	9.9	6.1	4.7	5.0	2.2
China	5.6	1.9	0.6	-0.5	-2.5
India	3.4	1.7	-0.8	-1.5	-0.8
Indonesia	1.9	1.0	0.2	0.1	-0.1
Thailand	7.7	3.7	2.1	1.4	0.9
Vietnam	3.0	1.6	1.1	0.7	0.7
Russia	2.7	1.4	2.0	1.6	1.4
Mexico	3.6	2.3	-0.4	-1.5	-1.5
South Africa	1.3	0.8	0.7	0.5	0.4
Turkey	3.3	1.7	1.3	0.9	0.9
Rest of South Asia	1.0	0.5	-0.2	-0.3	-0.3
Rest of East Asia	5.3	2.7	2.9	2.0	1.7
Rest of LAC	10.3	6.6	2.0	-0.6	-2.1
Rest of ECA	1.0	0.3	0.6	-0.2	-0.4
Middle East and North Africa	14.0	8.1	3.8	2.2	1.6
Selected SSA countries	1.0	0.6	0.3	0.4	0.3
Rest of Sub Saharan Africa	2.5	1.4	-0.2	-0.6	-0.8
Rest of the World	3.4	1.6	1.4	0.4	0.0
High-income countries	**201.6**	**109.8**	**103.7**	**77.9**	**75.8**
Developing countries	**85.7**	**43.9**	**23.7**	**10.6**	**2.0**
East Asia and Pacific	23.5	9.4	6.9	3.7	0.6
South Asia	4.5	2.2	-1.2	-2.1	-1.5
Europe and Central Asia	7.0	3.5	3.9	2.3	1.9
Middle East and North Africa	14.0	8.1	3.8	2.2	1.6
Sub Saharan Africa	4.8	2.8	0.7	0.2	-0.1
Latin America and the Caribbean	28.7	17.9	8.1	4.0	-0.5
World total	**287.3**	**156.4**	**127.4**	**88.5**	**77.8**

[a] The scaled dynamic results refer to the impact of global merchandise trade reform with limited reductions in some key agricultural sectors in Japan (rice and sugar) and Korea and Taiwan (rice, oil seeds and other grains). The percentage change in real income in each region in 2015 resulting from the dynamic simulation is scaled to the 2001 level of income for that region

Source: Authors' World Bank LINKAGE model simulations