Welfare and poverty effects of global agricultural and trade policies using the Linkage Model

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Abstract

This paper analyzes the economic effects of agricultural price and merchandise trade policies around the world as of 2004 on global markets, net farm incomes, and national and regional economic welfare and poverty, using the global economy wide Linkage Model, new estimates of agricultural price distortions for developing countries, and a poverty elasticities approach. It addresses two questions: To what extent are policies as of 2004 still reducing rewards from farming in developing countries and thereby adding to inequality *across* countries in farm household incomes? Are they depressing value added more in primary agriculture than in the rest of the economy of developing countries, and earnings of unskilled workers more than of owners of other factors of production, thereby potentially contributing to inequality and poverty *within* developing countries (given that farm incomes are well below non-farm incomes in most developing countries and that agriculture there is intensive in the use of unskilled labor)? Results are presented for the key countries and regions of the world and for the world as a whole. They reveal that, by moving to free markets, income inequality between countries would be reduced at least slightly, all but one-sixth of the gains to developing countries would come from agricultural policy reform, unskilled workers in developing countries – the majority of whom work on farms – would benefit most from reform, net farm incomes in developing countries would rise by 6 percent compared with 2 percent for non-agricultural value added, and the number of people surviving on less than US$1 a day would drop 3 percent globally.

JEL codes: D30, D58, D63, F13, Q18

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Despite much reform over the past quarter of a century in policy distortions to agricultural incentives, many intervention measures remain (Anderson 2009). A question of great interest to the agricultural, trade, and development policy communities in many developing countries and international agencies is: How do those policies affect economic welfare, inequality and poverty levels? More specifically, for any developing country of interest, how important are its own policies as compared with those of the rest of the world in affecting the welfare of the poor in that country; and, given that three-quarters of the world's poor depend on agriculture directly or indirectly for their livelihood (World Bank 2008), and an earlier finding that farm policies as of 2001 were responsible for more than three-fifths of the global welfare cost of trade distortions (Anderson, Martin and van der Mensbrugghe 2006), what contributions do agricultural policies in particular contribute to those outcomes?

Now is an appropriate time to address this set of questions for at least three reasons. One is that the World Trade Organization (WTO) is struggling to conclude the Doha round of multilateral trade negotiations, and agricultural policy reform is once again one of the most contentious issues in those talks. Another is that poorer countries and their development partners are striving to achieve their United Nations–encouraged Millennium Development Goals by 2015, the prime ones being the alleviation of hunger and poverty. And third, a new set of estimates of distortions to agricultural incentives in many countries has been brought together recently by the World Bank (Anderson and Valenzuela 2008), and those estimates in turn have been expressed as an alternative set of price distortions for using in CGE models (Valenzuela and Anderson 2008). This latter set differs from the usual ones used by trade modelers in that it

is based on direct domestic-to-border price comparisons rather than (as with the GTAP dataset, see Badri Narayanan and Walmsley 2008) on just applied rates of import tariffs.

This chapter serves two purposes. The first is to analyze the economic effects of agricultural price and merchandise trade policies around the world as of 2004 on global markets, net farm incomes, and national and regional economic welfare and poverty. That is, it assesses how far the world still has to go in removing the disarray in world agriculture (to use the title of the seminal study by Johnson 1991), and to at least provide a crude indication of the poverty that could be alleviated by such a reform. In doing so this chapter also serves a second purpose, which is to explain the origin of the exogenous shocks used in the global modeling of the following chapter and in the national modeling studies in part II to IV of this volume to represent the market effects on particular developing countries of rest-of-world agricultural and trade policies.

To quantify the impacts of current policies, we first amend the distortions in Version 7 of the GTAP global protection database (Badri Narayanan and Walmsley 2008) by replacing its applied tariffs with distortion rates that reproduce those estimated by authors of the developing country case studies in the World Bank's recent Agricultural Distortion research project as collated by Valenzuela and Anderson (2008).[1] Those distortion estimates suggest that, despite reforms of the past 25 years, there was still a considerable range of rates across commodities and countries in 2004, including a strong anti-trade bias in national agricultural and trade policies for many developing countries. Furthermore, non-agricultural protectionism is still rife in some developing countries, and agricultural price supports in some high-income countries remain high.

The present analysis addresses the following two questions: To what extent are policies as of 2004 still reducing rewards from farming in developing countries and thereby adding to inequality *across* countries in farm household incomes? Are they depressing value added more in primary agriculture than in the rest of the economy of developing countries, and earnings of unskilled workers more than of owners of other factors of production, thereby potentially contributing to inequality and poverty *within* those developing countries (given that farm incomes are well below non-farm incomes in most developing countries and that agriculture there is intensive in the use of unskilled labor)?

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[1] That distortions database is documented fully in Anderson and Valenzuela (2008) and is based on the methodology summarized in Anderson et al. (2008a and 2008b).

To provide answers to these and related questions, we use our amended GTAP distortion database in a global computable general equilibrium model (the LINKAGE model, see van der Mensbrugghe 2005) to assess how agricultural markets, factor prices and value added in agriculture versus non-farm sectors would differ if all price and trade policies that distort markets for farm and non-farm goods as of 2004 were removed. It is important to include nonagricultural trade policies in the reform experiment because, as shown in the new study reported in Anderson (2009), in many developing countries they may be more harmful in depressing farmer incentives then those countries' agricultural policies.

Results are presented for the key countries and regions of the world and for the world as a whole. While no-one anticipates a move to completely free markets globally in the near future, this prospective analysis serves as a benchmark to suggest what is at stake in terms of further reforms via WTO rounds of multilateral trade negotiations. At the same time, by showing how different the trade patterns of various countries would be without distortions, it also provides a better indication of agricultural comparative advantages in different parts of the world than is available by looking at actual trade and self-sufficiency indicators in the current distortion-ridden situation.

The chapter begins with an examination of the extent of price distortions in 2004 provided by various policy instruments as calibrated in Valenzuela and Anderson (2008), the emphasis being mainly on import tariffs in the case of non-farm products but, in the case of agriculture, the full range of production, consumption and trade taxes and subsidies. This is followed by a description of the LINKAGE model of the global economy to be used to analyze the consequences of removing those distortions. The key results of the two simulations are then presented: full global liberalization of markets for all merchandise, and – so as to see the relative contribution of farm policies to those outcomes – full global reform of just agricultural policies.[2] The chapter concludes by highlighting the main messages that emerge from the results. They are that, by moving to free markets, income inequality between countries would be reduced at least slightly, all but one-sixth of the gains to developing countries would come from agricultural policy reform, unskilled workers in developing countries – the majority of whom work on farms

[2] Some of the questions raised here were addressed by Anderson, Martin and van der Mensbrugghe (2006) who use the same Linkage model as in the present analysis, and by Anderson and Valenzuela (2007a) using the GTAP-AGR model, but in each case those authors relied on the GTAP Version 6 protection database for 2001 that included only applied import tariffs for developing countries).

– would benefit most from reform, net farm incomes in developing countries would rise by 6 percent compared with 2 percent for non-agricultural value added, and the number of people surviving on less than US$1 a day would drop by 3 percent globally.

Key Distortions in Global Markets

Border measures traditionally have been the main means by which governments distort prices in their domestic markets for tradable products, with the relative prices of the various goods being affected by trade taxes or subsidies. Product-specific domestic output or farm input subsidies have played a more limited role, in part because of their much greater overt cost to the treasury.[3]

To quantify the impacts current policies, we use the Altertax procedure (Malcolm 1998) to amend the distortions in the pre-release of Version 7 of the GTAP global protection database. The amendments are mainly for developing countries but, following Anderson and Valenzuela (2007b), we also alter cotton distortions in the United States to better reflect policies there. To simplify the discussion below, European transition economies (in which we include Turkey) are treated as one of the world's developing country regions, the others being Africa, Asia, and Latin America.[4]

Version 7 of the GTAP database includes estimates of bilateral tariffs and export subsidies and of domestic supports as of 2004 for more than 100 countries and country groups spanning the world. As with Version 6 of the GTAP dataset (which relates to 2001, see Dimaranan 2007), the protection data come from a joint CEPII (Paris)/ITC (Geneva) project known as MAcMaps. MAcMaps is a detailed database on bilateral import protection at the HS6 tariff line level that integrates trade preferences, specific and compound tariffs and a partial

[3] In principle services trade and foreign investment distortions also could distort incentives in the agricultural and industrial sectors, but they are ignored here because much controversy still surrounds their measurement and how they should be modeled. This is reflected in the results emerging from attempts to include services distortions in trade reform modeling, which have led to widely differing results. Compare, for example, Brown, Deardorff and Stern (2003), Francois, van Meijl and van Tongeren (2005), and Hertel and Keeney (2006).

[4] We have no new distortion estimates for countries in the Middle East, so in what follows little attention is given to this small and relatively affluent part of the global agricultural economy.

evaluation of non-tariff barriers such as tariff rate quotas (TRQs).[5] The new Version 7 GTAP database for 2004 has lower tariffs than the previous Version 6 database for 2001, because of major reforms such as completing the implementation of the Uruguay Round agreements and unilateral reforms including those resulting from WTO accession negotiations by China and other recent acceding countries.

As mentioned above, the agricultural price distortion rates in that database have been replaced with an alternative set for numerous developing countries, based on nominal rate of assistance estimates for 2004 in Valenzuela and Anderson (2008). The sectoral averages of these amended values are shown in table 1. In the case of amendments to the import tariffs on individual farm products for any particular developing country, the bilateral tariff structure in the GTAP Version 7 database is preserved by simply lowering or raising the bilateral tariffs by the same proportion we amend the country's average import tariff on each product for 2004.

According to this amended dataset, the weighted average applied tariff for agriculture and lightly processed food in 2004 was 21.8 percent for developing countries and 22.3 percent for high-income countries, while for non-farm goods it was 7.5 percent for developing countries and just 1.2 percent for high-income countries. Export subsidies for farm products for a few high-income regions, and export taxes in a few developing countries, were still in place in 2004, but they are generally small in their impact compared with tariffs, as are production subsidies and taxes.[6]

The averages on their own are not necessarily good indicators of overall distortions to farmers' incentives. Also of importance is the composition of each country's trade. Two examples serve to illustrate the point. First, if high-income countries' tariffs on temperate farm products are at a near-prohibitive level but are zero on tropical products such as coffee beans, those countries' import-weighted average agricultural tariff could be quite low even though agricultural value added in those rich countries had been enhanced substantially. A second illustration is where the non-agricultural primary sector receives a similar level of import protection as the farm sector and less than the manufacturing sector, but is much more export-

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[5] More information on the MAcMaps database is available in Bouët et al. (2008) and at http://www.cepii.fr/anglaisgraph/bdd/macmap.htm. For details of its incorporation into the GTAP Version 7 dataset, see Badri Narayanan and Walmsley (2008).

[6] Using the GTAP Version 6 database for 2001, Anderson, Martin and Valenzuela (2006) found that agricultural production and export subsidies together contributed just 7 percent of the global welfare cost of agricultural protection.

focused than agriculture: trade reform may cause that other primary sector to expand at the expense not only of manufacturing but also of farming. Even though we have used production rather than trade weights to get sectoral averages rates of distortion in table 1, and even though the ratio of agricultural to other goods' tariffs for 2004 in that table is well above unity for many of the regions shown, it is not possible to say from those distortion rates alone whether developing country policies have an anti-agricultural bias. Equally, it is not possible to know how the benefits of removal of agricultural tariffs in the protective countries would be distributed among the various agricultural-exporting countries. What is needed to address such issues is a global general equilibrium model to estimate the net effects of all sectors' distortions in all countries on the various nations' agricultural markets and net farm incomes, to which we now turn.

The LINKAGE Model of the Global Economy

The model used for this analysis is the World Bank's global computable general equilibrium (CGE) model, known as LINKAGE (van der Mensbrugghe 2005). For most of this decade it has formed the basis for the World Bank's standard long-term projections of the world economy and for much of its trade (and more recently migration) policy analysis (e.g., World Bank 2002, 2004, 2005, 2006, 2007). It is a relatively straightforward CGE model but with some characteristics that distinguish it from other comparative static models such as the GTAP model (described in Hertel 1997). Factor stocks are fixed, which means in the case of labor that the extent of unemployment (if any) in the baseline remains unchanged. 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 possibilities between extensive and intensive farming; livestock sectors reflect the substitution possibilities between pasture and intensive feeding; and all other sectors reflect standard capital/labor substitution. There are two types of labor, skilled and unskilled, and the total employment of each is assumed fixed (so no change in their unemployment levels) but both are assumed to be intersectorally mobile. 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.[7]

Government fiscal balances are fixed in US dollar terms, with the fiscal objective being 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. The current account balance also 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 and additional imports are financed by increasing export revenues. The latter typically is achieved by a depreciation of the real exchange rate. Finally, investment is driven by savings. With fixed public and foreign saving, investment comes from changes in the savings behavior of households and from changes in the unit cost of investment. The model only solves for relative prices, with the numéraire, or price anchor, being the export price index of manufactured exports from high-income countries. This price is fixed at unity in the base year.

A virtue of beginning with the latest GTAP database is that it includes bilateral tariffs that capture not only reciprocal but also non-reciprocal preferential trade agreements, the latter providing low-income exporters duty-free access to protected high-income country markets. This allows us to take into account the fact that future reform may cause a decline in the international terms of trade for those developing countries that are enjoying preferential access to agricultural and other markets of high-income countries (in addition to those that are net food importers because their comparative advantage is in other sectors such as labor-intensive manufacturing).

The version of the LINKAGE model used for this study is based on an aggregation involving 23 sectors and 49 individual countries plus 11 country groups spanning the world (see van der Mensbrugghe, Valenzuela and Anderson 2009). There is an emphasis on agriculture and

[7] The size of the Armington elasticities matters, see Valenzuela, Anderson and Hertel (2008) and Zhang (2009). The Linkage model assumes larger values than some other models because it is seeking to estimate long-run consequences of liberalization. An example of the difference this can make to the results is detailed in Anderson and Martin (2006, table 12A.2).

food, which comprise 16 of those 23 sectors. Note that, consistent with the WTO, we include Korea and Taiwan in the 'developing country' category.[8]

The results below are comparative static results, so they do not include the (often much larger) dynamic gains that result from an acceleration in investment due to the reduction in tariffs on industrial goods lowering the cost of investment. Also missing, therefore, are any costs of adjustment to reform. And because this version of the Linkage Model assumes perfect competition and constant returns to scale, it captures none of the benefits of freeing markets that could come from accelerated productivity growth, scale economies, and the creation of new markets (extensification vs. intensification). There is also a dampening effect on estimates of welfare gains because of product and regional aggregation, which hides many of the differences across products in rates of distortions. The results therefore should be treated as providing very much lower-bound estimates of the net economic welfare benefits from policy reform.[9]

Prospective Effects of Global Removal of Price-Distorting Policies

To see what could result from removing policies as of 2004, we examine in this section the results from two modeling simulations. The main one involves the full global liberalization of both agricultural policies and non-agricultural goods trade policies. An additional simulation, which liberalizes just agricultural policies globally, is also discussed towards the end of this section, to give a sense of the relative contribution to various outcomes of farm policies alone.

Global and national economic welfare

[8] The more-affluent economies of Hong Kong and Singapore are in our high-income category but, since they have close to free trade policies and almost no farm production anyway, their influence on the results is not noticeable.

[9] As well, the model does not include any divergences between private and social marginal costs and benefits that might arise from externalities, market failures, and other behind-the-border policies not represented in our amended GTAP protection database. These omissions could affect the welfare estimates in either direction.

Beginning with the baseline projection of the world economy in 2004, all agricultural subsidies and taxes plus import tariffs on other merchandise, as summarized in table 1,[10] are removed globally. Our LINKAGE model suggests that would lead to a global gain of $168 billion per year (table 2). As a share of national income, developing countries would gain nearly twice as much as high-income countries by completing that reform process (an average increase of 0.9 percent compared with 0.5 percent for high-income countries). Thus in this broad sense of a world of just two large country groups, completing the global reform process would reduce international inequality – to use the Milanovic (2005) term, taking into account each country's economic size.[11] The results vary widely across developing countries, however, ranging from slight losses in the case of some South Asian and Sub-Saharan African countries that would suffer exceptionally large adverse terms of trade changes to 8 percent increases in the case of Ecuador (whose main export item, bananas is currently heavily discriminated against in the EU market where former colonies and least developed countries enjoy preferential duty-free access).

If one were to treat each of the 60 regions in table 2 as able to be represented by a single household (that is, ignoring intra-region inequality), income inequality between countries as measured by the Gini Coefficient would be reduced at least slightly, from 0.8513 to 0.8506.[12]

The second column of numbers and those in parentheses in table 2 show the amount of that welfare gain due to changes in the international terms of trade for each country. For

[10] The only other policy change is the removal of export taxes on non-farm products in Argentina This is done because they were introduced at the same time (end-2001) and for the same reason (for the government to gain popular support from the urban poor) as were the country's export taxes on farm products.

[11] This would continue a process that began in the 1980s, when many countries began to reform their trade and exchange rate regimes. Using the same Linkage model and database as the present study, Valenzuela, van der Mensbrugghe and Anderson (2009) found that the global reforms between 1980-84 and 2004 also boosted economic welfare in developing countries proportionately more than in high-income economies (by 1.0 percent, compared with 0.7 percent for high- income countries).

[12] This is a measure of inter-country inequality, in the Milanovic (2005) sense of treating each country as a single observation and not taking into account its economic size. It is calculated using the 60 regions and Deaton's Gini coefficient calculation: $G = \frac{N+1}{N-1} - \frac{2}{N(N-1)u}(\Sigma_{i=1}^{n} P_i X_i)$

where N is the number of regions, *u* is the sample average GDP, P_i is the GDP sample rank (with the highest being 1 and the lowest a rank of N) and X_i is the GDP of country i.

developing countries as a group the terms of trade effect is slightly negative, and conversely for high-income countries.

Regional and sectoral distribution of welfare effects

One way to way to decompose the real income gains from full removal of price distortions globally, so as to better understand the sources for each region, is to assess the impacts of developing country liberalization versus high-income country liberalization in different economic sectors. These results are provided in table 3. They suggest global liberalization of agriculture and food markets would contribute 60 percent of the total global gains from merchandise reform. This is similar to the 63 per cent found for 2015 by Anderson, Martin and van der Mensbrugghe (2006b) using the earlier Version 6 of the GTAP database anchored on 2001 estimates of distortions. This robust result is remarkable given the low shares of agriculture and food in global GDP and global merchandise trade (less than 9 percent). For developing countries, the importance of agricultural policies is even greater at 83 percent (compared with just 5 percent for high-income countries – see row 7 of table 3).

Three-fifths of those global gains that could come from removing agricultural policies are accounted for by the farm policies of high-income countries (column 3 of table 3, $61 billion of the $101 billion per year). Those policies also account for just over half of the overall gains to developing countries from global agricultural and trade policy reforms (column 1 of table 3, $63 billion of the $118 billion per year).

Quantities produced and traded

The full global liberalization results suggest there would be little change in the developing countries' aggregate shares of global output and exports of non-farm products other than for textiles and apparel. Their shares in agricultural and processed food markets, however, change noticeably: the export share rises from 54 to 64 percent and the output share rises from 46 to 50 percent. More significantly, the rises occur in nearly all agricultural and food industries. As a result, the share of global production of farm products that is exported rises dramatically for

many industries and, for the sector as a whole, increases from 8 to 13 percent excluding intra-EU trade (table 4). That 'thickening' of international food markets would have a substantial dampening effect on the instability of prices and quantities traded in those markets.

The impact of full trade reform on agricultural and food output and trade is shown for each country/region in table 5, where it is clear that global farm trade is enhanced by more than one-third (39 percent) whereas the global value of output is virtually unchanged (dropping just 2.6 percent). This suggests that, in aggregate, the pro-agricultural policies of high-income countries are not quite fully offset by the anti-agricultural policies of developing countries – whereas the anti-trade biases in policies of both groups of countries reinforce each other. The increase in exports of those goods from developing countries would be a huge $163 billion per year. Latin America accounts for nearly half of that increase, but all developing regions' exports expand. This means their share of production exported would be much higher. It would increase for almost all developing countries, rising in aggregate for the group from 10 to 17 percent (table 6).

Also of interest is what happens to agricultural imports: developing countries as a group would see them growing less than farm exports (table 5). That means their food and agricultural self sufficiency ratios would rise, although in aggregate only slightly. For high-income countries that ratio would fall five percentage points (slightly less if Eastern Europe is included), while in East Asia and Africa it would rise two to three points, for South Asia it would be unchanged, and for Latin America it would jump from 112 to 126 percent (table 7).

As already mentioned, such reform also raises substantially the share of agricultural and food production that is exported globally, thereby 'thickening' international markets, which would dampen international food price fluctuations and thereby reduce concerns about vulnerability to import dependence. The extent of this global public good aspect of agricultural and trade reform can be sensed for different products from the results reported in tables 8. Highly protected sugar and milk, as well as grains and oilseeds, are especially noteworthy. Also noteworthy from that table is the extent to which the developing country shares of output exported rise for certain products. The share of their grain production that is exported would double, and for meat it would more than double while for sugar it would rise nearly four-fold. Global exports of cotton (plant-based fibers) would become more dominated by developing

countries as the share of high-income cotton production exported would fall from 50 to 31 percent.

Effects on product and factor prices

The average real international prices of agricultural and lightly processed food products would be only 1.3 percent higher in the absence of all merchandise trade distortions, or 2.0 percent if just agricultural policies were liberalized (table 9: the model's numéraire is the export price index of high-income countries' manufactured exports). The net effects of distortions as of 2004 are especially dampening the international prices of beef, milk, rice and cotton. But they are propping up the international prices of some other products, because of export taxes still in place in some developing countries, most notably Argentina.

The redistributions of welfare among groups within each country following trade reform can be much larger than the aggregate change, partly because of the impacts on real pre-tax rewards to labor, capital and land. Those effects are reported in table 10, where factor rewards are deflated by the overall consumer price index (CPI) and also, in the case of unskilled wages, by the food and the food plus clothing CPIs (since those items are so prominent in the spending of unskilled workers). Consistent with trade theory, those results suggest unskilled workers in developing countries – the majority of whom work on farms – would benefit most from reform, followed by skilled workers, then capital owners. Returns to immobile agricultural land also rise in developing countries, but by less than for more-mobile factors. Land returns fall substantially in highly-protected Western Europe and Japan, change little in the United States, rise considerably in Australia and Canada and rise dramatically in dairy-intensive New Zealand.

Effects on sectoral value added

Also of crucial interest in terms of these policies' impact on inequality and poverty is how they affect value added in agriculture, in other words net farm income. These results for full global reform are reported in the first four columns of table 11. They show that for developing countries as a group, value added in agriculture rises by 5.6 percent, compared with 1.9 percent for non-agriculture, following full global reform of all merchandise trade. Latin America is where net

farm income expands most, averaging 37 percent but exceeding 100 percent for Argentina and Ecuador and 40-50 percent for Brazil and Colombia. In East Asia it also expands considerably, and more than non-agricultural value added – including in China. However, among the countries listed in Africa, net farm incomes would increase substantially only in Mozambique, Zambia and Zimbabwe, and for the continent as a whole including North Africa they would fall very slightly (by less than 1 percent). Partly that is because non-agricultural primary sectors – in which numerous African countries have a strong comparative advantage – would expand (raising Africa's self-sufficiency in that sector from 180 to 189 percent – see table 7), and that in turn would boost production and employment of non-tradable goods and services. Net farm incomes are estimated to fall also in South Asia (by 7 percent), but there it is textiles and clothing that would expand (raising self-sufficiency from 144 to 153 percent) and, in India where the skilled/unskilled wage differential rises, also skill-intensive goods and services production.

Effects on poverty using the elasticities approach

The above results for real factor rewards and net farm income suggest both inequality and poverty could be alleviated globally by agricultural and trade policy liberalization. It is possible to go a step or two further in assessing reform impacts on poverty with a global model, even with only one single representative household per country. That involves using the elasticities approach, which is employed here in two ways. The first involves taking the impact on real household income, applying an estimated income to poverty elasticity, and then assessing the impacts on the poverty headcount index for each country. This simple approach assumes distributional neutrality: the poor receive the same proportional increase in real income as the average household in the economy, and all are subject to the same higher rate of direct income taxation to replace the customs revenue forgone because of trade liberalization.

A slightly more complex but more reasonable 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 the model's results some of the distributional aspects of the changes in real income, rather than simply the average gain. This has been done by calculating the change in the (pre-tax) average wage of unskilled workers deflated by the food and clothing CPI—presumably the most relevant consumer prices for the poor, including those many poor farm and other rural households that

earn most of their income from wages and are net buyers of food. These workers are assumed to be exempt from the direct income tax imposed to replace the lost customs revenue following trade reform—a realistic assumption for many developing countries.[13]

Table 12 summarizes the key poverty results to emerge from the global reform scenario using both of these approaches. As is clear from the comparison, the more-naïve first approach yields little change in poverty numbers, so we concentrate attention here on the results generated using the more realistic second approach.

Under the full merchandise trade reform scenario, extreme poverty (the number of people surviving on less than US$1 a day) in developing countries would drop by 26 million relative to the baseline level of just under one billion, a reduction of 2.7 percent. The proportional reduction in China is much higher than in other developing countries, though: 3.7 percent compared with 2.6 percent. This would continue the trend of the recent past, with China being the region where poverty alleviation has been most numerous (see Chen and Ravallion 2007, 2008). Nonetheless, in this scenario the number of extreme poor in Sub-Saharan Africa would fall by 3.7 percent. In India (though not in the rest of South Asia), by contrast, the number of extreme poor is estimated to rise, by 4.0 percent.

Recall that this set of poverty calculations is 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 5.9 percent—six times greater than the average net income increase in developing countries (after raising direct taxes to compensate for the loss of tariff revenue), assuming that the change in unskilled wages is fully passed through to households. This suggests such reform would deliver a marked reduction in income inequality within developing countries on average.

Under the broader definition of poverty—those living on no more than US$2 per day—the number of poor in developing countries would fall by 87 million under the full reform scenario compared to an aggregate baseline level of nearly 2.5 billion. This represents a somewhat larger proportionate reduction in the number of poor in developing countries, of 3.4 percent, or 3.7 percent if China is excluded. The proportionate decline in Sub-Saharan Africa is 2.7 percent, while for India there is still an increase, of 1.7 percent.

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

Caveats

As with all modeling, the results depend on the assumptions made in structuring the model. Of particular relevance here is that several assumptions bias downwards the estimates of welfare gains from trade. They include constant (rather than increasing) returns to scale, no productivity effects of reform (for example, of the sort stressed by Melitz 2003), and no possibility for new markets to be created following reform. As well, there is always the issue of product and regional aggregation: the less disaggregated is the specification of the world economy, the smaller the estimated benefits from reform. This is because there is no accounting for welfare gains from adjustments within aggregated sectors or regions.

As for the effects on poverty, the crude methodology used at the end of the previous section of this chapter is meant simply as a beginning of our examination of the poverty consequences of global trade reform. The Linkage model global reform results presented above are used in the next chapter (Bussolo, De Hoyos and Medvedev 2010), in association with micro-simulation survey data for individual countries, to assess the effects on the distribution of income between and within 101 countries. It is thus able to say much more precisely what the inequality and poverty effects of 2004 policies are for the world. Then in Parts II to IV of this volume, individual developing country case studies examine (again with the help of micro-simulation national survey data) the effects of not only own-country policies but also the policies of the rest of the world. The border price and export demand shocks associated with rest-of-world liberalization are almost the same as those presented above, the only difference being that, for each of the case study countries, a separate global simulation has been run that excludes reform by the case study country under examination. Those border shocks are reported for all of the case study countries in Valenzuela and Anderson (2009).

Conclusions

The findings presented above, aimed at understanding the global economic effects of the agricultural and trade policies remaining in place as of 2004, can be summarized as follows:

- as a share of national income, developing countries would gain nearly twice as much as high-income countries by removing those policies (an average increase of 0.9 percent compared with 0.5 percent for high-income countries, such that international income inequality between countries would improve;
- even inter-country inequality (not taking into account differences in the economic size of nations) as measured by the Gini Coefficient would improve slightly even though some developing countries (notably in South Asia) would lose and a few (e.g. Ecuador) would gain many times more than the average;
- of those prospective welfare gains from global liberalization, 60 percent would come from agriculture and food policy reform – a striking result given that the shares of agriculture and food in global GDP and global merchandise trade are less than 9 percent;
- the contribution of agricultural policy reform to the prospective welfare gain for developing countries is even greater, at 83 percent;
- with full goods trade liberalization, the share of global production of farm products that is exported would rise from 8 to 13 percent excluding intra-EU trade, thereby 'thickening' international food markets and reducing instability of prices and quantities traded in those markets;
- unskilled workers in developing countries – the majority of whom work on farms – would benefit most from reform (followed by skilled workers and then capital owners), with the average change in the real unskilled wage over all developing countries rising 3.8 percent or nearly five times more than the average net income increase in developing countries;
- net farm incomes in developing countries would rise by 5.6 percent, compared with 1.9 percent for non-agricultural value added, suggesting that inequality as between farm and nonfarm households in developing countries would fall;
- by contrast, in high-income countries net farm incomes would fall by 15 percent on average (compared with a slight rise for real non-farm value added), so inequality

between farm households in those countries versus in developing countries would reduce substantially; and

- extreme poverty (the number of people surviving on less than US$1 a day) in developing countries would drop by 29 million relative to the baseline level of just under one billion, a reduction of 3 percent (and 4 percent when the more moderate US$2 a day poverty level is used).

To get a more precise sense of the inequality and poverty effects within countries, and to explore the extent to which it is own-country as distinct from rest-of world's policies that are doing the harm, requires country case studies using national economy-wide models that are enhanced with detailed earning and spending information of numerous types of urban and rural households. That is the purpose of Parts II, III and IV of this volume.

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Table 1: Structure of producer price distortions in global goods markets,[a] 2004

(percent)

	Primary Agriculture	Agriculture and Lightly Processed Food		Other goods
	Domestic Support	Export Subsidy	Tariff	Tariff
Africa	**-0.8**	**0.1**	**20.4**	**11.2**
Egypt	0.0	0.0	5.0	13.5
Madagascar	0.0	-4.4	3.4	2.7
Mozambique	0.2	0.0	14.5	10.9
Nigeria	0.1	0.0	76.1	17.2
Senegal	0.0	-1.1	6.2	8.9
South Africa	0.0	0.0	10.2	6.5
Uganda	0.0	-2.6	9.2	5.5
Tanzania	-0.3	0.0	11.8	13.7
Zambia	-0.8	0.0	7.0	9.0
Zimbabwe	-3.2	0.0	8.9	15.4
Rest of Africa	-1.2	0.3	19.0	13.4
East and South Asia	**2.4**	**0.6**	**29.6**	**8.1**
China	0.0	0.2	6.5	7.1
Korea	0.0	0.0	319.4	5.9
Taiwan	-0.4	0.0	84.2	3.9
Indonesia	0.0	-1.6	7.3	4.9
Malasya	0.0	-0.2	5.0	5.9
Philippines	-4.7	0.0	7.1	3.4
Thailand	-0.2	0.0	26.2	12.9
Vietnam	-3.6	-0.5	21.5	18.5
Bangladesh	-1.0	0.0	9.9	22.5
India	10.1	2.5	2.9	20.8
Pakistan	0.0	-0.2	19.4	18.5
Sri Lanka	0.6	-0.3	23.8	5.8
Rest of East and South Asia	-0.7	0.0	4.3	2.7
Latin America	**-0.2**	**-1.4**	**7.2**	**6.7**
Argentina	0.0	-14.8	0.0	5.8
Brazil	0.0	0.0	4.8	8.9
Chile	0.0	0.0	2.4	1.8
Colombia	0.0	0.0	21.6	9.8
Ecuador	0.0	0.0	13.4	10.4
Mexico	1.2	0.0	6.2	3.4
Nicaragua	0.0	-2.8	9.6	3.9
Rest of Latin America	-1.7	0.3	9.9	9.9
EEurope & Central Asia	**0.8**	**-0.3**	**15.9**	**4.8**
Baltic States	3.4	0.0	8.2	0.9
Bulgary	0.6	0.0	14.8	11.5
CZE Republic	0.6	0.0	3.0	0.5
Hungary	3.1	0.0	6.2	0.5
Poland	0.4	0.0	6.2	0.8

(continued)

Table 1 (continued): Structure of producer price distortions in global goods markets,[a] 2004 (percent)

	Primary Agriculture	Agriculture and Lightly Processed Food		Other goods
	Domestic Support	Export Subsidy	Tariff	Tariff
Romania	1.3	0.0	18.0	9.8
Slovakia	0.0	0.0	5.2	0.4
Slovenia	0.0	0.0	7.8	0.4
Russia	1.7	-0.9	18.9	7.4
Kazakhstan	-0.9	0.0	3.4	2.7
Turkey	0.8	0.0	33.3	3.1
Rest of EEurope and CAsia	-1.1	-0.9	9.7	5.7
High-income countries	**2.6**	**7.2**	**22.3**	**1.2**
Australia	0.0	0.0	0.5	3.3
Canada	1.6	3.6	18.9	1.4
EU15	1.2	12.8	6.9	0.7
Japan	2.0	0.0	151.7	1.7
New Zealand	0.0	-0.2	0.7	3.3
Rest West Europe	2.6	13.4	53.9	2.2
USA	5.2	0.6	6.1	1.3
Developing countries	**1.4**	**0.0**	**21.8**	**7.5**
Africa	-0.8	0.1	20.4	11.2
East Asia	-0.3	0.0	41.6	6.7
South Asia	7.2	1.7	6.9	20.2
Latin America	-0.2	-1.4	7.2	6.7
Middle East	-12.4	0.0	7.5	5.7
EEurope and CAsia	0.8	-0.3	15.9	4.8
WORLD TOTAL	**1.9**	**3.5**	**22.1**	**3.3**

[a] Using value of production at undistorted prices as weights.

Source: Valenzuela and Anderson (2008), based on calculations compiled by Anderson and Valenzuela (2008).

Table 2: Impact on real income of full liberalization of global merchandise trade, by country/region, 2004

(relative to the 2004 benchmark data, in 2004 US dollars and percent)

	Total real income gain p.a. ($billion)	*Change in income due just to change in terms of trade ($billion)*	***Total real income gain as percentage of benchmark[a]***	
North and Sub Saharan Africa	***0.9***	***-6.0***	***0.2***	***(-1.1)***
Egypt	-0.2	-0.6	-0.3	(-0.9)
Madagascar	0.0	0.0	-0.9	(-1.2)
Mozambique	0.1	-0.1	2.4	(-2.0)
Nigeria	0.3	-0.6	0.7	(-1.3)
Senegal	0.0	-0.1	-2.3	(-4.0)
South Africa	0.2	-0.7	0.1	(-0.5)
Uganda	0.0	0.0	-0.6	(-0.1)
Tanzania	0.0	0.0	-0.5	(-0.4)
Zambia	0.0	0.0	0.1	(-0.3)
Zimbabwe	0.1	0.0	3.4	(0.5)
Rest of Africa	0.5	-3.8	0.2	(-1.5)
East and South Asia	***29.7***	***-4.9***	***0.9***	***(-0.1)***
China	3.3	0.5	0.2	(0.0)
Korea	14.0	0.2	2.8	(0.0)
Taiwan	1.0	0.0	0.4	(0.0)
Indonesia	0.5	0.0	0.2	(0.0)
Malaysia	4.2	-1.0	4.7	(-1.1)
Philippines	0.0	-0.5	0.1	(-0.7)
Thailand	3.3	-0.1	1.4	(-0.1)
Vietnam	1.9	-0.9	5.3	(-2.5)
Bangladesh	-0.2	-0.8	-0.4	(-1.7)
India	-0.8	-2.9	-0.2	(-0.6)
Pakistan	-0.1	-0.6	-0.2	(-0.8)
Sri Lanka	0.8	0.5	5.1	(3.1)
Rest of East and South Asia	1.9	0.8	1.4	(0.5)
Latin America	***15.8***	***2.5***	***1.0***	***(0.2)***
Argentina	3.2	-0.7	2.6	(-0.6)
Brazil	6.8	5.6	1.6	(1.3)
Chile	0.3	0.2	0.4	(0.3)
Colombia	2.2	0.7	3.1	(1.0)
Ecuador	2.0	1.1	8.2	(4.4)
Mexico	-0.7	-3.4	-0.1	(-0.6)
Nicaragua	0.0	0.0	1.3	(0.4)
Rest of Latin America	2.0	-1.0	0.5	(-0.3)
EEurope & Central Asia	***14.2***	***-3.6***	***1.2***	***(-0.3)***
Baltic States	0.5	0.1	1.8	(0.3)
Bulgaria	0.2	-0.2	1.4	(-1.4)
Czech Republic	1.0	-0.1	1.4	(-0.2)
Hungary	0.4	-0.1	0.6	(-0.1)

Poland	2.0	0.1	1.2	(0.1)
Romania	-0.1	-0.7	-0.3	(-1.9)
Slovakia	0.7	0.1	2.3	(0.4)
Slovenia	0.3	0.1	1.5	(0.3)
Russia	5.4	-3.1	1.2	(-0.7)
Kazakhstan	0.4	0.2	1.1	(0.6)
Turkey	1.3	-0.5	0.6	(-0.2)
Rest of EEurope & Central Asia	2.2	0.5	2.1	(0.4)
High-income countries	***102.8***	***11.3***	***0.5***	***(0.1)***
Australia	2.4	1.9	0.5	(0.4)
Canada	0.6	-1.2	0.1	(-0.2)
EU 15	56.8	-3.8	0.7	(0.0)
Japan	23.1	10.4	0.7	(0.3)
New Zealand	2.2	1.8	3.2	(2.6)
Rest of Western Europe	13.1	-0.1	2.7	(0.0)
United States	2.8	0.9	0.0	(0.0)
Hong Kong and Singapore	1.7	1.4	1.4	(1.1)
Developing countries	***64.9***	***-12.2***	***0.9***	***(-0.2)***
North Africa	0.9	-2.8	0.5	(-1.5)
Sub-Saharan Africa	0.0	-3.2	0.0	(-0.9)
East Asia	30.1	-1.0	1.1	(0.0)
South Asia	-0.4	-3.9	-0.1	(-0.6)
Latin America	15.8	2.5	1.0	(0.2)
Middle East	4.2	-0.2	0.8	(0.0)
EEurope & Central Asia	14.2	-3.6	1.2	(-0.3)
World total	***167.7***	***-1.0***	***0.6***	***(0.0)***

[a] Numbers in parentheses refer to that due to terms of trade effects.
Source: Authors' World Bank LINKAGE model simulations

Table 3: Regional and sectoral sources of welfare gains from full liberalization of global merchandise trade, 2004

(relative to the 2004 benchmark data in 2004 US dollars and percent)

	Gains[a] by region in $billion			**Percent of regional gain[b]**		
	Developing	*High-income*	*World*	*Developing*	*High-income*	*World*
Developing countries liberalize:						
Agriculture and light processing	35.6	4.7	40.3	30.1	9.4	24.0
Manufacturing and services	6.0	51.5	57.5	5.1	103.9	34.3
Total	41.6	56.2	97.7	35.2	113.3	58.3
High-income countries liberalize:						
Agriculture and light processing	62.6	-2.0	60.6	53.0	-4.0	36.1
Manufacturing and services	13.9	-4.6	9.3	11.8	-9.3	5.6
Total	76.5	-6.6	69.9	64.8	-13.3	41.7
All countries liberalize:						
Agriculture and light processing	98.2	2.7	100.9	83.1	5.4	60.1
Manufacturing and services	19.9	46.9	66.8	16.9	94.6	39.9
Total	118.1	49.6	167.7	70.4	29.6	100.0

[a] Small interaction effects are distributed proportionately and numbers are rounded to sum to 100 percent
[b] Percentage in last row refers to the total regional gain relative to the world total.

Source: Authors' World Bank LINKAGE model simulations

Table 4: Impact of full global liberalization on shares of global output exported, and developing country shares of global output and exports,[a] by product, 2004

(percent)

	Share of global output exported[a]		**Developing countries' share of global output**		**Developing countries' share of global exports[a]**	
	Benchmark	*Full Global liberalization*	*Benchmark*	*Full Global liberalization*	*Benchmark*	*Full Global liberalization*
Paddy rice	1	2	81	82	56	42
Wheat	16	22	67	71	25	39
Other grains	11	15	55	57	35	56
Oil seeds	21	28	69	74	54	68
Plant-based fibers	25	25	74	83	50	79
Vegetables and fruits	9	15	72	77	69	80
Other crops	14	17	49	49	75	62
Cattle sheep etc	2	2	43	48	56	59
Other livestock	4	4	65	67	43	46
Wool	13	14	82	81	16	18
Beef and sheep meat	7	21	27	41	31	68
Other meat products	7	12	32	34	42	45
Vegetable oils and fats	20	30	52	58	80	84
Dairy products	5	11	29	33	28	41
Processed rice	5	7	76	79	85	87
Refined sugar	8	42	52	85	78	90
Other food, beverages and tobacco	9	12	35	36	50	59
Other primary products	31	33	64	63	76	76
Textile and wearing apparel	28	35	53	57	74	77
Other manufacturing	24	26	32	31	43	43
Services	3	3	20	20	31	30
Agriculture and food	8	13	46	50	54	64
Agriculture	8	11	62	65	55	64
Processed foods	8	14	37	40	52	63

[a]excluding intra-EU trade.

Source: Authors' World Bank LINKAGE model simulations

Table 5: Impacts of full global trade liberalization on agricultural and food output and trade, by country/region, 2004

(relative to 2004 benchmark data, in 2004 billion US dollars and percent)

	$billion			Percent change relative to baseline		
	Output	**Exports**	**Imports**	**Output**	**Exports**	**Imports**
North and Sub Saharan Africa	***13.8***	***20.5***	***10.0***	***7.2***	***99.1***	***46.0***
Egypt	0.4	0.5	-0.1	2.2	39.2	-4.2
Madagascar	0.0	0.0	0.0	-0.4	2.7	-4.3
Mozambique	0.9	1.0	0.1	52.3	597.1	33.3
Nigeria	-0.5	0.4	0.7	-2.9	92.8	43.1
Senegal	0.0	0.0	0.0	-1.9	35.0	0.3
South Africa	0.7	0.9	0.8	2.4	26.7	42.9
Uganda	0.0	0.0	0.0	-0.6	1.3	1.5
Tanzania	0.0	0.2	0.1	-0.7	28.5	31.2
Zambia	0.1	0.1	0.0	5.2	22.3	35.9
Zimbabwe	0.4	0.3	0.1	25.7	38.0	39.2
Rest of Africa	12.0	17.0	8.3	10.5	133.1	64.3
East and South Asia	***25.0***	***39.5***	***24.7***	***2.7***	***83.4***	***36.7***
China	6.2	7.7	6.7	1.7	76.5	27.5
Korea	-1.0	1.0	6.2	-1.7	194.1	75.0
Taiwan	-1.9	0.3	1.5	-9.1	62.8	35.5
Indonesia	1.1	1.6	1.0	1.8	21.6	21.5
Malaysia	1.6	1.3	0.7	8.9	17.0	17.8
Philippines	1.1	1.9	0.8	3.5	120.5	35.0
Thailand	9.5	8.3	1.9	17.4	133.0	78.1
Vietnam	0.5	1.1	0.6	3.3	54.0	55.6
Bangladesh	-0.6	0.4	0.8	-2.4	261.2	38.3
India	1.1	9.0	1.4	0.5	131.2	24.2
Pakistan	-0.6	0.5	1.0	-1.3	45.0	43.0
Sri Lanka	-0.1	-0.1	0.6	-1.2	-18.2	69.3
Rest of East and South Asia	8.0	6.4	1.4	41.5	266.1	29.5
Latin America	***87.2***	***71.5***	***7.2***	***26.8***	***106.4***	***29.8***
Argentina	12.2	15.1	0.3	37.8	95.6	81.8
Brazil	45.8	25.7	2.1	45.3	100.7	94.8
Chile	0.5	0.4	0.2	4.7	11.3	15.8
Colombia	3.1	4.9	1.1	14.6	161.4	81.7
Ecuador	4.2	4.6	0.3	46.1	198.7	71.8
Mexico	-0.3	0.3	0.4	-0.4	5.8	4.3
Nicaragua	0.0	0.1	0.0	2.9	21.6	19.4
Rest of Latin America	21.6	20.4	2.8	25.7	175.9	30.4
EEurope & Central Asia	***-10.4***	***17.4***	***20.3***	***-2.6***	***79.7***	***77.6***
Baltic States	-1.2	-0.1	0.4	-16.9	-15.5	30.9
Bulgaria	4.2	2.6	0.6	6.6	366.5	118.1
Czech Republic	-2.2	-0.1	0.7	-12.0	-10.9	40.5
Hungary	-0.9	0.4	0.8	-6.0	17.1	66.6
Poland	1.7	2.5	2.5	3.9	80.7	88.8
Romania	-0.2	1.3	1.1	-1.0	190.5	78.3

Slovakia	-0.9	-0.1	0.4	-11.3	-12.0	64.1
Slovenia	-0.6	-0.1	0.2	-17.1	-54.1	26.2
Russia	-12.9	3.2	8.8	-13.1	179.4	98.9
Kazakhstan	1.5	1.4	0.0	11.8	142.9	11.6
Turkey	-2.0	2.3	2.9	-3.1	61.5	92.1
Rest of EEurope & Central Asia	3.0	4.1	2.0	7.7	71.3	53.4
High-income countries	***-233.2***	***-9.2***	***89.8***	***-13.1***	***-4.0***	***38.3***
Australia	12.0	7.0	0.2	19.8	41.2	11.1
Canada	-1.6	3.6	2.7	-2.4	24.1	32.8
EU 15	-190.9	-38.8	50.9	-21.2	-29.2	31.9
Japan	-39.1	0.4	16.8	-22.9	87.7	69.1
New Zealand	10.6	6.4	0.2	46.6	74.3	27.1
Rest of Western Europe	-11.6	11.7	9.8	-19.4	312.0	132.7
United States	-12.8	0.6	9.3	-2.6	1.1	32.4
Hong Kong and Singapore	0.1	0.0	0.1	2.1	6.3	1.6
Developing countries	***137.6***	***163.6***	***64.6***	***7.1***	***100.0***	***40.4***
North Africa	11.4	13.3	6.1	17.3	377.2	62.5
Sub-Saharan Africa	2.5	7.2	3.8	1.9	41.9	32.3
East Asia	25.1	29.5	20.8	4.0	77.4	37.4
South Asia	-0.1	10.0	3.9	0.0	108.3	33.2
Latin America	87.2	71.5	7.2	26.8	106.4	29.8
Middle East	22.0	14.8	2.5	21.5	222.7	12.1
EEurope & Central Asia	-10.4	17.4	20.3	-2.6	79.7	77.6
World total	***-95.7***	***154.4***	***154.4***	***-2.6***	***39.1***	***39.1***

Source: Authors' World Bank LINKAGE model simulations

Table 6: Impact of global liberalization on share of agricultural and food production exported by country/region, 2004

(percent)

	2004 benchmark data	Full global liberalization
Developing countries	***9.5***	***16.9***
North Africa	6.3	20.6
Sub-Saharan Africa	13.8	19.3
East Asia	8.4	15.1
South Asia	3.7	7.5
Latin America	18.1	28.2
Middle East	7.4	17.2
EEurope & Central Asia	6.8	11.1
High-income countries	***13.0***	***14.1***
World total	***11.4***	***15.4***

Source: Authors' World Bank LINKAGE model simulations

Table 7: Impact of global liberalization on self sufficiency[a] in agricultural and other products, by region, 2004

	High-income countries		**Developing countries**		**North and Sub Saharan Africa**		**Latin America**		**East Asia**		**South Asia**		**EEurope & Central Asia**	
	Benchmark	*Global lib*	*Benchmark*	*Global lib*	*Benchmark*	*Global lib*	*Benchmark*	*Global lib*	*Benchmark*	*Global lib*	*Benchmark*	*Global lib*	*Benchmark*	*Global lib*
Paddy rice	101	105	100	99	97	96	93	72	100	101	101	101	95	92
Wheat	141	140	88	89	67	46	80	98	68	65	100	98	102	117
Other grains	108	102	94	98	94	91	98	119	88	81	103	105	103	113
Oil seeds	104	92	97	103	104	130	140	167	66	51	100	101	106	115
Plant-based fibers	161	112	88	97	177	265	94	107	54	58	93	95	104	118
Vegetables and fruits	90	78	105	109	108	103	153	221	102	104	99	98	99	92
Other crops	90	91	113	110	138	138	143	133	110	104	104	104	90	88
Cattle sheep etc	100	100	100	100	101	99	102	102	98	97	100	100	102	102
Other livestock	101	101	100	100	101	100	101	100	99	99	100	100	99	98
Wool	161	180	92	91	103	104	103	102	78	75	96	93	96	99
Beef and sheep meat	101	85	97	134	96	102	108	183	83	77	126	652	95	85
Other meat products	100	99	100	103	92	85	121	143	101	103	96	95	96	93
Vegetable oils and fats	95	85	103	114	69	191	141	143	115	116	78	66	93	96
Dairy products	103	100	94	101	76	79	97	102	78	78	99	99	102	104
Processed rice	99	95	100	101	69	63	94	85	104	108	104	104	92	87
Refined sugar	98	41	102	133	95	100	131	227	98	196	96	91	98	70
Other food, bev. and tob.	99	97	103	105	101	100	108	112	105	113	106	94	100	98
Other primary products	76	76	122	122	180	189	148	155	84	82	75	69	115	116
Textile and wearing app.	81	76	123	128	98	91	104	91	144	155	144	153	101	95
Other manufacturing	101	102	98	96	77	74	96	91	106	105	90	89	95	95
Services	101	101	101	101	101	102	100	100	101	100	100	101	101	101
Agriculture and food	100	95	101	105	100	103	112	126	100	102	100	100	99	98
Agriculture	99	96	100	102	104	103	115	126	96	95	100	100	100	101
Processed foods	100	95	101	108	94	103	110	126	104	111	100	101	99	96

[a] Self sufficiency is defined as domestic production as a percentage of domestic consumption measured in value terms at fob prices.
Source: Authors' World Bank LINKAGE model simulations

Table 8: Share of production exported and of consumption imported by world, high-income and developing countries, before and after full global liberalization of all merchandise trade, by product, 2004

(percent)

	Share of production exported				Share of consumption imported			
	High-income countries[a]		Developing countries		High-income countries[a]		Developing countries	
	2004 benchmark	*Global lib.*	*2004 benchmark*	*Global lib.*	*2004 benchmark*	*Global lib.*	*2004 benchmark*	*Global lib.*
Paddy rice	3	7	1	1	2	3	1	2
Wheat	37	47	6	12	11	25	17	21
Other grains	15	16	7	15	9	14	11	15
Oil seeds	31	34	16	25	26	36	16	22
Plant-based fibers	50	31	17	24	18	22	26	25
Vegetables and fruits	10	13	9	15	18	30	4	7
Other crops	7	13	21	22	16	20	11	14
Cattle sheep etc	1	2	2	2	2	2	2	2
Other livestock	6	7	3	3	6	6	3	3
Wool	60	62	2	3	35	31	10	12
Beef and sheep meat	6	11	7	35	5	24	10	13
Other meat products	6	10	9	16	6	12	8	14
Vegetable oils and fats	8	11	31	43	12	24	26	34
Dairy products	5	10	4	14	2	10	10	14
Processed rice	3	4	5	8	4	9	5	7
Refined sugar	4	30	12	44	5	66	10	25
Other food, bev. and tob.	7	8	12	20	8	10	9	16
Other primary products	20	21	37	39	38	39	22	24
Textile and wearing app.	15	19	39	48	30	37	23	31
Other manufacturing	20	21	32	36	19	20	32	38
Services	3	3	5	4	2	2	5	5
Agriculture and food	7	9	9	17	8	13	8	12
Agriculture	9	11	7	11	10	15	7	9
Processed foods	6	9	12	23	7	13	10	16

[a] Excluding intra-EU trade

Source: Authors' Linkage model simulations

Table 9: Impact of full global liberalization on real international product prices, 2004

(percent relative to 2004 baseline)

	Agricultural policies	*All goods sectors' policies*
Paddy rice	6.9	6.6
Wheat	1.8	1.4
Other grains	2.6	2.7
Oil seeds	-2.2	-2.4
Sugar cane and beet	-1.1	-2.0
Plant-based fibers	4.7	2.9
Vegetables and fruits	2.4	1.8
Other crops	1.7	1.0
Cattle sheep etc	-0.2	-1.1
Other livestock	-1.2	-2.1
Raw milk	0.7	-0.2
Wool	3.5	3.3
Beef and sheep meat	5.6	4.6
Other meat products	1.3	0.6
Vegetable oils and fats	-1.4	-1.9
Dairy products	4.6	3.8
Processed rice	2.8	2.9
Refined sugar	2.5	1.3
Other food, beverages and tobacco	-1.7	-1.3
Textile and wearing apparel	0.3	-1.2
Other manufacturing	0.2	-0.2
Merchandise trade	0.3	-0.2
Agriculture and food	0.8	0.3
Agriculture	1.5	0.9
Agriculture and light processing	2.0	1.3

Note: Model numéraire is the export price index of high-income countries' manufactured exports

Source: Authors' World Bank LINKAGE model simulations

Table 10: Impacts of full global merchandise trade liberalization on real pre-tax factor prices, by country and region, 2004

(relative to the benchmark data, percent)

	Nominal change deflated by aggregate CPI			Real change in unskilled wages deflated by:		
	Skilled wages	**Capital[a] user cost**	**Land[a] user cost**	**Aggregate CPI**	**Food CPI**	**Food and clothing CPI**
North and Sub Saharan Africa	**4.7**	**4.3**	**0.1**	**4.4**	**5.8**	**6.9**
Egypt	3.2	1.7	3.4	2.3	2.2	2.9
Madagascar	2.0	-0.2	-0.3	-0.8	-0.8	-0.7
Mozambique	-0.2	4.3	-5.8	10.7	12.0	13.0
Nigeria	10.1	10.5	-1.3	3.2	7.7	8.6
Senegal	2.4	3.2	0.7	3.1	2.6	3.6
South Africa	1.8	2.4	-0.1	1.6	1.7	3.6
Uganda	2.2	0.7	-0.8	0.2	0.2	0.5
Tanzania	2.1	2.4	1.6	2.8	2.6	3.0
Zambia	2.6	3.2	0.7	3.0	3.1	3.5
Zimbabwe	6.7	11.8	23.1	13.6	15.9	16.8
Rest of Africa	6.2	5.5	1.1	6.4	7.2	8.5
East and South Asia	**3.4**	**3.0**	**-1.8**	**3.2**	**4.6**	**4.8**
China	1.9	2.0	3.6	2.6	1.6	2.1
Korea	7.1	6.5	-14.5	5.8	26.6	22.7
Taiwan	2.4	2.8	-11.8	3.3	10.9	10.3
Indonesia	0.7	0.7	0.1	1.4	1.5	1.8
Malaysia	10.7	10.2	3.6	11.1	32.3	29.2
Philippines	-1.0	1.4	7.2	8.5	9.2	9.4
Thailand	2.6	3.5	7.5	5.6	8.5	7.8
Vietnam	17.7	16.0	9.1	19.6	23.9	26.7
Bangladesh	2.1	2.8	2.8	3.3	4.5	5.3
India	2.1	0.2	-8.5	-1.9	-4.4	-3.8
Pakistan	3.9	3.5	1.5	3.8	3.3	3.5
Sri Lanka	0.1	14.1	0.9	3.0	4.8	4.8
Rest of East and South Asia	2.0	2.9	6.5	5.1	8.3	9.1
Latin America	**1.4**	**1.9**	**21.1**	**4.5**	**2.4**	**4.1**
Argentina	-3.1	4.1	43.6	8.8	4.9	7.2
Brazil	1.3	2.7	26.5	1.4	0.2	1.1
Chile	1.3	0.5	3.0	1.3	1.1	1.9
Colombia	-0.8	0.3	30.2	6.0	4.4	5.6
Ecuador	2.1	-1.2	61.7	15.1	12.1	13.9
Mexico	0.5	0.5	2.3	0.8	-2.3	0.9
Nicaragua	1.9	2.5	2.1	3.8	3.9	4.7
Rest of Latin America	0.8	1.5	18.0	5.4	4.9	6.1
Europe & Central Asia	**3.2**	**2.6**	**-4.5**	**1.7**	**4.2**	**4.5**
Baltic States	3.9	2.0	-9.8	1.3	5.6	5.0
Bulgaria	0.3	1.6	5.9	2.5	1.8	2.3
Czech Republic	2.4	1.5	-26.1	0.7	3.9	3.3
Hungary	2.2	1.1	-19.9	-1.0	1.6	1.4

Poland	3.9	2.6	-24.6	0.5	5.2	4.6
Romania	4.5	3.5	-3.4	3.4	4.5	5.7
Slovakia	2.9	2.2	-15.9	1.0	4.9	4.0
Slovenia	2.3	1.8	-17.2	1.3	4.9	4.2
Russia	3.9	3.8	-1.9	2.5	4.3	5.1
Kazakhstan	1.0	1.4	14.0	3.0	2.4	3.3
Turkey	2.1	1.4	-3.4	0.4	1.8	1.8
Rest of EEurope & Central Asia	3.7	4.2	12.7	6.3	9.7	10.3
High-income countries	**1.0**	**0.5**	**-17.9**	**0.2**	**3.3**	**3.3**
Australia	0.4	0.8	9.4	1.3	0.0	1.6
Canada	0.5	0.4	6.3	0.4	1.7	2.7
EU 15	1.7	0.6	-39.5	-0.1	4.2	3.6
Japan	1.7	1.2	-29.3	0.9	6.5	6.0
New Zealand	-1.2	1.5	34.8	5.9	6.2	7.3
Rest of Western Europe	3.1	3.1	-50.6	0.8	19.3	14.0
United States	0.2	0.1	-2.9	-0.1	-2.0	0.0
Hong Kong and Singapore	0.3	0.8	0.4	2.2	1.8	2.4
Developing countries	**3.0**	**2.9**	**1.6**	**3.5**	**5.5**	**5.9**
North Africa	7.7	5.3	-0.5	7.0	9.3	10.4
Sub-Saharan Africa	3.2	3.8	0.2	3.2	4.4	5.3
East Asia and Pacific	3.4	3.3	1.9	4.0	6.9	6.9
South Asia	2.3	1.2	-6.2	-0.6	-2.5	-1.9
Latin America	1.4	1.9	21.1	4.5	2.4	4.1
Middle East	2.9	4.7	43.8	8.3	17.0	16.5
EEurope & Central Asia	3.2	2.6	-4.5	1.7	4.2	4.5
World total	**1.3**	**1.2**	**-3.1**	**0.9**	**3.6**	**3.8**

[a] The user cost of capital and land represents the subsidy inclusive rental cost.

Source: Authors' World Bank LINKAGE model simulations

Table 11: Effects of full global liberalization of agricultural and all merchandise trade on sectoral value added (GDP), by country and region, 2004

(relative to benchmark data)

	billion US dollars				Percent			
	Agricultural policies		*All sectors' policies*		*Agricultural policies*		*All sectors' policies*	
	Agric	Non-agric	Agric	Non-agric	Agric	Non-agric	Agric	Non-agric
North and Sub Saharan Africa	**0.1**	**5.1**	**-0.9**	**-0.2**	**0.1**	**0.8**	**-0.9**	**0.0**
Egypt	0.1	0.2	0.0	-0.7	1.3	0.4	-0.1	-1.1
Madagascar	0.0	0.0	0.0	-0.1	-3.2	0.1	-3.4	-3.1
Mozambique	0.3	0.0	0.3	0.0	23.6	0.6	22.7	0.1
Nigeria	-0.6	0.2	-1.2	-0.8	-4.8	0.5	-9.3	-1.7
Senegal	0.0	0.0	0.0	0.0	1.5	-0.8	-1.1	-0.8
South Africa	-0.2	0.7	-0.1	0.1	-2.7	0.4	-0.7	0.1
Uganda	-0.1	0.0	-0.1	-0.1	-1.6	-0.4	-2.9	-1.6
Tanzania	0.0	0.0	0.0	-0.1	0.6	-0.3	-0.3	-1.3
Zambia	0.0	0.0	0.0	0.0	0.7	0.5	0.6	0.6
Zimbabwe	0.1	0.0	0.2	0.2	24.2	0.8	38.9	4.9
Rest of Africa	0.5	3.9	0.0	1.4	0.7	1.4	0.1	0.5
East and South Asia	**-1.4**	**24.4**	**2.0**	**100.7**	**-0.3**	**0.7**	**0.5**	**2.9**
China	4.6	2.5	9.4	37.5	2.8	0.2	5.7	3.0
Korea	-4.0	7.2	-3.2	31.3	-18.7	1.2	-15.1	5.4
Taiwan	-0.5	0.8	-0.5	10.1	-11.3	0.3	-9.9	3.7
Indonesia	0.3	1.1	0.2	2.7	1.1	0.5	0.8	1.2
Malaysia	-0.2	0.9	-0.1	4.0	-6.3	0.8	-2.0	3.8
Philippines	1.7	0.3	1.9	1.0	13.8	0.5	15.6	1.7
Thailand	2.9	2.7	3.0	7.3	14.0	1.0	14.3	2.8
Vietnam	1.4	0.0	1.2	4.5	22.8	0.0	18.8	15.6
Bangladesh	-0.2	0.4	-0.3	-2.1	-2.6	0.9	-3.8	-4.4
India	-7.8	6.3	-10.6	-1.3	-6.1	1.4	-8.3	-0.3
Pakistan	-0.2	-0.1	-0.1	0.2	-1.0	-0.1	-0.5	0.2
Sri Lanka	0.0	0.0	0.3	1.3	0.0	0.1	7.1	9.6
Rest of East and South Asia	0.6	2.3	0.7	4.3	9.6	1.4	11.2	2.7
Latin America	**40.0**	**42.2**	**40.7**	**34.6**	**36.3**	**2.8**	**37.0**	**2.3**
Argentina	12.4	8.1	10.9	15.1	116.8	7.4	103.5	13.8
Brazil	12.2	22.7	13.0	21.3	40.1	4.4	42.6	4.2
Chile	0.2	0.3	0.2	0.7	5.0	0.3	5.5	0.9
Colombia	5.0	2.1	5.0	1.2	53.5	2.7	53.5	1.5
Ecuador	2.6	2.9	2.9	1.7	113.1	11.4	126.0	6.7
Mexico	-0.2	0.6	0.1	-3.4	-1.0	0.2	0.3	-1.0
Nicaragua	0.0	0.0	0.0	0.1	3.0	1.4	2.4	2.3
Rest of Latin America	7.9	5.5	8.6	-2.1	26.3	1.5	28.7	-0.6
EEurope & Central Asia	**-5.2**	**4.4**	**-6.2**	**4.4**	**-4.4**	**0.3**	**-5.2**	**0.3**
Baltic States	-0.1	0.1	-0.1	0.2	-7.5	0.3	-8.9	0.5
Bulgaria	0.3	-0.1	0.4	0.1	5.1	-0.4	5.6	0.3
Czech Republic	-0.7	0.4	-0.7	-0.3	-19.2	0.4	-20.9	-0.3
Hungary	-0.7	0.3	-0.7	-0.1	-16.8	0.4	-17.9	-0.1
Poland	-2.4	2.1	-2.5	1.7	-21.8	1.1	-22.6	0.9
Romania	-0.3	0.2	-0.5	0.3	-3.7	0.4	-5.8	0.5

Slovakia	-0.1	0.1	-0.1	0.1	-11.8	0.2	-13.5	0.4
Slovenia	0.0	0.1	0.0	0.1	-9.2	0.4	-11.1	0.4
Russia	-2.2	-0.7	-2.3	-1.3	-6.3	-0.2	-6.6	-0.3
Kazakhstan	0.5	0.4	0.5	0.5	23.1	1.1	23.0	1.2
Turkey	-1.0	0.9	-1.5	0.9	-3.2	0.4	-4.7	0.4
Rest of EEurope & Central Asia	1.5	0.5	1.5	2.1	11.1	0.4	11.1	1.8
High-income countries	**-55.1**	**61.9**	**-58.5**	**28.6**	**-13.8**	**0.2**	**-14.7**	**0.1**
Australia	2.2	8.4	2.7	11.7	10.9	1.5	13.7	2.1
Canada	0.4	2.5	0.7	-4.6	3.4	0.3	5.3	-0.5
EU 15	-42.9	16.7	-47.4	-45.9	-23.0	0.2	-25.4	-0.4
Japan	-7.6	4.5	-7.6	93.2	-16.7	0.1	-16.8	2.3
New Zealand	2.7	4.1	2.7	4.4	57.7	5.0	57.2	5.4
Rest of Western Europe	-3.6	6.5	-3.6	-8.4	-25.8	1.0	-25.8	-1.3
United States	-6.4	18.6	-6.0	-25.2	-5.7	0.2	-5.3	-0.2
Hong Kong and Singapore	0.0	0.6	0.0	3.4	3.7	0.4	2.2	2.1
Developing countries	**42.7**	**79.5**	**44.4**	**145.6**	**5.4**	**1.0**	**5.6**	**1.9**
North Africa	-0.1	3.9	-0.3	1.8	-0.4	1.8	-1.1	0.8
Sub-Saharan Africa	0.2	1.2	-0.6	-2.0	0.3	0.3	-0.8	-0.5
East Asia	6.8	17.7	12.6	102.8	2.6	0.6	4.7	3.5
South Asia	-8.2	6.7	-10.7	-2.1	-5.1	1.1	-6.7	-0.3
Latin America	40.0	42.2	40.7	34.6	36.3	2.8	37.0	2.3
Middle East	9.2	3.3	8.9	6.1	26.3	0.5	25.4	0.9
EEurope & Central Asia	-5.2	4.4	-6.2	4.4	-4.4	0.3	-5.2	0.3
World total	**-12.4**	**141.4**	**-14.2**	**174.2**	**-1.0**	**0.4**	**-1.2**	**0.5**

Source: Authors' World Bank LINKAGE model simulations.

Table 12: Poverty effects of full global liberalization of merchandise trade reform, by region, 2004

(a) the benchmark

	Benchmark				**Poverty elasticities**	
	\$1/day		\$2/day		\$1/day	\$2/day
	Headcount (%)	*Number of poor* million	*Headcount* (%)	*Number of poor* million		
East Asia	9	169	37	684		
China	10	128	35	452	-1.9	-1.3
Other East Asia	9	41	50	232	-3.7	-2.1
South Asia	31	446	77	1116		
India	34	371	80	868	-1.1	-0.5
Other South Asia	29	76	94	248	-2.5	-0.7
East Europe & Central Asia	1	4	10	46	-1.7	-1.7
Middle East & North Africa	1	4	20	59	-2.5	-2.3
Sub Saharan Africa	41	298	72	522	-0.7	-0.5
Latin America	9	47	22	121	-1.7	-1.1
Developing country total	**18**	**969**	**48**	**2548**		
Developing excl China	21	841	52	2096		

Table 12 (continued)

(b) Assuming all get average income gain

		$1/day		$2/day		Change in no. of poor	
	Avg. income change, real (%)	Headcount (%)	Number of poor million	Headcount (%)	Number of poor million	$1/day million	$2/day million
East Asia	*1.1*	9	166	36	675	-2.9	-8.9
China	*0.2*	10	128	35	451	-0.6	-1.4
Other East Asia	*1.9*	8	38	49	224	-2.3	-7.5
South Asia	*-0.1*	31	446	77	1116	0.1	0.3
India	*-0.2*	34	371	80	868	0.6	0.7
Other South Asia	*0.3*	29	75	94	248	-0.5	-0.4
East Europe & Central Asia	*1.2*	1	4	10	45	-0.1	-1.0
Middle East & North Africa	*0.7*	1	4	19	58	-0.1	-1.0
Sub Saharan Africa	*0.0*	41	298	72	522	0.0	0.0
Latin America	*1.0*	9	46	22	119	-0.8	-1.3
Developing country total	*0.9*	18	966	47	2536	-3.7	-12.0
Developing excl China	*1.1*	21	838	51	2085	-3.1	-10.6

(c) Focus on gain in real earnings of unskilled workers

		$1/day		$2/day		Change in no. of poor	
	Avg. income change, real[a] *(%)*	Headcount (%)	Number of poor million	Headcount (%)	Number of poor million	$1/day million	$2/day million
East Asia	*4.4*	8	151	34	632	-17	-52
China	*2.1*	9	123	34	440	-5	-12
Other East Asia	*8.1*	6	29	42	192	-12	-40
South Asia	*-1.9*	32	454	78	1124	8	8
India	*-3.8*	36	386	82	883	15	15
Other South Asia	*4.0*	26	68	92	241	-8	-7
East Europe & Central Asia	*4.5*	1	4	9	43	-0	-4
Middle East & North Africa	*14.3*	1	3	13	40	-2	-19
Sub Saharan Africa	*5.3*	39	287	70	508	-11	-14
Latin America	*4.1*	8	44	21	115	-3	-6
Developing country total	***5.9***	**18**	**944**	**46**	**2462**	**-26**	**-87**
Developing excl China	*6.5*	20	820	50	2022	-21	-74

Source: Authors' World Bank LINKAGE model simulations. [a] Nominal unskilled wage deflated by the food and clothing CPI