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Global Impacts of the Doha Scenarios on Poverty

by

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Abstract

This paper illustrates some of the potential consequences of the WTO's Doha Round of multilateral trade negotiations on incomes and poverty globally. Using the global LINKAGE model to generate changes in domestic and international prices that have a direct impact on factor incomes and consumer prices, we estimate the change in real income at the poverty line that would accompany various reform scenarios. When accompanied by additional information about the elasticity of poverty with respect to income, this provides an estimate of the change in poverty by country. Under most liberalization scenarios considered, unskilled wages rise more than average incomes, but the estimated impact on global poverty is modest, especially if developing countries are unwilling to undertake much reform.

JEL codes: C68, D58, F17, Q17

Key words: Trade policy reform, computable general equilibrium modeling, poverty alleviation

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Introduction

This chapter illustrates some of the potential consequences of a Doha agreement and alternative reform scenarios on incomes and poverty globally. Use of global models can set the overall stage for the impacts of multilateral trade reforms, even though by design they are not particularly well suited for looking at poverty impacts because few global models contain systematic information at the household level. Global models can nonetheless provide some useful information for assessing potential poverty impacts of multilateral trade reform. In particular, they generate changes in domestic and international prices that have a direct impact on factor incomes and consumer prices. These may be used to construct an estimate of the change in real income at the poverty line. When accompanied by additional information about the elasticity of poverty with respect to income, this can provide an estimate of the change in poverty by country.

An overall benchmark for assessing the gains from partial trade reform that are likely to arise from a successful conclusion to the current multilateral trade negotiations is full merchandise trade reform. Using the World Bank's LINKAGE model (see van der Mensbrugghe [2004b]), it is estimated that the global gains from full merchandise trade reform would amount to about US$290 billion in 2015. This is below the previous estimate (using the same model) of about US$400 billion.[1] These differences can be explained by noting three facts. First, a new GTAP dataset is used here, with a 2001 base year instead of the earlier 1997 benchmark. The tariff data reflect reforms between 1997 and 2001 and the incorporation of nonreciprocal tariff preferences, which were largely ignored in the previous version. Second, the new dataset reflects the changing structure of the global economy, particularly the rising prominence of Asia's

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

economies.[2] Third, the baseline developed in this chapter takes account of recent reform commitments, such as China's WTO accession agreement, final implementation of the Uruguay Round (including elimination of quotas on textile and clothing imports), and the EU's eastward expansion in 2004. These changes alone are estimated to be worth more than US$70 billion to the global economy (evaluated in 2015). When incorporated into the baseline, they are no longer permitted to contribute to the estimated global welfare gains from trade liberalization.

A successful Doha Round could generate between US$95 billion and $126 billion per year by 2015 in real global income gains. This assumes that there are no exemptions for sensitive and special agricultural products. Most of the gains would be garnered by the rich countries that have agreed to undertake a more aggressive reform, particularly in agriculture. The significant binding overhang in most developing countries suggests that only modest reforms are likely to emerge there. Under such a scenario, rich countries would achieve between 40 percent and 45 percent of what they could gain from full merchandise trade reform, and developing countries would achieve about 20 percent. In aggregate, this would provide the world about one-third of the potential welfare gains from freeing global merchandise trade.

Trade reform promotes growth, but it is also likely to reduce poverty in developing countries because, under most liberalization scenarios, unskilled wages rise more than average incomes. Nonetheless, the impact of global trade reform on global poverty, as measured by the model in this chapter, is modest. By 2015, as currently projected in the baseline, the majority of the poor will be concentrated in Sub-Saharan Africa and to a lesser extent in South Asia. Despite the rather high increase in unskilled wages in the former emanating from trade reform, the region

2. The new dataset also reflects changes in the dollar evaluation of the global economy—with a relatively strong dollar in 2001 compared to 1997. It is unclear in which direction this would affect the estimated impacts of trade reform.

has a relatively low elasticity of poverty reduction relative to economic growth. Overall, the number of poor (those living on less than US$1 per day) would decline by 32 million by 2015, a reduction of some 5 percent compared to the projected baseline level of 622 million, of which 21 million would be in Sub-Saharan Africa. The modest extent of reform by developing countries explains the smallness of the poverty impact from the Doha Round.

The remainder of the paper is organized as follows. Section 1 provides a brief overview of the model, which is followed by a brief section describing the base-year patterns of protection. The third section discusses some baseline issues. The fourth and fifth sections discuss results of the simulations, the sixth discusses poverty impacts, and the final section provides some concluding remarks.

1. Model Overview

The model used for this analysis is the World Bank's global dynamic computable general equilibrium (CGE) model, LINKAGE (van der Mensbrugghe 2004b). The model is a relatively standard GE model with a few distinguishing characteristics. First, it is recursive dynamic, with a 2001 base year, and typically solved through to 2015. The dynamics are driven by exogenous population and labor supply growth, savings-driven capital accumulation, and labor-augmenting technological progress. In any given year, factor stocks are largely fixed. Producers minimize costs subject to constant returns to scale (CRS), consumers maximize utility, and all markets clear 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 possibilities between ranch- and range-fed production. All other sectors reflect the

standard capital-labor substitution (with two types of labor—skilled and unskilled).[3] There is a single representative household for each country or region. It allocates income to consumption using the extended linear expenditure system (LES). Trade is modeled using a nested Armington structure. First, aggregate import demand is the outcome of allocating domestic absorption between domestic goods and aggregate imports. At the next level, 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 is bilateral tariffs. There are also bilateral export subsidies.[4] Domestic protection includes subsidies on intermediate demand, output, and payments to capital and land in agriculture.

The model has three closure rules. First, government fiscal balances are fixed in any given year.[5] The fiscal objective is met by changing the level of lump-sum taxes on households. This implies that changes in revenues—for example, the loss 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 via 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 to the extent imported

3. Both are aggregated into a single labor bundle substitutable with capital. The model allows for skilled labor to be combined with capital and this capital–skilled labor bundle to be substitutable with unskilled labor.
4. The textile and apparel quotas are modeled as export tax equivalents, implying that the quota rents accrue to the exporting country. The LINKAGE model is also designed to implement TRQs, though none are used in the simulations described in this paper.
5. For the sake of simplicity, they are fixed at their base-year level, minimizing potential sustainability problems.

capital goods are taxed. Because the capital account is exogenous, rates of return across countries can differ over time and across simulations. The model solves only for relative prices. The numeraire, 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 unit value in the base year and throughout time.

The new version of the LINKAGE model, Version 6, is based on the latest release of the GTAP dataset, Release 6.0.[6] 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 of the protection data. The new protection data come from a joint CEPII (Paris)–ITC(Geneva) project. The product of this joint effort, known as MAcMap, is an HS-6 detailed database on bilateral protection that integrates trade preference, specific tariffs, and TRQs.[7] In summary, the new GTAP database has lower tariffs than the previous database because of the reform efforts between 1997 and 2001—for example, China's progress toward WTO accession and continued implementation of the Uruguay Round Agreement—and the inclusion of bilateral trade preferences.

The version of LINKAGE used for this study comprises a 27-region, 25-sector aggregation of the GTAP dataset.[8] There is a heavy emphasis on agriculture and food, which make up 13 of the 25 sectors, and a focus on the largest commodity exporters and importers.

6. 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 four key resources to the trade community. First is an integrated and consistent international database for trade policy analysis. The current version is composed of 87 country and region groupings and 57 economic sectors. The second is a publicly available global trade model, also known as the GTAP model. (Note The LINKAGE model is distinct from the GTAP model, though it uses the same underlying database.) The third is an annual course in applied trade modeling. Finally, GTAP organizes and cohosts the annual Conference on Global Economic Analysis. More information on the GTAP Center and project can be found at http://www.gtap.agecon.purdue.edu.

7. More information on the MAcMap database is available at http://www.cepii.fr/anglaisgraph/bdd/macmap.htm and from Bouët and others (2004).

8. Details on the aggregation are available in appendix A of this paper.

2. Overview of Protection

An overview of protection in the LINKAGE model is offered in tables 2.7 and 2.8 of Anderson and Martin (2005), and so it will not be repeated here. However, it is important to bear in mind the main features of global protection gleaned from this earlier chapter as impacts of its removal are analyzed. Recall that the main source of protection resides in tariffs or border barriers, with many countries having significant domestic distortions in agriculture. As noted in Anderson and Martin (2005), the world average tariff on agriculture and food is 16.7 percent, with little difference between high-income and developing countries,[9] 16.0 percent and 17.7 percent, respectively. Of course, the averages obscure large variations across countries and commodities. Not surprisingly, the highest agricultural tariffs are in the high-income Asian economies, but several low-income countries also have high tariffs—for example India, Vietnam, the rest of Sub-Saharan Africa, and the rest of South Asia. These same developing countries tend to have high tariffs in other sectors as well—for example, India's tariff on textile and clothing is more than 26 percent, and on other goods, it is nearly 25 percent. In summary, the patterns of protection are relatively clear, agriculture and food have the highest level of protection, followed by textile and apparel and then other goods. Developed-country protection is largely concentrated in agriculture and food, and developing-country protection is by and large more uniform across broad sectors.

Recall that precommitments (handled via a pre-experiment) represent those tariff changes that have been agreed to in 2001, but not yet fully implemented. These are implemented as part of the baseline scenario. As can be seen from table 2.7 in Anderson and Martin (2005), these precommitments are small except for the case of China. Under WTO accession, its average tariff

9. This paper uses the World Bank definitions for developing countries, unless otherwise stated. This means that East Asia's newly industrialized economies are classified with the high-income countries.

declines by more than one-half—from 13.6 percent to 6.1 percent, subsequent to the 2001 starting point. Other significant changes include agriculture and food in the case of the Republic of Korea and Taiwan, China, and Thailand.[10] There is not much discernable impact from the final phases of the Uruguay Round. These would mostly be reflected in developing countries that had a longer phase-in period. However, the impact would be slight because the tariff bindings are well above applied tariffs in most cases.

Table 2.8 in Anderson and Martin (2005) shows the average tariffs faced by exporters in these broad sectors. Taking all goods together, exporters from Argentina face the highest average tariffs, along with Brazil. This is due to their propensity to export agricultural products to high-tariff regions. However, Canada and Mexico face the lowest tariffs in their export markets. This reflects the impacts of NAFTA, because intraregional trade dominates export market share for these two countries. The United States, a more diversified exporter, faces an average tariff considerably higher than its two partners in NAFTA. Unlike import protection levels, the patterns of barriers faced by exporters is less distinctive, although existing preferential trade agreements have some impact, as does the resource intensiveness of exports. Neither Russia, nor the Middle East and North Africa (both big energy exporters) face particularly high average tariffs. The final baseline tariffs—that is, those after incorporation of existing commitments—are lower than the initial tariffs. Argentina in particular benefits from greater market access into China, with the average tariff faced by its exporters declining from 14.1 percent to 9.4 percent (and from 23.0 percent to 13.7 percent in the case of agriculture and food).

10. EU expansion is not depicted in these tables because intra-EU trade is excluded. It would be modest at any rate, because tariffs between the EU and the candidate countries had been converging.

3 Scenarios

3.1 Base-Data and Base-Year Adjustments

The starting point for the model simulations is the GTAP dataset, Version 6.0, which is aggregated to 27 regions and 25 sectors (see Appendix A). The aggregated dataset is then adjusted to incorporate additional information on protection. In particular, an output subsidy of 36 percent is imposed on U.S. cotton (the plant-based fiber [pfb] sector),[11] and bilateral tariffs are lined up with the scenario file prepared by CEPII.[12] A process based on the GTAP *Altertax*[13] procedure is used to impose these changes while minimizing the distortions to the original GTAP dataset.

3.2 Baseline Scenario

The starting point for the baseline scenario is the adjusted 2001 GTAP database. The model is solved in recursive dynamic fashion through to 2015, lining up with the World Bank's most recent medium- and long-term forecast for the global economy.[14] The baseline scenario includes two changes to the base-year level of protection. First, the export tax equivalents on textiles and clothing are removed, emulating the removal of quotas. Second, tariffs are adjusted to match existing commitments—completion of Uruguay Round commitments, Chinese WTO accession, EU expansion, and so forth. Both of these changes are phased in between 2002 and 2004. From 2005 forward, there are no changes in the levels of protection.

11. This is an approximation of the effect of the various programs supporting cotton production in the U.S., see Sumner (2005).
12. The CEPII scenario file contains 10 Doha scenarios, the base tariffs, and the preshock tariffs. The base tariffs are consistent with the GTAP tariffs at the 87-region, 57-sector level, that is, they correspond exactly to the GTAP Version 6.0 tariffs. However, when aggregated to the level of aggregation used in the model, they could differ from the CEPII aggregation if the CEPII trade weights are used because the aggregate tariffs can be quite sensitive to the trade weights. In all aggregations, the GTAP CIF-based trade weights are used to aggregate the tariffs. In the adjustment process, the GTAP weighted CEPII base tariffs are imposed over the GTAP tariffs.
13. See Malcolm (1998).
14. See World Bank (2005).

3.3 Reform Scenarios

For purposes of comparison with the Doha scenarios, two benchmark simulations are developed. The first is the baseline or reference scenario, described above; the second is a scenario of complete merchandise trade reform that provides the maximum potential gain from eliminating import protection (and export subsidies and domestic support in agriculture). To provide a more complete picture of the impacts of multilateral trade reform, the global reform scenario is decomposed into partial shocks. The decompositions look at the sources of gain by broad sector—agriculture and food, textile and clothing, and other manufacturing—and by broad income classification—high-income countries versus developing countries.[15]

The remaining scenarios all pertain to some version of a possible Doha accord. The central Doha scenario is the same one explored throughout this book and outlined in detail in Anderson and Martin (2005). Some attention is also devoted to an alternative scenario, Doha-all, in which developing countries and LDCs cut their bound tariffs at the same rate as for industrial countries. This is of particular interest, because it represents a concrete instance of deeper developing-country commitments in the Doha Round.

These two Doha scenarios entail relatively modest reform, as can be seen by the average cut in protection in table 2.7 (columns 3 and 4) in Anderson and Martin (2005). For high-income countries, the average cut for both Doha scenarios is 1.3 percentage points (from 2.9 percent to 1.6 percent). This is largely driven by the relatively small tariffs in other manufacturing and the large weight this sector represents in total trade for high-income countries. The cuts in

15. For most purposes, this paper uses the World Bank's definition of developing countries. One exception is the EU-accession countries that are incorporated into the EU aggregate. Another is that this paper also reports the WTO-accepted definition of developing countries that includes the newly industrialized economies of East Asia.

agricultural and food tariffs are more substantial, being nearly halved on average (15.9 percent to 8.2 percent), as are those for textiles and clothing (from 7.3 percent to 4.1 percent).

The implied tariff reductions for developing countries are similarly modest, but for different reasons. The average tariff drops from 8.4 percent to 7.5 percent in the case of the central Doha scenario, and further to 6.8 percent when developing-country cuts (including those of LDCs) are fully reciprocal (Doha-all). The principal reason for the modest reductions lies in the huge gap between applied tariffs and tariff bindings. Average bound tariffs in agriculture are 2.4 times as high as applied tariffs, and this ratio is 5 in the case of the LDCs.[16] Thus, when bound tariffs are reduced, there is often no real liberalization because they remain above the currently applied tariffs.[17]

4. Global Merchandise Trade Reform

4.1 Welfare Impact

Table 1 presents the standard welfare impact, or change in real income.[18] Global merchandise trade reform that includes elimination of domestic support would generate US$287 billion in additional income in 2015 at the global level compared with the baseline scenario. Almost 70 percent of the global gains would accrue to the high-income countries. However, as a share of income, developing countries do somewhat better, with an average increase of 0.8 percent compared to 0.6 percent for high-income countries. The results vary widely across

16. The scenarios, though assessed at an aggregate level, are based on formula cuts at the six-digit level thanks to the MAcMaps database that also incorporates the existing tariff bindings.
17. Francois and Martin (2004) have explored potential gains from setting bindings at applied levels even in the absence of actual liberalization. It could encourage imports by reducing the risk of reversal in tariff policies.
18. Technically, it is a measure of Hicksian equivalent variation.

developing countries, ranging from little impact in the case of Bangladesh and China to upward of 5 percent increases in parts of East Asia.

Table 1 also provides an indication of the terms of trade (TOT) impact from the full reform scenario. South Asia is the region most affected by the terms of trade impacts (a loss of US$11 billion, or about 1 percent of income), although this loss is more than offset by the efficiency gains. Across Sub-Saharan Africa, the picture is mixed. The group of countries included in the southern and eastern subregion sees a TOT gain. However, the rest of Sub-Saharan Africa faces a relatively significant loss—a total of US$2.3 billion relative to a net gain of US$2.5 billion. Although this region is too aggregated to accurately gauge the nature of the TOT loss, it does include major oil exporters that are unlikely to benefit much from better market access because, by and large, oil imports face low tariffs.[19] Moreover, the oil exporters, and some of the other major mineral- or tropical product (for example, cocoa)–dependent countries are typically net food importers and are therefore likely to lose from the increase in international food prices.

4.2 Decomposition by Region and Sector

There are a number of ways to decompose the global trade reform scenario to better understand the sources of the gains. One common decomposition is to assess the impacts of developing-country liberalization versus industrial-country liberalization and further decompose these shocks across broad economic sectors—agriculture and food, textiles and apparel, manufacturing, and total. This decomposition is provided in Table 2. First, as noted before, the entries on the bottom row of the table show that developing countries receive 30 percent of the global gains (US$86 billion of $287 billion). Second, global liberalization of agriculture and

19. Taxes on energy may be high, but these are typically not reflected in tariffs.

food yields 63 percent of the total gains (top of last block of numbers, final column). This is consistent with the high tariffs in agriculture and food (16.6 percent global average) versus other sectors but is nonetheless remarkable, given the relatively low share of agriculture in GDP—even in developing countries as an aggregate. For developing countries, the gains from global agricultural liberalization are about 63 percent of total gains (US$54 billion of $86 billion total gains), with textiles and clothing bringing in an additional 27 percent so that the contribution of other manufacturing is only 10 percent. The gains in agriculture for developing countries are roughly equally divided between south-south agricultural liberalization (US$28 billion) and increased market access in developed countries (US$26 billion). Improved market access in high-income countries for textiles and clothing yields somewhat better returns for developing countries than their own reform (US$13 billion versus $9 billion), but the reverse is true in other manufacturing—though in both cases, the gains are small.

This symmetry exists also for industrial countries but to a greater extent. Industrial-country reform in agriculture yields most of the gain for industrial countries (US$109 billion), whereas greater market access in the south yields them only US$19 billion. However, developing-country manufacturing reform yields large payoffs for high-income countries (US$14 billion in textiles and clothing and US$52 billion in other manufacturing). Similar to developing countries, own-manufacturing reform yields negligible benefits.

4.3 Productivity Impacts of Global Trade Reforms

Though the LINKAGE model is dynamic, the growth impacts of reform captured by this model are relatively modest. For example, if one compares the dynamic results of 2015—scaled back to 2001 levels of income—with comparative static results, the difference in the gains is

estimated to be about 24 percent.[20] This result is not so surprising when one considers the assumptions made in the model. The labor force is exogenous across simulations, as is productivity. Thus, the only channel for growth effects to be felt comes from changes in the level of investment. Savings behavior is largely fixed, but the unit cost of investment can change as tariffs on imported capital goods decline. For the same amount of savings, this implies a greater volume of investment.[21]

There is an increasing literature on the linkage between openness in trade and investment, on the one hand, and productivity growth on the other. There are at least four channels widely cited. First, a rise in the level of imports can lead to pro-competitive effects and force domestic producers to improve their products and reduce their costs—similar to the pro-productivity arguments regarding export growth. There is now a wide body of literature exploring this channel, dating back to at least Harris's seminal paper of 1984 and with a broad overview provided in Francois and Roland-Holst (1997). Most of the studies show that the role of scale economies and pro-competitive effects can be important, but there is less consensus on the exact specification of market behavior—free entry and exit, Cournot versus Bertrand behavior, and so forth. Nor is there much empirical evidence on the cost disadvantage ratio or on price markups, particularly in developing countries. In an effort to circumvent some of these issues, it is possible to posit a reduced form relation that links sectoral productivity to changes in the price of imports relative to the price of domestic goods. This is an approach used by Itakura, Hertel, and Reimer (2003), for example.

20. See Anderson, Martin, and van der Mensbrugghe. (2005), table 12.2.
21. There are also dynamic changes in the structure of output and trade that can lead to changing comparative advantage and net export positions.

A second channel relies on the technology embedded in imports—either in improved intermediate goods or in capital good imports. Access to greater varieties of inputs can increase productive efficiency,[22] and consumers can also benefit from a greater choice of varieties. This avenue for growth emphasizes the services sector reforms in Russia.

A third channel is offered by the linkage between trade reform and increased FDI inflows, the latter bringing in new capital, knowledge, and management skills. This channel may be hard to separate out from either the import or export channel because FDI is typically associated with increased imports of technology-laden inputs or capital or both and with a high share of exported output.

Finally, there is the linkage between increased exports and productivity growth. Here, the evidence is mixed. Empirical estimates are problematic because of the direction of causality. Looking at firm level data for Indonesia, Sjöholm (1999) finds evidence supporting the export-productivity linkage, with weaker evidence supporting an import-productivity linkage. Bernard and Jensen (2004) report a similar finding using firm data for the United States.

In an effort to capture some of these effects, an alternative dynamic specification is introduced in which sector-specific labor productivity is allowed to respond to changes in sectoral openness. The latter is measured by the export to output ratio. This relation is modeled as follows:

(1) $$\pi_i = \alpha_i + \chi_i + \gamma$$

(2) $$\chi_i = \beta_i \left(\frac{E_i}{X_i} \right)^{\varepsilon_i}$$

22. See, for example, Coe, Helpman, and Hoffmaister (1997) and Grossman and Helpman (1991).

Equation (1) defines sector-specific productivity, π. It is composed of three components—two of which are sector specific, α and χ, and the third is economy-wide, γ. The first sector-specific parameter is a sectoral shifter that allows baseline productivity differentials across sectors. For example, it is typically assumed that productivity in manufacturing is higher than in services. The second sector-specific parameter is linked to the export-output ratio. It is calibrated (through the β parameters) in the baseline simulation so that it represents some fixed percentage of total productivity. It is assumed for the purposes of this simulation that it represents 40 percent of total productivity growth. The economy-wide parameter is calibrated in the baseline simulation as a residual to achieve a prespecified target for GDP growth. In most reform scenarios, all three factors are exogenously fixed. In the alternative scenario, where productivity is permitted to be influenced by openness, the χ-factor will evolve depending on the elasticity, ε, which is here assumed to be equal to 1 for manufactures and 0.5 for agriculture.[23] Assume, for example, that the total sectoral productivity growth rate is 5 percent and the χ-factor in the baseline is 2 percent. If the reform scenario leads to a 10 percent increase in the export-output ratio, the χ-factor will increase to 2.2 percent. Therefore, total (labor-augmenting) productivity in the sector will increase to 5.2 percent, or an increase of 4 percent over the baseline level.[24]

Key results pertaining to the trade-productivity linkages are summarized in Table 3. The main dynamic gains occur for developing countries. Whereas high-income countries see an

23. The agricultural elasticity is set to one-half of the manufacturing elasticity for several reasons. One is that most of the econometric evidence has been linked to manufacturing only, with little or no empirical support in agriculture. As well, agriculture in many developing countries is still dominated by subsistence farming, with weak linkages even to the domestic market. Many of the more developed agricultural exporters—for example, Chile and Brazil—are already closely integrated with world markets. Enhancing productivity in the short and medium terms will be driven more by changes in land tenure policies, as well as improvements in local infrastructure and extension services. Finally, based on estimates from Martin and Mitra (1999), a relatively high level of agricultural productivity in the baseline is assumed.

24. See *Global Economic Prospects* ([GEP] World Bank 2002) for further discussions on these assumptions and how they compare with other studies. For more details on the specification, see van der Mensbrugghe (2004a).

increase in their gains from 0.6 percent of baseline income to 0.8 percent, developing countries see a more significant gain, from 0.8 percent to 2.0 percent. At the global level, the gains would increase by 61 percent—amounting to US$461 billion in 2015. These gains are substantially lower than previous estimates (World Bank 2002, 2004). For example, in World Bank (2002), the gains for developing countries increased by a multiple of 3.2 rather than the more modest multiple of 2.3 reported in this chapter. There are essentially two main reasons for this result. The first lies in the fact that the trade barriers are substantially lower compared with the earlier work—incorporating trade reforms between 1997 and 2001, preferences ,and, significantly in the case of China, baseline policy changes. The second reason is the lower assumed elasticity between openness and productivity in the agricultural sectors, which has been reduced from 0.75 to 0.5.[25]

Table 4 reports the average change in the growth of productivity in manufacturing relative to the baseline labor productivity growth rate for selected countries and regions in 2015.[26] The largest impacts are in the regions that have a relative comparative advantage in manufacturing—for example, South Asia. The predominant agricultural exporters—Argentina, Brazil, and the rest of Latin America, for example—see relatively negligible productivity impacts from reform. Because productivity is assumed to be labor augmenting, the macro impacts will be reflected by changes in the share of labor employed in manufacturing relative to aggregate value added.

25. See van der Mensbrugghe (2005) for further details.
26. It should be noted that baseline productivity is calibrated to line up with exogenous assumptions regarding per capita GDP growth. The openness shifter is calibrated so that in the baseline it represents 40 percent of total sectoral productivity, and the uniform shifter is calibrated to achieve the overall GDP growth target. Productivity in this version of the model is labor augmenting only.

The pro-growth scenario is essentially meant to be illustrative, but the assumptions and their impacts are consistent with other empirical work in this area. For example, Dessus, Fukasaku, and Safadi at the OECD (1999) estimate a macro relationship between openness—as measured by the export plus import to GDP ratio—and per capita GDP, and they derive an elasticity of 0.09. This is only about one-fourth of the elasticity implied by this work (0.4). However, once one adjusts for the share of agriculture and manufacturing in GDP and the share of labor in value added (because the measure of productivity does not apply to services and is only labor augmenting), the skill- and sector-specific elasticity of 0.4 implies a macro trade to GDP elasticity[27] below 0.1, which is about the same as that of the OECD work.

In a similar vein, Itakura, Hertel, and Reimer (2003) develop a formula that links gains in efficiency to export performance, on the assumption that firms are heterogeneous and that exporters are more efficient than other firms:

$$(3) \qquad Efficiency = \frac{(\delta - 1)\, s_E s_D \left(\hat{E} - \hat{D}\right)}{s_D + \delta\, s_E}$$

In this formula, δ represents the ratio of the technology index between export-oriented firms relative to domestic-oriented firms, s_E is the share of exports in production, s_D is the share of output supplied to the domestic market, and E and D represent exports and domestic supply (with hats used for percentage changes). Based on estimates from Bernard and Jensen (2004) for U.S. firms, they assume that the ratio of the technology indexes is 1.08—that is, exporting firms are on average 8 percent more efficient than firms oriented exclusively toward the domestic market. Here, formula (3) is inverted to derive the implied δ generated by the results reported in this chapter. In other words, the results from the model provide the change in export and domestic

27. For example, if manufacturing is 33 percent of output and labor has a 50 percent share, the macro elasticity would be 0.066.

supply (and the initial shares), plus the change in *labor* productivity. The latter is adjusted by the labor share to estimate the average sectoral change in total factor productivity. The implied average productivity differential over all developing countries and all manufacturing sectors is a ratio of 1.05, though with wide variations across manufacturing sectors and regions. This is surprisingly close to the original estimates of Bernard and Jensen.

In summary, although this is clearly an area that needs more research, there is accumulating evidence that increased openness affects productivity. Thus, it makes sense to factor this into this chapter's analysis. This has been done, and the parametric specification used in this chapter is broadly consistent with empirical evidence, both at the macro- and the micro-level. Overall, adding this factor boosts global welfare gains by about 60 percent.

5. Doha Scenarios

The real income impacts of the various Doha scenarios are summarized in Tables 5 and 6, respectively, shown in level terms (US$ billion) and as a percent of baseline income. Results for the core Doha scenario, as well as for the Doha-all scenario, are reported here. In the case of the former, the impacts of allowing for agricultural and manufacturing productivity to respond to increases in the export to output ratio are also assessed. Relative to the global merchandise trade reform benchmark, the core Doha scenario would yield, respectively, 42 percent of the potential gains for rich countries and only 18 percent for developing countries (and 34 percent for the world total). Among developing regions, Doha's share of potential gains is greatest for South Asia (47 percent) and for Latin America and the Carribean (26 percent), with negative gains for the Middle East and North Africa and a relatively paltry 7 percent for Sub-Saharan Africa.

Adding the productivity boost provides nearly a doubling of the gains from the static simulation, but this is still relatively small compared to what could be achieved with greater reform—particularly relative to the full reform scenario with dynamic gains. The Doha-all scenario, in which developing countries reform using the same tariff-cutting formulas as developed countries, has an additional, but modest, impact for developing countries. The largest benefits arise for the agricultural exporters. Many benefit from improved market access in other developing countries that otherwise are able to maintain higher tariff barriers in the core Doha scenario.

Based on current discussions of Doha modalities in Geneva, these scenarios appear to be the most optimistic outcome one might expect in terms of improving agricultural and manufacturing access. The consideration of additional modalities (for example, the exclusion of some sensitive products) could significantly weaken the gains depicted in this chapter. Also, these scenarios ignore other potentially beneficial reforms that could emanate from a successful conclusion to the ongoing negotiations, such as trade facilitation and further opening of the services sectors.

6. Impacts on Poverty

Assessing reform impacts on poverty with a global model could be seen as somewhat heroic, given the aggregate nature of these models. They nonetheless contain quite a bit of information from which it is possible to make some judgment at least on the nature of changes in poverty if not a precise quantitative estimate. The simplest approach is to take the growth in real income, apply an estimated income to poverty elasticity and assess the impacts on the headcount index. This approach assumes distribution neutrality: the poor receive the same increase in real

income as the average household in the economy. A more appropriate approach is to link key model variables to the possible change in the average per capita consumption of the poor, that is, to capture from model results some of the distributional aspects of the changes in real income and not simply the average gain. This has been done by calculating the change in the average wage of unskilled workers deflated by a food and clothing CPI—presumably the most relevant one for the poor. Table 7 summarizes the key results from the global reform scenario and some of the Doha alternatives, including two that were not discussed in this chapter.

Under the full merchandise trade reform scenario, extreme poverty in developing countries would drop by 31.9 million in 2015 relative to the baseline level of 622 million, a reduction of 5 percent. With real incomes climbing by only 0.8 percent, this would seem to imply a relatively high poverty to income elasticity. However, recall that in this chapter, poverty calculations are based on the change in the real wage of unskilled workers deflated by the food and clothing CPI. The average change in the real unskilled wage over all developing countries is 3.6 percent—more than four times greater than the average income increase. Critically, it is assumed that the change in unskilled wages is fully passed through to households. Also, although the model closure has the loss in tariff revenues replaced by a change in direct household taxation, the poverty calculation assumes that these tax increases affect only skilled workers and high-income households—a realistic assumption in many developing countries.[28] Under the broader definition of poverty—the number of poor living on US$2 per day or less—the number of poor would fall by 65.6 million under the full reform scenario compared to an aggregate baseline level in 2015 of 1.95 billion. This represents a less significant proportionate reduction,

28. Even if the fiscal closure affects a domestic sales or value added tax instead of direct taxes on households, in many countries, food, at least, is typically exempt from taxation, or the tax is difficult to collect in practice because of the informal nature of many food markets.

only 3.6 percent, because the US$2 per day poverty-income elasticity is significantly lower than the US$1 per day poverty-income elasticity.

These poverty impacts from full merchandise trade reform are significantly lower than past estimates. For example in the 2002 GEP, the number of poor people living on a US$1 per day was estimated to fall by 110 million, and the number living on US$2 per day to fall by 320 million (World Bank 2002). The new numbers reflect three changes in increasing significance. The first is the change in the baseline poverty forecast. The baseline US$1 per day poverty forecast is currently 622 million, compared to 734 million in the 2004 GEP (World Bank 2004). Using the 2004 GEP forecast would raise those lifted out of poverty to 38 million and 80 million, respectively, for US$1 per day and US$2 per day poverty lines from the current estimate of 32 million and 66 million. The second change is the new estimate of the change in the food wage. Both the unweighted and population-weighted estimates of the food wage impacts from global reform are reduced by 50 percent compared to the previous results.[29] This is largely due to the role of the new tariff database (particularly preferences and the policy reforms that are now subsumed in the baseline). If the previous estimates of the change in the food wage are used, the reductions in poverty would rise to 63 million and 190 million, respectively. The third change reflects the use of region- and indicator-specific income poverty elasticities.[30] Using the old

29. Earlier studies with the Linkage model found an estimated impact of roughly an 8 percent increase in the food wage (averaged over all developing countries). The new impact is roughly a 4 percent increase. The largest changes occur in China and the Middle East and North Africa, the regions with the most significant revision in tariffs. For China, the revision is largely due to the baseline changes, that is, WTO accession commitments. In the case of the Middle East and North Africa, it reflects a significant revision of the base-year tariffs, in part influenced by preferences.

30. Earlier studies with the Linkage model assumed a uniform poverty elasticity of 2.0 across regions and for both the US$1 per day and US$2 per day poverty lines. The assumption of the uniform poverty elasticity was maintained mainly to keep results comparable across studies despite newer estimates showing the relative variation across regions. For the US$1 per day index, the range over regions is 0.9 to 3.0. For the US$2 per day index, the range is 0.5 to 2.0. The average over regions is declining over time because those regions with high elasticities also tend to have high growth; therefore poverty becomes more and more concentrated in regions with relative low poverty elasticities with respect to income growth.

uniform elasticities (with a value of 2.0) in place of the survey-based estimates currently used, the poverty estimate impact rises to 100 million and 280 million, respectively—close to the old poverty impact estimates.[31]

Table 7 also provides the poverty impacts of two additional full-reform simulations. One is the comparative static simulation, excluding dynamic effects. The effects on global poverty are somewhat smaller than when dynamics are taken into account—a reduction of the number of poor of 23.8 million as opposed to a reduction of 31.9 million. The table also shows the impacts on poverty from full reform in the dynamic simulation with productivity changes. The aggregate impact on poverty remains quite modest—a decline of 43.5 million in the number of poor, compared to 31.9 million without the productivity effects. Although the increase in unskilled productivity tends to raise wages, the lower *ex ante* demand for labor dampens the effect, given that labor supply is assumed to be exogenously determined.

Under the Doha scenarios reported in Table 7, the poverty impacts are more modest. The number of poor living on US$1 per day or less would fall by 2.5 million in the case of the core Doha scenario (of which 0.5 million are in Sub-Saharan Africa) and by 6.3 million in the case of Doha-all (of which 2.2 million are in Sub-Saharan Africa). This corresponds to the relatively modest ambitions of the merchandise trade reforms as captured in these Doha scenarios. Allowing for the productivity effect, the decrease in the number of poor would rise modestly to 4.3 million (from 2.5 million without productivity impacts).

Table 7 also reports impacts from three additional Doha scenarios not discussed earlier. One reflects a Doha agreement in agriculture only (Doha-ag). This scenario shows the importance for poverty implications of including manufactured products in the negotiations

31. See van der Mensbrugghe (2005) for additional details.

because the poverty impacts are just 0.5 million in an agriculture-only scenario. The second scenario, Doha-ag-sp, shows the impacts of allowing all countries to exempt 2 percent of their tariff lines as sensitive products (plus another 2 percent in developing countries for special products). This greatly dilutes the gains from a potential agricultural deal. Indeed, according to the estimates in table 17.7, there could even be a poverty *increase*. A final scenario assesses the impacts of the core Doha scenario in a comparative static framework. This would slightly diminish the poverty reduction to 1.7 million individuals lifted out of poverty (from 2.5 million in the corresponding dynamic scenario).

These simple calculations are not a substitute for the more detailed analysis that has been generated by the individual country case studies in Hertel and Winters (2005) through use of detailed household surveys. However, it is useful to have a global assessment, and one that provides a sense of the possible range of poverty impacts. Moreover, the elasticity approach[32] may be somewhat conservative because these are derived elasticity estimates from the baseline scenario.[33]

7. Conclusions

The global economy of 2015 is likely to look quite different from the world economy of 2001 or 2005—particularly if the growth assumptions underlying this chapter's baseline scenario obtain. The changing structure of production, demand, trade, and comparative advantage will

32. The World Bank's headcount index forecast is derived from an estimated Lorenz curve based on the most recently available household survey and not from an elasticity approach. A forecast of the growth of per capita consumption is plugged into the Lorenz curve–based functional form for the headcount index, assuming distribution neutrality. See Datt (1998) for a derivation of this methodology.
33. Elasticities at the low end of the income spectrum should be rising over time as mean incomes rise; therefore the marginal elasticity in 2015 should normally be higher than the average implied elasticity between 2001 and 2015.

engender different impacts from trade reform compared to a static analysis, even if the current patterns of protection that hold today are carried forward into the next 10 years. One inevitable proposition is that agriculture will continue to lose prominence as a share of global output, and services will gain. Despite this, the role of agricultural protection will continue to have a major impact on the overall gains from merchandise trade reform—it alone being responsible for more than 60 percent of the total gains. The world will also witness an increasing share of output from today's developing countries, because growth on average in developing countries exceeds that of rich countries.[34] Nonetheless, rich countries will gain more from global merchandise trade reform than developing countries in dollar terms—US$201 billion versus $86 billion (in 2015). As a percent of baseline income, however, developing countries have more to gain from full elimination of trade barriers and domestic support in agriculture. To the extent that trade reform generates positive externalities in the form of improved productivity, the gains to developing countries could increase up to US$200 billion, an increase of 2.0 percent in baseline income in 2015.

The current shape of the ongoing Doha discussions suggests that reforms in agriculture and manufacturing will be relatively modest, but hopefully there will be significant improvements in agricultural market access in industrial countries. In the central Doha scenario, the overall gains from a WTO accord could amount to US$96 billion, of which US$80 billion would be reaped by rich countries. This scenario assumes no exemption of sensitive and special farm products and only modest reductions in developing-country tariffs (because of their large binding overhang). If developing countries—including LDCs—participate more fully, the global gains would rise to US$120 billion.

34. Overall, the level of convergence will be modest because many developing countries' per capita growth rates are projected to lag behind rich countries' growth rates in the baseline, with the key exception of East Asia.

The global impacts from trade reform on poverty are positive to the extent that the existing patterns of trade protection favor skilled labor and capital relative to unskilled workers, so that their removal lifts unskilled wages, the primary source of income for many of the world's poor. On average in developing countries, the real wage of unskilled workers—deflated by a food and clothing price index—rises four times as much as average real income (3.6 percent versus 0.8 percent). Assuming import tariff revenues are replaced by taxes on the non-poor, the number of poor at the US$1 per day level would decline by some 32 million globally under a full trade reform scenario. The impacts from a Doha scenario are much less, corresponding to only a modest increase in real wages of the unskilled.

These results are likely to be seen by some as too pessimistic, and others might view them as overly optimistic, with solid arguments on both sides. The specific modalities assumed in the central Doha scenario involve much deeper cuts in bound tariffs than in previous WTO rounds. However, it should be borne in mind that the analysis reported in this chapter only touches on some of the issues being discussed in the context of the Doha Development Agenda—perhaps the thorniest in agriculture—while ignoring other aspects that potentially have significant development impacts, most notably services and trade facilitation. In the end, it will be the final overall package that will determine the long-term impacts for the world's poor.

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Table 1. Gains from Global Merchandise Trade Reform
(*gains in* 2015 *compared to baseline*

Region	*Real income*	*TOT impact*	*Real income*	*TOT impact*
	US$ billion		*Percent of baseline income in 2015*	
Australia and New Zealand (ANZ)	6.1	3.5	1.0	0.6
EU-25 plus EFTA	65.2	0.5	0.6	0.0
United States	16.2	10.7	0.1	0.1
Canada	3.8	-0.3	0.4	0.0
Japan	54.6	7.5	1.1	0.2
Korea, Rep. of, and Taiwan, China	44.6	0.4	3.5	0.0
Hong Kong, China and Singapore	11.2	7.9	2.6	1.8
Argentina	4.9	1.2	1.2	0.3
Bangladesh	0.1	-1.1	0.2	-1.4
Brazil	9.9	4.6	1.5	0.7
China	5.6	-8.3	0.2	-0.3
India	3.4	-9.4	0.4	-1.1
Indonesia	1.9	0.2	0.7	0.1
Thailand	7.7	0.7	3.8	0.4
Vietnam	3.0	-0.2	5.2	-0.4
Russia	2.7	-2.7	0.6	-0.6
Mexico	3.6	-3.6	0.4	-0.4
South Africa	1.3	0.0	0.9	0.0
Turkey	3.3	0.2	1.3	0.1
Rest of South Asia	1.0	-0.8	0.5	-0.4
Rest of East Asia	5.3	-0.9	1.9	-0.3
Rest of Latin America and the Caribbean (LAC)	10.3	0.0	1.2	0.0
Rest of Europe and Central Asia (ECA)	1.0	-1.6	0.3	-0.6
Middle East and North Africa	14.0	-6.4	1.2	-0.5
Selected Sub-Saharan Africa (SSA) countries	1.0	0.5	1.5	0.7
Rest of SSA	2.5	-2.3	1.1	-1.0
ROW	3.4	0.1	1.5	0.1
High-income countries	201.6	30.3	0.6	0.1
Developing countries (WTO definition)	141.5	-21.4	1.2	-0.2
Low- and middle-income countries	85.7	-29.7	0.8	-0.3
Middle-income countries	69.5	-16.7	0.8	-0.2
Low-income countries	16.2	-12.9	0.8	-0.7
Low- and middle-income, excluding China and India	80.1	-21.3	1.1	-0.3
Low-income, excluding India	12.7	-3.6	1.2	-0.3
Middle-income, excluding China	63.9	-8.4	1.1	-0.2
East Asia and the Pacific	23.5	-8.5	0.7	-0.2
South Asia	4.5	-11.2	0.4	-1.0
ECA	7.0	-4.0	0.7	-0.4
Middle East and North Africa	14.0	-6.4	1.2	-0.5
SSA	4.8	-1.8	1.1	-0.4
LAC	28.7	2.2	1.0	0.1
World total	287.3	0.6	0.7	0.0

Source: Authors' World Bank LINKAGE model simulations.

Table 2. Regional and Sectoral Source of Gains from Global Trade Reform
(*Change in real income in 2015 relative to baseline scenario*)

Region	*Gains by region in US$ billion*			*Percent of global gain*		
	Developing	*High-income*	*World*	*Developing*	*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 manufacturing	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	46
Textiles and clothing	13	2	15	17	1	6
Other manufacturing	4	5	9	3	3	3
All sectors	43	116	159	50	58	55
All countries liberalize:						
Agriculture and food	54	128	182	63	63	63
Textiles and clothing	22	16	38	27	8	14
Other manufacturing	10	57	67	10	29	23
All sectors	86	201	287	100	100	100

Source: Authors' World Bank LINKAGE model simulations.

Table 3. Impacts of Global Merchandise Trade Reform with and without Productivity Changes
(*change in real income in 2015 compared to baseline*)

Region	*Productivity fixed*		*Productivity linked to export-output ratio*	
	US$ billion	*%*	*US$ billion*	*%*
High-income countries	201.6	0.6	261.1	0.8
Quad countries plus ANZ	145.8	0.5	202.5	0.7
Other high-income countries	55.8	3.3	58.6	3.5
Developing countries (WTO definition)	141.5	1.2	258.7	2.2
Low- and middle-income countries	85.7	0.8	200.1	2.0
Middle-income countries	69.5	0.8	145.1	1.8
Low-income countries	16.2	0.8	55.0	2.8
World total	287.3	0.7	461.2	1.1

Source: Authors' World Bank LINKAGE model simulations.

Table 4. Impact on Labor Productivity from Full Merchandise Trade Reform

Region	*Labor productivity growth in baseline in 2015*	*Difference in labor productivity growth with reform in 2015*
Argentina	4.2	0.2
Bangladesh	4.5	1.2
Brazil	4.2	0.2
China	6.8	0.5
India	5.0	1.7
Indonesia	2.2	0.1
Thailand	3.0	0.4
Russia	3.7	0.6
Mexico	4.4	0.4
South Africa	3.9	0.3
Turkey	3.9	0.5
Rest of East Asia	1.2	0.0
Rest of South Asia	4.0	0.9
Rest of LAC	3.0	0.2
Rest of ECA	4.1	0.4
Middle East and North Africa	3.8	0.5
Selected SSA countries	3.5	1.2
SSA	2.8	0.5

Source: Authors' World Bank LINKAGE model simulations.

Table 5. Real Income Gains from Doha Scenarios, 2015

Region	*Real income gains (US$ billion)*			*TOT impact (US$ billion)*		
	Doha	*Doha + productivity*	*Doha-all*	*Doha*	*Doha + productivity*	*Doha-all*
ANZ	2.4	0.8	2.8	1.5	1.5	1.7
EU-25 plus EFTA	31.4	38.2	35.7	-4.6	-4.7	-2.0
United States	4.9	15.0	6.6	0.6	0.9	1.9
Canada	0.9	1.3	1.0	-0.5	-0.6	-0.5
Japan	23.7	23.9	25.4	1.5	1.8	2.8
Korea, Rep. of, and Taiwan, China	15.0	14.9	22.6	1.5	1.6	1.2
Hong Kong, China, and Singapore	1.5	1.6	2.2	1.1	1.3	1.7
Argentina	1.3	0.0	1.6	0.6	0.6	0.6
Bangladesh	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1
Brazil	3.6	0.2	3.9	2.1	2.1	2.0
China	1.7	14.6	1.6	-2.6	-3.0	-4.9
India	2.2	5.1	3.5	-0.9	-0.9	-1.9
Indonesia	1.0	2.3	1.2	0.3	0.3	0.4
Thailand	2.0	1.9	2.7	0.6	0.6	0.7
Vietnam	-0.5	-0.4	-0.6	-0.3	-0.3	-0.3
Russia	0.8	1.7	1.5	-1.1	-1.0	-1.5
Mexico	-0.9	-0.4	-0.2	-0.7	-0.6	-1.0
South Africa	0.4	0.4	0.7	0.1	0.1	0.2
Turkey	0.7	0.9	1.4	0.0	0.0	0.0
Rest of South Asia	0.3	0.4	0.7	0.1	0.1	0.1
Rest of East Asia	0.3	0.8	0.6	-0.1	-0.1	-0.2
Rest of LAC	3.9	3.5	4.0	1.2	1.1	0.9
Rest of ECA	-0.6	-0.4	-0.7	-0.4	-0.4	-0.6
Middle East and North Africa	-0.6	-0.8	0.1	-1.1	-1.1	-1.6
Selected SSA countries	0.1	0.1	0.2	0.1	0.1	0.1
Rest of SSA	-0.1	0.0	0.3	-0.1	-0.1	-0.3
ROW	0.6	0.2	0.6	0.3	0.3	0.2
High-income countries	79.9	95.8	96.4	1.1	1.7	6.8
Quad countries plus ANZ	63.4	79.2	71.6	-1.5	-1.1	3.9
Other high-income countries	16.5	16.6	24.8	2.6	2.9	2.9
Developing countries (WTO definition)	32.6	46.4	47.7	0.7	0.4	-4.3
Low- and middle-income countries	16.1	29.9	22.9	-1.9	-2.5	-7.2
Middle-income countries	12.5	22.3	17.1	-1.3	-1.7	-5.4
Low-income countries	3.6	7.6	5.9	-0.6	-0.8	-1.9
Low- and middle-income, excluding China and India	12.2	10.2	17.8	1.6	1.4	-0.5
Low-income, excluding India	1.4	2.5	2.3	0.2	0.2	0.1
Middle-income, excluding China	10.8	7.7	15.5	1.3	1.3	-0.5
East Asia and the Pacific	4.5	19.2	5.5	-2.2	-2.6	-4.4
South Asia	2.5	5.4	4.2	-0.8	-0.9	-1.9
ECA	0.8	2.2	2.1	-1.4	-1.3	-2.1
Middle East and North Africa	-0.6	-0.8	0.1	-1.1	-1.1	-1.6
SSA	0.4	0.6	1.2	0.1	0.1	0.0
LAC	7.9	3.2	9.2	3.3	3.1	2.6
World total	96.1	125.7	119.3	-0.8	-0.7	-0.4

Source: Authors' World Bank LINKAGE model simulations.

Table 6. Real Income Gains from Doha Scenarios as Percent Change from Baseline, 2015

Region	*Real income gains (percent of baseline income)*			*TOT impact (percent of baseline income)*		
	Doha	*Doha + productivity*	*Doha-all*	*Doha*	*Doha + productivity*	*Doha-all*
ANA	0.42	0.14	0.48	0.27	0.26	0.30
EU-25 plus EFTA	0.31	0.38	0.36	-0.05	-0.05	-0.02
United States	0.03	0.11	0.05	0.00	0.01	0.01
Canada	0.10	0.14	0.11	-0.06	-0.06	-0.05
Japan	0.48	0.48	0.51	0.03	0.04	0.06
Korea, Rep. of, and Taiwan, China	1.19	1.18	1.79	0.12	0.12	0.10
Hong Kong, China, and Singapore	0.35	0.38	0.52	0.25	0.31	0.39
Argentina	0.34	0.00	0.39	0.14	0.14	0.15
Bangladesh	-0.10	-0.08	-0.09	-0.08	-0.09	-0.09
Brazil	0.55	0.03	0.59	0.33	0.33	0.31
China	0.07	0.56	0.06	-0.10	-0.11	-0.19
India	0.25	0.57	0.40	-0.10	-0.11	-0.22
Indonesia	0.37	0.88	0.44	0.11	0.10	0.14
Thailand	0.99	0.92	1.33	0.30	0.27	0.33
Vietnam	-0.83	-0.76	-0.97	-0.53	-0.60	-0.61
Russia	0.16	0.36	0.31	-0.22	-0.21	-0.32
Mexico	-0.11	-0.05	-0.02	-0.08	-0.07	-0.11
South Africa	0.25	0.30	0.49	0.10	0.10	0.10
Turkey	0.26	0.35	0.55	0.01	0.02	0.02
Rest of South Asia	0.17	0.21	0.39	0.05	0.03	0.05
Rest of East Asia	0.09	0.29	0.22	-0.05	-0.05	-0.08
Rest of LAC	0.46	0.41	0.47	0.15	0.13	0.11
Rest of ECA	-0.22	-0.15	-0.26	-0.13	-0.14	-0.21
Middle East and North Africa	-0.05	-0.07	0.01	-0.09	-0.09	-0.14
Selected SSA countries	0.19	0.23	0.26	0.13	0.14	0.15
Rest of SSA	-0.02	-0.01	0.13	-0.05	-0.07	-0.13
ROW	0.26	0.07	0.28	0.13	0.15	0.10
High-income countries	0.25	0.30	0.30	0.00	0.01	0.02
Quad countries plus ANZ	0.21	0.26	0.23	0.00	0.00	0.01
Other high-income countries	0.97	0.98	1.46	0.15	0.17	0.17
Developing countries (WTO definition)	0.27	0.39	0.40	0.01	0.00	-0.04
Low- and middle-income countries	0.16	0.29	0.22	-0.02	-0.02	-0.07
Middle-income countries	0.15	0.27	0.21	-0.02	-0.02	-0.07
Low-income countries	0.18	0.38	0.30	-0.03	-0.04	-0.09
Low- and middle-income, excluding China and India	0.18	0.15	0.27	0.02	0.02	-0.01
Low-income, excluding India	0.13	0.23	0.21	0.02	0.02	0.01
Middle-income, excluding China	0.19	0.14	0.28	0.02	0.02	-0.01
East Asia and Pacific	0.13	0.56	0.16	-0.06	-0.08	-0.13
South Asia	0.21	0.47	0.36	-0.07	-0.08	-0.17
ECA	0.08	0.22	0.21	-0.14	-0.13	-0.20
Middle East and North Africa	-0.05	-0.07	0.01	-0.09	-0.09	-0.14
SSA	0.10	0.13	0.27	0.03	0.02	-0.01
LAC	0.29	0.12	0.33	0.12	0.11	0.09
World total	0.23	0.30	0.28	0.00	0.00	0.00

Source: Authors' World Bank LINKAGE model simulations.

Table 7a. Macro Poverty Impacts from Global Reform and Alternative Doha Scenarios, US$1 per Day

		Full merchandise trade			*Doha alternatives*					
	Baseline	*Comparative Static*	*Dynamic*	*Dynamic with productivity effects*	*Agriculture only*	*Agriculture with sensitive proudcts*	*Rull Doha*	*Full Doha with productivity effects*	*Doha-All: includes reciprocal cuts*	*Full Doha comparative static*
2015 headcount (%)										
East Asia and the Pacific	0.9	0.8	0.8	0.7	0.9	0.9	0.9	0.9	0.9	0.9
China	1.2	1.1	1.1	1.0	1.2	1.2	1.2	1.1	1.1	1.2
East Asia, excluding China	0.4	0.2	0.2	0.1	0.3	0.3	0.3	0.3	0.3	0.3
ECA	0.4	0.3	0.3	0.3	0.3	0.4	0.3	0.3	0.3	0.3
LAC.	6.9	6.7	6.6	6.5	6.9	6.9	6.9	6.9	6.8	6.9
Middle East and North Africa	0.9	0.8	0.7	0.7	0.9	0.9	0.9	0.9	0.9	0.9
South Asia	12.8	12.6	12.5	12.1	12.8	12.8	12.7	12.7	12.6	12.8
SSA	38.4	36.6	36.0	35.7	38.4	38.4	38.3	38.3	38.1	38.3
Developing countries	10.2	9.8	9.7	9.5	10.2	10.2	10.2	10.1	10.1	10.2
2015 headcount (%)	*2015 level*	*Decrease from baseline, millions*			*Decrease from baseline, millions*					
East Asia and the Pacific	18.6	2.0	2.2	4.1	0.1	0.0	0.3	0.9	0.5	0.3
China	16.3	0.9	1.0	2.6	0.0	0.0	0.2	0.6	0.3	0.2
East Asia, excluding China	2.3	1.0	1.2	1.5	0.0	0.0	0.1	0.2	0.2	0.1
ECA	1.7	0.2	0.2	0.3	0.0	0.0	0.0	0.0	0.1	0.0
LAC	42.9	1.3	2.1	2.3	0.3	0.1	0.4	0.4	0.5	0.2
Middle East and North Africa	3.5	0.5	0.7	0.8	0.0	0.0	0.0	0.0	0.0	0.0
South Asia	215.9	3.8	5.6	12.5	0.2	0.1	1.4	2.6	3.0	1.0
SSA	339.5	16.0	21.1	23.5	-0.1	-0.2	0.5	0.5	2.2	0.3
Developing countries	622.0	23.8	31.9	43.5	0.5	-0.1	2.5	4.3	6.3	1.7

Table 7b. Macro Poverty Impacts from Global Reform and Alternative Doha Scenarios, US$2 per day

	Full merchandise trade				*Doha scenarios*					
	Baseline	*Comparative Static*	*Dynamic*	*Dynamic with productivity effects*	*Agriculture only*	*Agriculture with sensitive proudcts*	*Rull Doha*	*Full Doha with productivity effects*	*Doha-All: includes reciprocal cuts*	*Full Doha comparative static*
2015 Headcount (%)										
East Asia and the Pacific	11.3	10.2	10.1	9.5	11.2	11.3	11.1	11.0	11.1	11.2
China	9.7	9.3	9.3	8.7	9.7	9.7	9.6	9.4	9.5	9.6
East Asia, excluding China	14.7	12.2	11.9	11.1	14.6	14.7	14.5	14.2	14.3	14.6
ECA	5.2	4.8	4.8	4.6	5.1	5.2	5.1	5.1	5.1	5.1
LAC	19.6	19.2	19.0	18.9	19.6	19.6	19.5	19.5	19.5	19.6
Middle East and North Africa	11.9	10.6	10.4	10.1	12.0	12.0	11.9	11.9	11.8	11.9
South Asia	54.2	53.8	53.6	52.9	54.2	54.2	54.0	53.9	53.9	54.1
SSA	69.2	67.4	66.9	66.6	69.2	69.2	69.1	69.1	68.9	69.2
Developing countries	32.0	31.1	30.9	30.4	31.9	32.0	31.9	31.8	31.7	31.9
2015 Headcount (%)	*2015 level*	*Decrease from baseline, millions*			*Decrease from baseline, millions*					
East Asia and the Pacific	229.8	21.1	23.6	36.6	0.5	0.0	2.5	6.3	4.3	1.7
China	134.4	4.7	5.2	13.4	0.1	-0.2	1.1	3.3	1.7	1.1
East Asia, excluding China	95.4	16.4	18.4	23.2	0.4	0.1	1.4	3.0	2.5	0.6
ECA	24.7	1.7	1.8	2.5	0.1	0.0	0.2	0.3	0.5	0.2
LAC	121.8	2.6	4.1	4.6	0.6	0.1	0.7	0.7	1.0	0.3
Middle East and North Africa	45.7	4.9	6.0	6.8	-0.1	-0.2	0.0	-0.1	0.3	0.0
South Asia	912.2	6.5	9.6	21.4	0.4	0.1	2.3	4.4	5.1	1.6
SSA	612.2	15.5	20.4	22.8	-0.1	-0.2	0.5	0.4	2.1	0.2
Developing countries	1946.3	52.3	65.6	94.7	1.3	-0.3	6.2	12.1	13.3	4.1

Source: Authors' World Bank LINKAGE model simulations and World Bank (2005).

Appendix A Model Details

Appendix Table A.1. Regional Concordance for the LINKAGE Model

Modeled regions[a]		
1	ANZ	Australia and New Zealand and Canada (anz, nzl)
2	EUR	EU-25 with EFTA (aut, bel, dnk, fin, fra, deu, gbr, grc, irl, ita, lux, nld, prt, esp, swe, cyp, cze, hun, mlt, pol, svk, svn, est, lva, ltu, che, xef, xer)
3	CAN	Canada (can)
4	USA	United States (usa)
5	JPN	Japan (jpn)
6	HYA	Republic of Korea and Taiwan, China (kor, twn)
7	HYC	Hong Kong, China, and Singapore (hkg, sgp)
8	ARG	Argentina (arg)
9	BGD	Bangladesh (bgd)
10	BRA	Brazil (bra)
11	CHN	China (chn)
12	IND	India (ind)
13	IDN	Indonesia (idn)
14	MEX	Mexico (mex)
15	RUS	Russia (rus)
16	ZAF	South Africa (zaf)
17	THA	Thailand (tha)
18	TUR	Turkey (tur)
19	VNM	Vietnam (vnm)
20	XSA	Rest of South Asia (lka, xsa)
21	XEA	Rest of East Asia and the Pacific (mys, phl)
22	RLC	Rest of Latin America and the Caribbean (col, per, ven, xap, chl, ury, xsm, xca, xfa, xcb)
23	XEC	Rest of Europe and Central Asia (alb, bgr, hrv, rom, xsu)
24	MNA	Middle East and North Africa (xme, mar, tun, xnf)
25	SSS	Selected Sub-Saharan African countries (bwa, mwi, moz, tza, zmb, zwe, xsd, mdg, uga, xss)
26	XSS	Rest of Sub-Saharan Africa (xsc, xsd, xss)
27	ROW	Rest of the world (xoc, xea, xse, xna)
Postsimulation aggregate regions by income classification[b]		
1	HIY	High-income (anz, eur, can, usa, jpn, hya, hyc)
2	HYO	Quad countries plus ANZ (anz, eur, can, usa, jpn)
3	OHY	Other high-income (hya, hyc)
4	LMY	Developing (arg, bgd, bra, chn, ind, idn, mex, rus, tha, tur, vnm, zaf, xsa, xea, rlc, xec, mna, sss, xss, row)
5	LMW	Developing, using WTO classification (hya, hyc + LMY)
6	MIY	Middle-income (arg, bra, chn, mex, rus, tha, tur, zaf, xea, rlc, xec, mna)
7	LIY	Low-income (bgd, ind, idn, vnm, xsa, sss, xss, row)
8	LMX	Developing, excluding China and India (LMY - chn, ind)
9	MIX	Middle-income, excluding China (MIY - chn)
10	LIX	Low-income, excluding India (LIY - ind)
11	WLT	World total (HIY + LMY)
Pos-simulation aggregate regions by regional classification[c]		
1	EAP	East Asia and the Pacific (chn, idn, tha, vnm, xea)
2	SAS	South Asia (bgd, ind, xsa)
3	ECA	Europe and Central Asia (rus, tur, xec)
4	MNA	Middle East and North Africa (mna)
5	SSA	Sub-Saharan Africa (zaf, sss, xss)
6	LAC	Latin America and the Caribbean (arg, bra, mex, rlc)

a. The modeled regions are an aggregate of the 87 GTAP regions. The GTAP acronyms are in parentheses. For details on the countries included in the GTAP aggregate regions, see either the GTAP Web site or van der Mensbrugghe (2004a).

b. Regional aggregations containing Europe have a counterpart that excludes intra-European trade. These are, respectively, EUX, HIX, HYX, and WLX.

c. ROW is not included in a regional aggregate, which therefore will not sum to the LMY total. Note that most of the EU-accession countries are still classified as developing countries by World Bank definitions, but not included in the ECA definition above.

Appendix Table A.2. Sectoral Concordance for the LINKAGE Model

Modeled sectors		
1	RIC	Rice (pdr, pcr)
2	WHT	Wheat (wht)
3	GRO	Other cereals (gro)
4	OSD	Oil seeds (osd)
5	SUG	Sugar (c_b, sgr)
6	V_F	Vegetables and fruits (v_f)
7	PFB	Plant-based fibers (pfb)
8	OCR	Other crops (ocr)
9	LVS	Livestock (ctl, oap, rmk, wol)
10	FFL	Fossil fuels (coa, oil, gas, p_c)
11	ONR	Other natural resources (frs, omn)
12	PMT	Processed meats (cmt, omt)
13	MIL	Dairy products (mil)
14	VOL	Vegetable oils and fats (vol)
15	OFD	Other food, beverages, and tobacco (fsh, ofd, b_t)
16	TEX	Textiles (tex)
17	WAP	Wearing apparel (wap)
18	LEA	Leather (lea)
19	CRP	Chemicals, rubber, and plastics (crp)
20	I_S	Iron and steel (i_s)
21	MVH	Motor vehicles and parts (mvh)
22	CGD	Capital goods (otn, ele, ome)
23	OMF	Other manufacturing (lum, ppp, nmm, nfm, fmp, omf)
24	CNS	Construction (cns)
25	SVC	Utilities and services (ely, gdt, wtr, trd, otp, wtp, atp, cmn, ofi, isr, obs, ros, osg, dwe)
Postsimulation aggregate sectors		
1	AGR	Agriculture (ric, wht, gro, osd, sug, v_f, pfb, ocr, lvs)
2	PFD	Processed food (pmt, mil, vol, ofd)
3	AGF	Agriculture and food (ric, wht, gro, osd, sug, v_f, pfb, ocr, lvs, pmt, mil, vol, ofd)
4	TWP	Textiles and wearing apparel (tex, wap, lea)
5	OMX	Other manufacturing (ffl, onr, crp, i_s, mvh, cgd, omf)
6	NTR	Nontradeables (cns, svc)
7	MRT	Merchandise trade (All sectors except nontradeables)
8	IND	Industrial sectors (merchandise trade excluding agriculture)
9	INX	Industrial sectors excl processed foods (merchandise trade excluding agriculture and food)
10	MNF	Manufacturing (industrial sectors, excluding natural resources—ffl and onr)
11	MNX	Manufacturing, excluding processed foods
12	TOT	All goods and nonfactor services (all sectors)