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Free Trade in Agriculture and Global Poverty

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1. INTRODUCTION

In most cases, trade liberalisation is welfare increasing, but it also brings about large income redistribution. While the empirical literature generally finds the aggregate gains to be small – on the order of a few percentage points of initial GDP – 'the [static] efficiency consequences of trade reform pale in comparison with its redistributive effects' (Rodrik, 1998). These effects often create complicated policy challenges both at the domestic and at the international levels because, in most cases, losers tend to be a smaller and more vocal group than winners.[1] The recent collapse of the Doha Round is an example of such tensions, with disputes over the reduction of agricultural distortions stalling the progress of the entire negotiations.

Resolving the current impasse could not only imply a solution to the distributional tension between countries – reconciling the demands of developing and agriculture exporting countries on one side and (mainly) high-income countries with large domestic support on the other – but also narrow income disparities *within* countries by reducing or eliminating the urban bias in the protection

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[1] According to Anderson and Martin (2005), self-interested vocal groups lobbying hard for excluding agricultural liberalisation from multilateral negotiations include 'not just farmers in the highly protecting countries and net food importing developing countries but also those food exporters receiving preferential access to those markets including holders of tariff rate quotas, members of regional trading agreements and parties to non-reciprocal preference agreements including all least-developed countries'.

structure of many developing nations.[2] This paper, using an *ex-ante* simulation analysis, assesses the likelihood of these developments by addressing the following three questions: (i) What is the likely reduction in global inequality if all agriculture trade distortions are removed? (ii) To what extent can this reduction be attributed to inequality changes between countries and within countries? (iii) What happens to global poverty and to poverty incidence in specific countries? A major result of this paper is that while the global impacts are generally mild, the likely changes at the country and regional level are much more pronounced, therefore highlighting the need for global coordination.

The paper is organised as follows. The next section presents the data used in the analysis and establishes some basic facts about the structure of global poverty and global income distribution. Section 3 discusses the methodology behind the analysis, and Section 4 presents the results. Section 5 concludes with some final remarks.

2. WHAT IS AT STAKE? THE INITIAL POSITION OF FARMERS AND THE POTENTIAL BENEFITS OR COST OF AGRICULTURAL DISTORTIONS

Almost 45 per cent of the population in the world lives in households where agricultural activities represent the main occupation of the head. And a large share of this agriculture-dependent group, close to 32 per cent, is poor. Agriculture households contribute disproportionably to global poverty: three out of every four poor people belong to this group (see Table 1). So changing economic opportunities in agriculture can significantly affect global poverty and inequality. The specific opportunity considered in detail here is the removal of agricultural trade barriers. Direct effects of this liberalisation will be changes in the international prices of agricultural products and in the returns of factors used intensively in agriculture with these changes determining winners and losers. Before considering these effects in detail, this section describes what is at stake by considering the socioeconomic characteristics of the agricultural population.

This initial descriptive analysis is based on the Global Income Distribution Dynamics (GIDD) data set that has been recently developed at the World Bank.[3] The GIDD data set consists of 73 detailed household surveys for low- and middle-income countries, complemented with more aggregate information

[2] Krueger et al. (1991) is perhaps the most well-known study documenting this anti-agriculture bias in developing counties. For 18 countries included in the study, policy interventions induced a 30 per cent decline in a price index of agricultural products relative to a non-agricultural price index. In fact, a key motivation for the current study is to revisit these former estimates and assess where the anti-agriculture bias stands now.

[3] The description of the data set may be found at the following website: http://www.worldbank.org/prospects/gidd

TABLE 1
Poverty is Higher among Agricultural Households even if Their Incomes are Less Unequal

	Gini (%)	*Pop Shares (%)*	*Average Monthly Income (2000, US Purchasing Power Parity)*	*1-dollar Poverty Incidence (%)*	*Poverty Share (%)*
Agriculture	44.9	44.8	65.4	31.7	75.9
Non-agriculture	62.8	55.2	328.9	8.1	24.0
World	67.0	100	210.8	18.7	100

Source: Global Income Distribution Dynamics database (http://www.world-bank.org/prospects/gidd).

on income distribution for 25 high-income and 22 developing countries.[4] Together, data on these 120 countries cover more than 90 per cent of the global population. Country coverage varies by region: while the GIDD data set includes more than 97 per cent of population in East Asia and Pacific, Eastern Europe and Central Asia, Latin America, and South Asia, coverage in sub-Saharan Africa and Middle East and North Africa is limited to 76 and 58 per cent of population, respectively. Among the detailed surveys, the majority (54) use per capita consumption as the welfare indicator, while the remaining surveys – all but one for countries in Latin America – include only per capita income as a measure of household welfare. Both income and consumption data are monthly; the data are standardised to the year 2000 and are expressed in 1993 purchasing power parity (PPP) prices for consistency with the 1- and 2-dollar-a-day poverty lines, which are calculated at 1993 PPP exchange rates.[5]

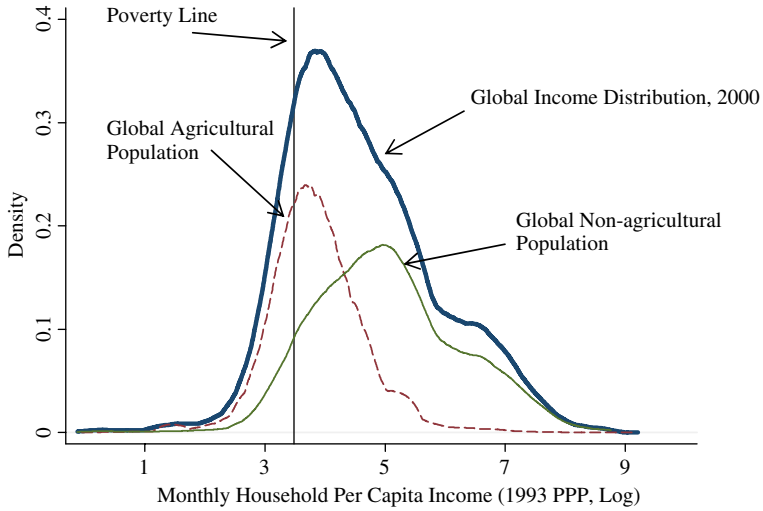
Three facts about the agricultural sector determine the overall welfare effects of a global-scale removal of agricultural distortions: (i) the proportion of the world population whose real incomes depend on the agricultural sector; (ii) the initial position of the agricultural population in the global income distribution; and (iii) the dispersion of incomes among the agricultural population.[6] Using

[4] This more aggregate information usually consists of 20 data points for each country, with each data point representing the average per capita income (or consumption) of 5 per cent of the country's population. In the absence of full survey data, using these 'vintile' data provides a close approximation to most economy-wide measures of inequality.

[5] The adjustment procedure for expressing welfare indicators in 1993 international dollars (PPP) is as follows. First, for countries with a survey year different than 2000, the welfare indicator (household per capita income or consumption) is scaled to the year 2000 using the cumulative growth in real income per capita between the survey year and 2000. Then, the welfare indicator is converted to 1993 national prices by multiplying the welfare indicator by the ratio of consumer price index (CPI) in 1993 to the CPI in the survey year. Finally, the welfare indicator is converted to 1993 international prices by multiplying the outcome of the previous calculations by the 1993 PPP exchange rate.

[6] The estimates of the welfare effects of a global agricultural liberalisation will also depend on the pattern of initial distortions (tariffs and subsidies) and, at least in the short term where no adjustment is possible, on the number of net consumers and net producers. Notice that, as explained in Section 3, our methodology allows for adjustments in the patterns of production (employment by sector changes) and consumption and thus consider the longer term.

FIGURE 1
Identifying the Agricultural Population in the Global Income Distribution



the GIDD data set, Figure 1 shows a kernel density for the global income distribution of household per capita income/consumption and kernel *densities* for incomes/consumption of the population in and out of the agricultural sector, respectively.[7] The area below the kernel *density* for the agricultural sector is equal to 0.45, showing that 45 per cent of the world population relies on agriculture for its livelihood. The distribution of the agricultural population is located to the left of the non-agricultural distribution implying that households in the agricultural sector earn, on average, lower incomes than their counterparts in other sectors. In PPP US dollars, the average agricultural household's per capita monthly income is 65 dollars, just 20 per cent of the 329 dollars of per capita income earned by the average households in the non-agriculture group, see Table 1. The differences in shape between the two distributions corroborates what Kuznets hypothesised more than 50 years ago, i.e. incomes in the traditional sector are less dispersed than in the modern industries. A more egalitarian traditional sector is depicted in the form of a taller and thinner distribution for agricultural population in Figure 1.

Income inequality can be estimated from the global income distribution data depicted in Figure 1. The Gini index for the world is equal to 67 per cent, which denotes a high level of inequality. In fact, the global Gini is about 28

[7] The distributions for the agricultural and non-agricultural populations are not, strictly speaking, density functions since the area below the curve do not add to 1. The densities of the agricultural and non-agricultural population had been rescaled so that the area under the curve represents the proportion of the world population within these two groups.

points worse than that of the United States and even higher than the level observed in extremely unequal countries such as Mexico. As Bourguignon et al. (2004) noted 'if the world were a country, it would be among the most unequal countries of the world'. How much of this inequality can be explained by the disparity on average incomes between the agricultural group and the rest? Inequality decomposition analysis shows that a quarter of global income disparities can be explained by the difference in average incomes between the two groups of households and the remaining three-quarters are due to within group income variation.

Based on the pre-established poverty line of 1 dollar (PPP) per day, the GIDD global income data also provide information about the differences in poverty incidence among the two population subgroups. Despite the fact that incomes are better distributed among the agricultural population (the Gini coefficient is 18 points lower in agriculture), lower average incomes in this sector result in higher poverty incidence: 31.7 per cent of agricultural households are poor versus 8.1 per cent among the non-agricultural households.

In terms of personal characteristics of the poor in and out of the agricultural sector, Table 2 shows that no noticeable differences are observed on the average age of the head and household size. However, poor people in agriculture tend to have lower education levels: just below a third of them has completed primary education. In agriculture, poor households headed by a woman are a small minority, close to 8 per cent, significantly below the 14 per cent observed in the non-agriculture segment (see Table 2).

Up to this point, the welfare information on agricultural and non-agricultural populations has been derived by agglomerating all households within these two groups irrespectively of their nationality. In fact, the kernel *densities* in Figure 1 exploit full income heterogeneity across households including variations between and within countries. Countries display large differences in terms of their population size, their level of development and the importance of the agricultural sector in their economies. These three country-specific characteristics are important determinants of the change of global poverty and global inequality. Clearly, as shown by Figure 2, global poverty would be strongly reduced in cases where China and India move towards higher income levels. Given their initial large share of global population and their position in the global income distribution, the economic expansion of these two giants is a key factor shaping the evolution of the world economy.[8] Figure 2 also depicts a negative relationship between income levels and share of workers in agriculture, and although this relationship is imperfectly inferred from a cross-section of countries at a particular point in time, it still suggests that profound structural shifts

[8] For a specific analysis of the importance of China and India for global growth and income distribution, see Bussolo et al. (2007).

TABLE 2
Characteristics of the Poor (for Developing Countries Only)

Sector of Employment	*Primary School Completed (%)*	*Age*	*Household Size*	*Female Headed (%)*
Agricultural	32.29	44.7	7.0	8.7
Non-agricultural	45.43	44.5	7.0	14

Notes:
(1) Primary school completed and age refers to the household head.
(2) Using data from the Global Income Distribution Dynamics.

will likely affect income distribution within countries. Clearly, the development challenges of a transition from an agriculture-based economy towards a more industrialised one, or even the management of the shocks originating from (agriculture) trade policy reform differ enormously across countries. Given the large variation in the proportion of the population whose incomes depend on the agricultural sector, the income effects following a removal of agricultural distortions would be highly different *between countries*.

An important element hidden in Figure 1 is the degree of cross-country variation in income inequality. Figure 3 shows that the difference in the Gini coefficient between countries is enormous, with former communist countries like Romania and Hungary showing an index below 0.3, whereas in highly unequal countries such as South Africa and Mozambique, the index reaches values above 0.6. Once again, the tendency of higher inequality within the non-agriculture

FIGURE 2
Income Levels and Employment in Agriculture: A Negative Cross-Section Relationship

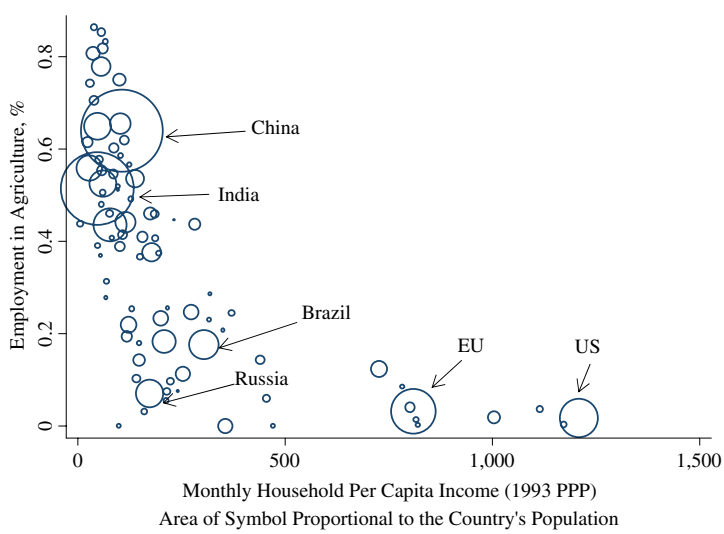
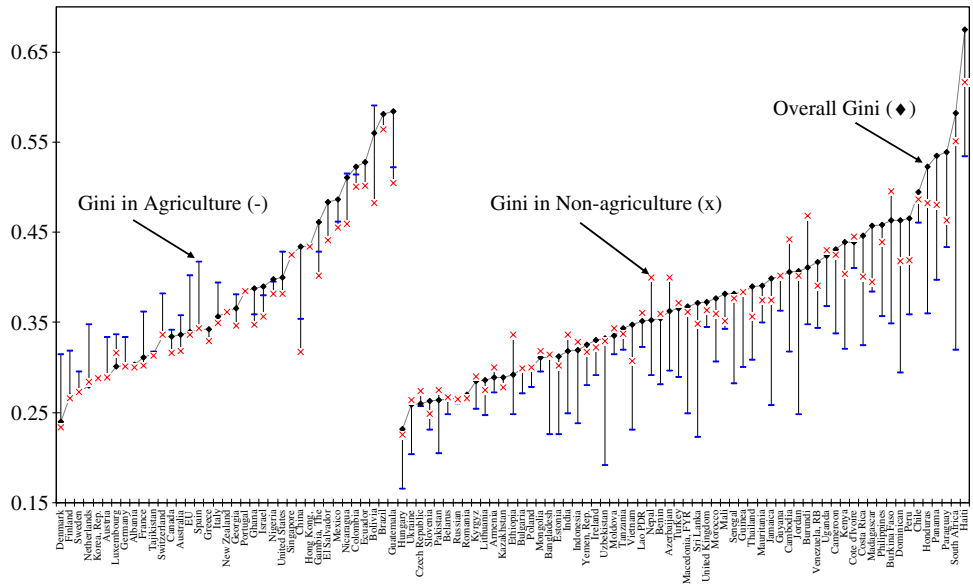


FIGURE 3
Inequality Variation Across Countries and Sectors



Note:
Authors calculations based on Global Income Distribution Dynamics data set using developing countries information only.

group observed at the global level is corroborated by the analysis of country-specific inequality. For more than three-quarters of the countries included in our data (56 of 73), Gini indicators of inequality within the non-agricultural group are higher than those of the agricultural group (Figure 3).

A global trade reform removing agricultural distortions is expected to reallocate resources between agricultural and non-agricultural sectors at the international level and within national states. Given global variations in: (i) the importance of the agricultural sector; (ii) the agriculture to non-agriculture income premium; and (ii) the within-sector income inequality, the resource reallocation following trade reform will have significant distributional effects *between and within countries*. Can economic theory provide some guidance on the expected global welfare effects following the removal of agricultural distortions?

3. METHODOLOGY

According to Winters (2000), Hoekman et al. (2002) and McCulloch et al. (2002), trade liberalisation and household welfare are linked via prices, factor

markets and consumer preferences. International prices of agricultural products will, most likely, increase as a result of the removal of agricultural trade barriers such as subsidies and tariffs (Anderson, 2003). Assuming some degree of pass-through, the increase in international prices will be followed by a rise in domestic agricultural prices enhancing a redistribution of resources from non-agricultural to the agricultural sector of the economy. Based on Figure 1, such redistribution could help reduce global poverty and inequality. However, household consumption patterns will also change as a result of the shift in prices, making the link between agricultural trade liberalisation and global household welfare a complex one. Finally, factor prices will also change after trade liberalisation, changing real incomes of households that are not directly involved in agricultural production.

The transition from trade theory to real-world analysis presents serious challenges. A sound empirical strategy has to estimate the effects of the reform on: prices, monetary incomes (via profits in the case of farm households and returns to factors of production for non-farm households), consumption and transfers.[9] The framework used in this paper, and described in more details below, accounts for the impact of agricultural trade liberalisation through changes in consumer welfare because of changes in prices of final products, changes in household incomes as a result of changes in returns to factors of production and sectoral allocation of labour in agricultural and non-agricultural sectors.

The empirical analysis in this paper relies on the GIDD data and methodology.[10] The GIDD, developed at the Development Economic Prospects Group of the World Bank, combines a consistent set of price and volume changes from a global computable general equilibrium (CGE) model with microdata at the household level to create a simulated or counterfactual income distribution capturing the welfare effects of the policy under evaluation.[11] Therefore, the GIDD has the ability to map CGE-consistent macroeconomic outcomes to disaggregated household survey data.

The GIDD's framework is based on microsimulation methodologies developed in the recent literature, including Bourguignon and Pereira da Silva (2003); Chen and Ravallion (2003); Ferreira and Leite (2003, 2004); and Bussolo et al. (2005). The starting point is the global income distribution in 2000, assembled using data from household surveys.[12] The 'simulated'

[9] For an empirical application of trade's effect on Mexican household welfare taking into account these effects, see Nicita (2004).
[10] A detailed methodological description of the GIDD can be found in Bussolo et al. (2010), as well as in the GIDD website referenced earlier.
[11] The GIDD uses the LINKAGE model as the global CGE framework; see van der Mensbrugghe (2005) for a detailed description of LINKAGE.
[12] Throughout the paper, when we talk about the global distribution, we are indeed referring to the GIDD's sample covering 92 per cent of the world population.

distribution is then obtained by applying three main exogenous changes to the initial distribution: (i) shifts in the sectoral composition of employment; (ii) economic growth, including changes in relative wages across skills and sectors; and (iii) changes in real income derived from the shifts in food prices.

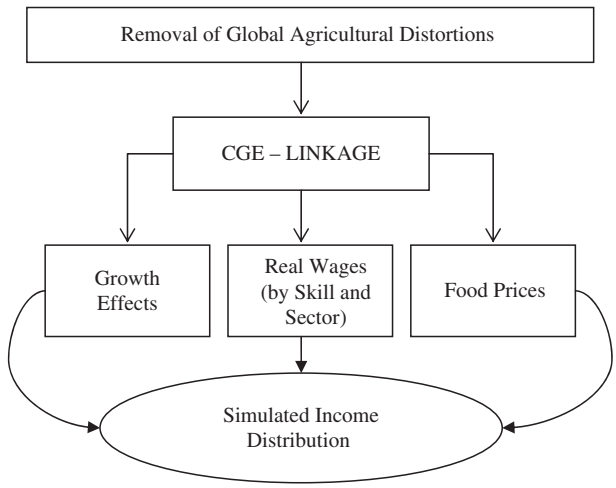
The empirical framework is depicted in Figure 4. The starting point is the price and quantity effects following the removal of agricultural distortions, which are computed using the global CGE model (top part of Figure 4). The CGE will compute the values of the three variables linking the macro- and microlevels of the model (middle part of Figure 4): overall economic growth, real wage premiums among agricultural/non-agricultural and skilled/unskilled groups, and the consumption (or real income) effects brought about by the change in relative price of food. These CGE results are passed-on to the household survey data, creating a new, simulated household income distribution (bottom link in Figure 4). Distribution and poverty comparisons between the initial and the counterfactual income distributions will capture the welfare effects of the removal of global agricultural distortions. By taking into account labour market (returns to skills in and out the agricultural sector) and consumption effects while evaluating macropolicies, GIDD's framework closely maps the theoretical linkages outlined above.[13]

In the real world, the changes depicted in Figure 4 take place simultaneously, but in the GIDD's simplified framework, they are accommodated in a sequential fashion. In the first step, consistent with an overall growth rate of real income per capita, changes in labour remuneration by skill level and sectoral location are applied to each worker in the sample depending on their education and sector of employment. In the second step, real household incomes are affected by the change in the price of food versus non-food; households with a higher share of household income allocated to food consumption will bear the larger impact after a change in the price of food.

The sequential changes described earlier reshape national income distribution under a set of strong assumptions. In particular, income inequality within population subgroups formed by skills and sector of employment is assumed to remain constant after the trade reform. Moreover, data limitations affect estimates of the initial inequality and its evolution. Although consumption expenditure is a more reliable welfare measure than income, and its distribution is normally more equal than the distribution of income, consumption data are not available for all countries' surveys. To get a global picture, this study had to include: countries for which only income data were available and countries with consumption information. Finally, measurement errors implicit in purchasing power parity exchange rates, which have been used to convert local currency units, also affect

[13] The GIDD does not take into account the welfare impacts via changes in transfers resulting from the trade reform.

FIGURE 4
Global Income Distribution Dynamics Methodological Framework



comparability across countries. The resulting simulated income distribution should thus not be seen as a *forecast* of what the future distribution might look like; instead, it should be interpreted as the result of an exercise that captures the *ceteris paribus* distributional effect of agricultural trade liberalisation.

4. WHAT HAPPENS TO POVERTY AND INCOME DISTRIBUTION WHEN AGRICULTURE TRADE DISTORTIONS ARE REMOVED?

In this section, we link the macro-outcomes of global agricultural trade reform to the changes in the distribution of income *between* and *within* countries. Our analysis is carried out in three stages. First, we briefly examine the macroeconomic results of the LINKAGE model, focusing on the variables that are used to change the household survey data. Second, we consider the income distribution results from a global perspective, quantifying the likely changes in global poverty and inequality and identifying groups of countries and individuals that are likely to benefit the most (least) from agricultural trade reform. Thirdly, we assess the potential trends in the distribution of income within countries, identifying countries where inequality pressures may heighten and thus erode support for additional reforms.

a. Macroeconomic General Equilibrium Results

The LINKAGE simulation analysis has been carried out with the 7.0 pre-release of the GTAP database, which disaggregates global trade into bilateral

flows between 101 countries/regions in 57 commodity groups. The base year for the simulations is 2004, and the data take into account changes in the global trade and tariff structure owing to the implementation of the Uruguay Round commitments, the EU enlargement, China's accession to the WTO and implementation of most major preferential trade agreements. The model is solved in a comparative static mode, which means that simulations are implemented as one-time shocks and do not take into account potential growth effects through changes in capital accumulation rates or variations in productivity.

Our main simulation envisions the full removal of import tariffs and export taxes/subsidies on agriculture and food products around the globe. The liberalisation schedule includes 17 of 57 commodities in GTAP, and the initial level of protection by exporter is shown in Table 3.[14,15]

Because of the removal of barriers to trade in agriculture and food products, global consumption rises by 0.29 per cent, two-thirds of the improvement expected under a full trade liberalisation scenario where tariff for all good are eliminated. Low- and middle-income countries gain more than the average, with consumption rising by 0.47 per cent in the developing world compared to 0.24 per cent for high-income countries. Following the removal of agricultural distortions, 50 of 60 LINKAGE country/regions – representing nearly 95 per cent of the world – experience positive changes in consumption (Figure 5).

There are three main channels that transmit the trade reform shocks to household consumption in the LINKAGE model and help explain the heterogeneity of the results in Figure 5. The first channel is the changes in the terms of trade, the ratio of export prices to import prices without taking into account domestic price distortions (i.e. own import tariffs and export taxes/subsidies). Net exporters of agriculture and food, such as Brazil, Ecuador and New Zealand, reap significant welfare gains when the world export prices of these commodities rise by 8, 19 and 11 per cent, respectively.[16] On the other hand, net importers of food, such as China, Mexico and Senegal, experience real consumption losses because of higher import prices.

The second channel is tightly linked to the first and has to do with the impact of countries' own policies. Thus, countries with high pre-reform tariffs or export taxes, such as Lithuania, Nigeria and North Africa, tend to experience larger consumption gains than countries where the initial distortions are low. If the initial trade barriers are sufficiently high, consumers may face lower

[14] Trade in other beverages and tobacco is excluded from the liberalisation list.

[15] An alternative scenario where all border distortions are removed is considered in the working paper version (see Bussolo et al., 2009).

[16] The price increases are calculated using the Paasche price index, i.e. using the post-reform exports as weights for aggregating the prices of individual commodities. Unless explicitly noted, all price indices in this section are calculated using the Paasche formula. Price indices differ by country due to differences in the composition of exports (i.e. aggregation weights).

TABLE 3
Developing Countries Face Higher Tariffs than High-Income Countries

Importer	*Low- and Middle-income Countries*		*High-income Countries*	
	Tariffs Faced (%)	*Exports (% of Total)*	*Tariffs Faced (%)*	*Exports (% of Total)*
Exporter				
World total	13.0	31.5	10.6	68.5
High-income countries	12.9	23.7	7.8	76.3
United States	10.0	48.3	24.1	51.7
EU 15	14.7	15.0	2.9	85.0
Low- and middle-income countries	13.0	44.3	16.6	55.7
East Asia and Pacific	16.5	41.4	23.7	58.6
China	16.7	25.3	27.6	74.7
Indonesia	15.6	57.6	11.3	42.4
Europe and Central Asia	9.2	51.7	9.3	48.3
Poland	12.3	35.0	3.6	65.0
Russia	13.3	59.0	21.4	41.0
Latin America and the Caribbean	14.1	40.9	16.5	59.1
Brazil	18.2	47.9	24.3	52.1
Mexico	16.2	7.4	5.4	92.6
Middle East and North Africa	10.4	55.1	12.2	44.9
Egypt	9.4	55.3	12.8	44.7
Morocco	12.8	17.7	7.8	82.3
South Asia	12.0	57.2	15.4	42.8
India	12.3	55.5	15.5	44.5
Pakistan	9.5	72.8	27.4	27.2
Sub-Saharan Africa	9.7	39.1	9.8	60.9
South Africa	13.5	39.4	8.8	60.6
Nigeria	10.9	17.6	1.6	82.4

Source: Authors' calculations with GTAP7.0 database.

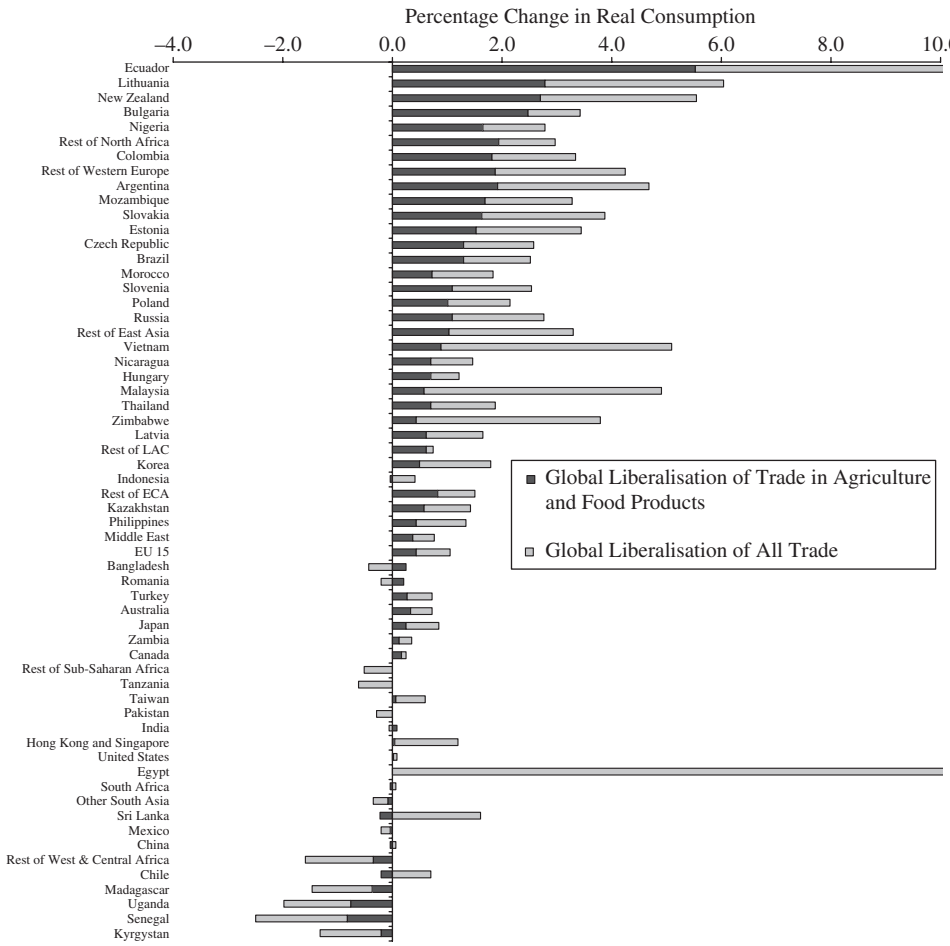
Notes:
'Tariffs faced' column shows the import-weighted average tariff imposed by the column country/region on exports from the row country/region. 'Exports' column shows the exports of the row country/region to the column country/region as a share of the former's total exports.

post-reform prices of food even if import prices are rising; this is the case of North Africa, which experiences an increase in real consumption despite being a net food importer.

The third channel is the impact of trade reform on government budgets. Since the model does not include an explicit transversality condition, we maintain a fixed budget deficit closure, which means that any losses in public revenue (such as a reduction in tariff income) must be offset by a compensatory increase in the direct tax rate on the households.[17] Therefore, welfare

[17] In other words, this closure choice gives rise to consistent measurement of household utility as the utility function does not include the consumption of public goods.

FIGURE 5
Most Countries Gain from the Removal of Agricultural Distortions



Notes:
The black bars show the percentage increase in consumption (at pre-reform prices) owing to the removal of trade distortions in agriculture and food products (excluding beverages and tobacco). The grey bars show the additional gains in consumption owing to the removal of all remaining trade barriers. The combined length of the two bars shows the consumption gains from a full global trade reform.

Source: Authors' simulations with the LINKAGE model.

gains are limited in countries such as Tanzania and Zimbabwe, which rely on taxes on international trade as an important component of public revenue.[18]

[18] In this situation, the ability of households to gain or lose from trade reform depends on (in addition to the impacts of the first two channels) their ability to substitute out of more expensive goods into cheaper alternatives.

In addition to changes in levels of per capita consumption *across* countries, the LINKAGE results hint at important distributional consequences of trade reform *within* countries through changes in returns to labour in different sectors and at varying skill levels. With the exception of China, all countries experiencing an increase in payments to unskilled labour in agriculture also register consumption gains owing to trade reform, but the converse does not hold. Real consumption increases in 29 of 40 countries that show a decline in unskilled agriculture wages; since unskilled workers in agriculture tend to be the poorest part of the population, these results suggest that pressures towards increased inequality may be intensifying in many regions in the world.[19] Furthermore, the losses and gains in agriculture wages exhibit strong regional patterns: real wages of unskilled farmers rise in Latin America, the Middle East, and East Asia and Pacific, while declining in other developing regions and, much more strongly, in high-income countries.

The initial level of protection in agriculture (excluding processed food), combined with the terms of trade shock, represent the main determinants of the trends in farm incomes. Consider the example of India, where unskilled farm wages decline by 6.1 per cent following trade reform.[20] Indian farmers must contend with a loss of tariff protection (2 per cent), export subsidies (3.3 per cent) and output subsidies (6.9 per cent). The first channel decreases the farmers' competitiveness on the domestic market and leads to higher import penetration, while the second channel erodes their competitiveness on the international markets. The third channel increases production costs and makes Indian farmers less competitive overall. Together, these effects result in lower farm labour earnings and create strong incentives for farmers to exit the agriculture sector.

In Mexico, the income losses among unskilled farmers are lower than in India. This is partially attributable to its close trading relationship with the United States. Mexico purchases 75 per cent of its agriculture imports from the United States, whose export prices rise by 5.7 per cent because of the elimination of export and production subsidies. Thus, the removal of agriculture price support in the United States puts upward pressure on import prices of agriculture in Mexico, which hurts consumers but increases the competitiveness of farmers on the domestic market. On the other hand, this trend is counteracted by the removal of tariff protection on agriculture (1.2 per cent) and output subsidies (0.8 per cent), which lead to a decrease in competitiveness of agriculture producers in Mexico and market share losses in both domestic and export markets.

[19] Note that trends in consumption per capita are unlikely to be representative of the welfare of agricultural households, since their weight in total consumption is low due to limited incomes and high incidence of poverty.

[20] The 6.1 per cent figure refers to change in the nominal wages. The change in real wages depends on the change of the CPI, which increases by 2 per cent relative to the base year.

Brazil, on the other hand, is an example of a country where a number of positive developments combine to produce a nearly 34 per cent gain in the wages of unskilled agriculture workers.[21] The import prices of agriculture in Brazil rise by 1.8 per cent, bolstering the domestic competitiveness of its farmers, while export prices increase by more than 10 per cent. Because Brazilian farmers do not receive any export or production subsidies, they are well positioned to take advantage of these opportunities and gain market share both domestically and abroad. Although some of the gains to agriculture producers are offset by the loss in domestic protection (import tariff of 2.4 per cent), Brazilian agriculture is still able to increase its production volume by 17.8 per cent following trade reform.

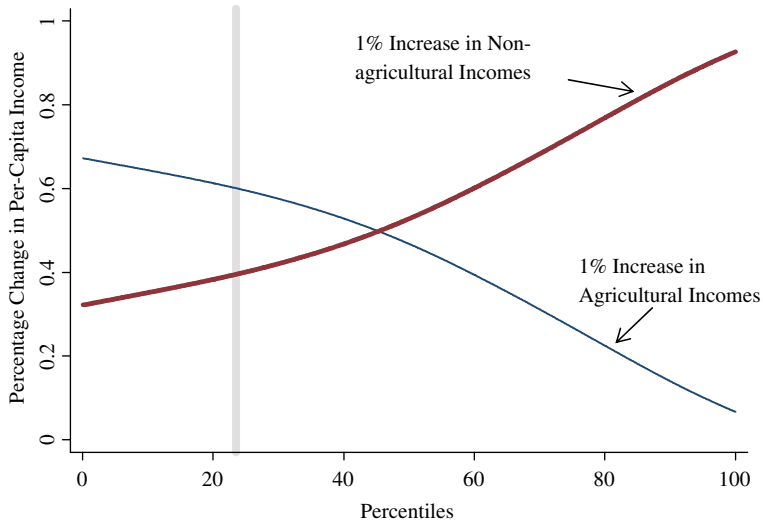
b. Microsimulation Results: Global Poverty and Inequality

In this section, we use the GIDD model and data to simulate the likely changes in global poverty and inequality because of the elimination of all agricultural trade distortions. Given the richness of the data and the numerous factors affecting global poverty and inequality within the GIDD, this section starts with two stylised simulations that illustrate, in a simple way, the expected effects of a global agricultural trade reform. Focusing only on low- and middle-income countries in our data, both these stylised simulations raise the *average* income in the developing world by 1 per cent. In the first instance, this occurs because of an increase in incomes of agricultural households only, while in the second exercise, the increase is due entirely to an expansion in non-agricultural incomes. The results of these two stylised simulations are shown with two growth incidence curves (GICs)[22] in Figure 6. The thin blue (Figure available in colour in the online version of the article) GIC captures the effects of assigning income gains only to agricultural households, while the thick red (Figure available in colour in the online version of the article) GIC raises incomes only for those households whose head works in non-agricultural activities. This simple exercise highlights the stark difference in the distributional consequences of these two shocks. The incidence of an increase in agricultural incomes is clearly progressive (the GIC is downward sloping) with the poorer quintile experiencing gains of about 0.6 per cent and the richer one gaining less than 0.2 per cent. Conversely, the incidence of an increase in non-agricultural incomes is regressive (the GIC is upward sloping) with the richer household benefiting more than poorer ones.

[21] This is a nominal, not a real increase. Consumer prices in Brazil rise by 4 per cent following trade reform.

[22] The GIC is shows the changes in welfare along the entire income distribution, therefore capturing, in a single graph, the growth and distributional components of overall welfare changes. For a detailed description of the properties characterising the growth incidence curves, see Ravallion and Chen (2003).

FIGURE 6
Growth Incidence Curve of a 1 Per Cent Increase in Incomes



(i) Poverty and Inequality Impacts: A Global View

Translating the shocks from the LINKAGE model into poverty and inequality outcomes with the GIDD shows that the effects of a full removal of agricultural trade distortions on global poverty are close to zero. This limited impact is explained by several factors. First, the growth effects of the reform (i.e. changes in per capita consumption) are very small.

According to the GIDD, the world's average monthly household income increases 0.3 per cent after the removal of agricultural distortions, passing from an initial level of $207 to a final value of $208, 1993 PPP (see Table 4). Second, the reform has little impact on inequality at the global level. Although incomes rise in the agricultural and non-agricultural sectors alike, agricultural incomes increase by a little more than 1 per cent, while incomes in non-agricultural activities rise at 0.2 per cent. While this reduction in the non-agricultural income premium reduces inequality, Table 4 shows that income dispersion within the agricultural sector is also increasing, with the final change in global income distribution being close to zero. The distributional changes taking place within the agricultural sector are such that the incidence of extreme poverty (under 1 dollar a day, PPP) in this sector rises by almost 1 percentage point as a consequence of the elimination of agricultural trade distortions. On the other hand, poverty among non-agricultural households experienced a reduction equal to 0.36 percentage points. The combination of poverty changes occurring in and out of the agricultural sector ends up increasing the number of individuals below the extreme poverty line by almost 10 million.

TABLE 4
Simulated Global Poverty and Inequality and Changes with Respect to Initial Levels

Strata	*Gini (%)*	*Pop Shares (%)*	*Average Income*	*1-dollar Poverty Incidence (%)*	*Poverty Share (%)*
Agricultural	44.9	44.8	65.4	31.7	75.9
Non-Agricultural	62.8	55.2	328.9	8.1	24.0
Total	67.0	100	210.8	18.7	100
Change with respect to the observed (simulated−observed)					
Agricultural	0.5	–	1.2*	0.87	1.02
Non-Agricultural	−0.2	–	0.2*	−0.36	−1.02
Total	−0.1	–	0.3*	0.18	–

Note:
*Changes in average income are expressed in percentage.

This result should be taken with caution since the poverty effect of the agricultural trade reform depends on where the poverty line is set. While global poverty measured by the 1-dollar-a-day poverty line shows a moderate increase of 0.18 percentage points (or 9.8 million additional poor) as a consequence of the reform, when measured at 2 dollars a day, poverty reduces by 0.3 percentage points (or 14.7 million less poor, see Table A1 in the Appendix).

The results presented so far have treated the world as a single entity, making no distinction between regions or countries. Thus, lack of major changes at the global level could be the outcome of offsetting trends between regions. As discussed in subsection 4a, farmers in many Latin America (LAC) countries are big winners from trade reform with an impressive increase of 16 per cent in their household income. By contrast, incomes of farmers in South Asia (SA) shrink more than 3 per cent after agricultural distortions are dismantled. To show the incidence of these changes among the population in the different regions, Figure 7 plots the GIC for Latin America, South Asia and the rest of the world. The GIC for Latin America shows that the agriculture-based growth in the region is highly pro-poor; on the contrary, South Asia's reduction in agricultural incomes is highly regressive, with the poorest households losing from the reform. East Asia and, to a lesser extent, sub-Saharan Africa benefit from the global reform, while the effects of the reform are progressive, albeit close to zero, for the rest of the world.

The differences in the reform outcomes across regions help explain the lack of significant change in global poverty. With half a billion people in extreme poverty, South Asia alone accounts for almost half of global poverty; on the other hand, Latin America contributes less than 5 per cent to global poverty (see Table 5). Hence, although removing agricultural distortions alleviates extreme poverty in most regions in the world, the increase in South Asia's head

FIGURE 7
Regional Growth Incidence Curves

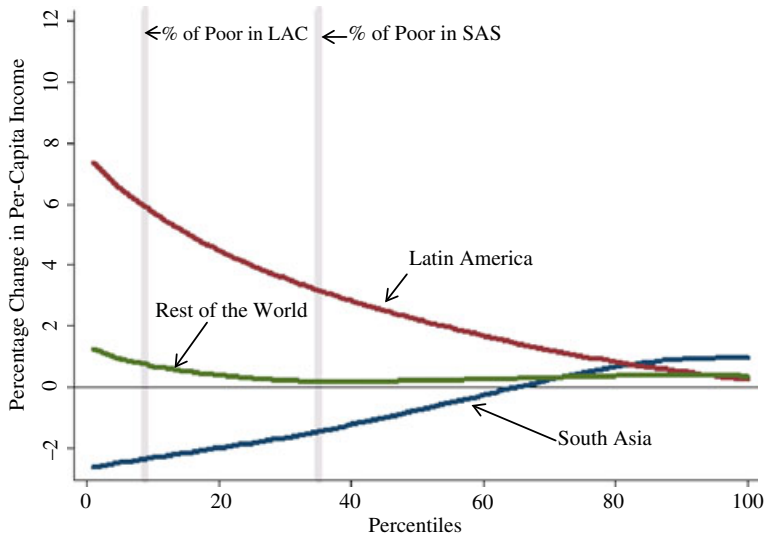


TABLE 5
Global and Regional Poverty

Region	*Number of Poor (in Thousands)*	*Share of Global Poverty*	*Simulated Number of Poor (in Thousands)*	*Δ (Simulated − Observed)*
East Asia	261,677	27.1	258,937	−2,740
Eastern Europe	3,607	0.4	3,576	−31
Latin America	40,075	4.1	37,677	−2,397
Middle East	1,614	0.2	1,544	−71
South Asia	466,165	48.3	481,350	15,185
Sub-Saharan Africa	192,555	19.9	192,461	−94
Global	965,693	100.0	975,545	9,851

Notes:
(1) Number of poor expressed in thousands.
(2) The simulations are based on the Global Income Distribution Dynamics's results.

count ratio offsets these gains and drags an extra 9.8 million people below the poverty line. The results using the 2-dollar-per-day poverty line show a very different picture. Poverty is alleviated in all regions except for Middle East and North (see Table A1 in the Appendix). The results at the moderate poverty line are particularly interesting for South Asia, where agricultural trade reform becomes pro-poor instead of anti-poor as it was the case when using the 1-dollar-a-day PPP poverty line. This result is explained by the large number of non-agricultural households that are below the moderate poverty line in South

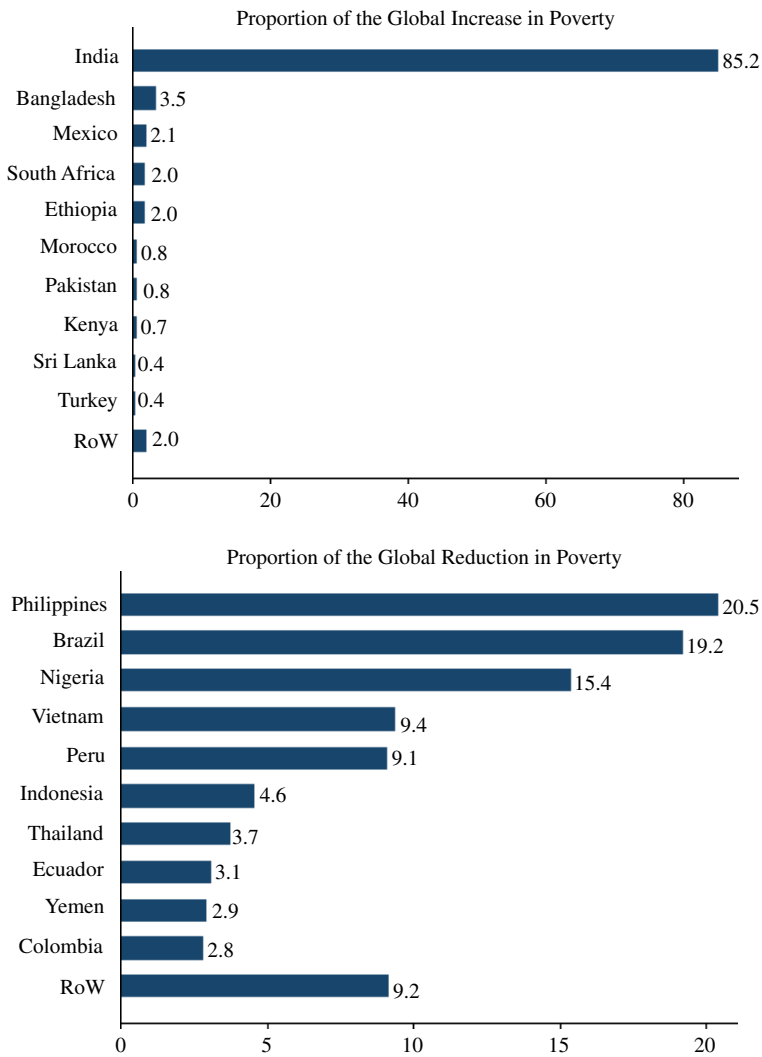
Asia. South Asian households working in non-agricultural activities experience an increase in purchasing power after the agricultural markets are liberalised and therefore contribute to reduction in moderate poverty in the region.

(ii) Zooming in: Poverty and Inequality Effects Between and Within Countries

Global agricultural liberalisation has distributional and poverty effects that vary not only across regions but also between and within countries. This subsection summarises the poverty effects for each of the countries included in our sample and the distributional changes taking place within them. Table 5 shows that roughly 10 million individuals that would be pushed into poverty as a consequence of agricultural reform are the combination of a 15 million increase in poverty in South Asia and a 5 million decrease in poverty in the rest of the developing world. Figure 8 shows the countries that contribute the most to this reduction and increase in global poverty, respectively. Among the *new* poor, 85.2 per cent – almost 13 million – are Indian nationals, while 3.5 per cent are located in Bangladesh, and 2.1 per cent are Mexican. Although the increase in poverty is mainly an Indian phenomenon, all five South Asian countries contribute significantly to the global increase in poverty. On the other hand, the gross reduction in global poverty is distributed more evenly among the *winning* countries with the great majority of them being located in Latin America and East Asia and the Pacific (EAP). In fact, no country in EAP and only Chile and Mexico in LAC experience an increase in the number of extreme poor as a result of agricultural trade reform.

The contributions to the global entry and exit of poverty depicted in Figure 8 are, to a certain extent, the outcomes of differences in population size. For instance, a very populous country such as India can have a substantial contribution to global poverty without necessarily implying a large increase in the country's *head count ratio*. Another way of ranking countries in terms of their poverty outcomes is to consider the post-reform change in the head count ratio. Undertaking this exercise shows that, among countries where poverty falls, Peru's reduction of 3 percentage points in the head count ratio is, by far, the largest in the developing world. The incidence of poverty in Philippines and Ecuador decreases by 1.8 percentage points, just below the fall registered in Yemen and Paraguay (1.2). On the other hand, with an increase of 1.4 percentage points in the head count ratio, India is still the country with the largest increase in poverty. At the same time, as mentioned earlier, poverty in India falls by 0.3 percentage points if changes are evaluated at the 2-dollar-a-day poverty line. Interestingly, these changes in the head count ratio in India occur while average household income remains almost constant and are therefore entirely a result of a deterioration in income distribution.

FIGURE 8
Poverty Changes as a Proportion of the Total Change among the 10 Most Losing/Winning Countries



Our results show that the significant increase in poverty in India is entirely explained by a post-reform increase in inequality of almost 1 Gini point. Three quarters of this increase are attributable to a rise in the agricultural-to non-agricultural income gap in India. On the other hand, poverty reduction in Brazil is the outcome of a combination of a 1 per cent increase in average income and a reduction in inequality of more than half a Gini point. The changes in overall growth and distribution taking place in India and Brazil are

summarised by the GIC for these two countries plotted in Figure 9. Given the importance of Brazil and India in their respective regions, it is not surprising that the shape of the GIC for these countries are very similar to the GICs of their respective regions plotted in Figure 7. Figure 9 shows that the only beneficiaries of agricultural liberalisation in India are those in the top 22 per cent of the distribution; given than 83 per cent of the Indian population is below the 2-dollar-a-day poverty line, part of the top 22 per cent is formed by household under moderate poverty.

As we mentioned in Section 2, agricultural reforms can have important – agricultural to non-agricultural – real income distributional effects. Our results show that for most countries in our sample, removing agricultural distortions does not have large distributional effects. In more than half of the countries, the Gini coefficient shows a change of less than half a Gini point. This pattern is also observed in the changes in the country-specific Theil index plotted in Figure 10. There are distinguishable regional differences in the distributional effects of the reform, with countries in Latin America and East Asia experiencing a considerable reduction in income inequality while inequality in countries outside these regions remains constant or rises marginally. The advantage of using the Theil index as the inequality measure is that we can decompose its change into an effect attributable to shifts in the agricultural-to-non-agricultural wage gap (between effects) and the effects as a result of income changes within these two groups. Figure 10 shows the total changes in the Theil index

FIGURE 9
Growth Incidence Curves for Brazil and India

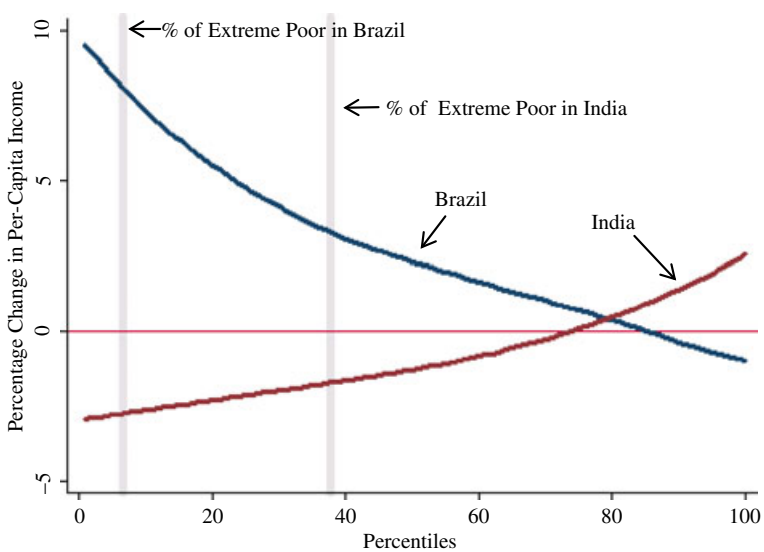
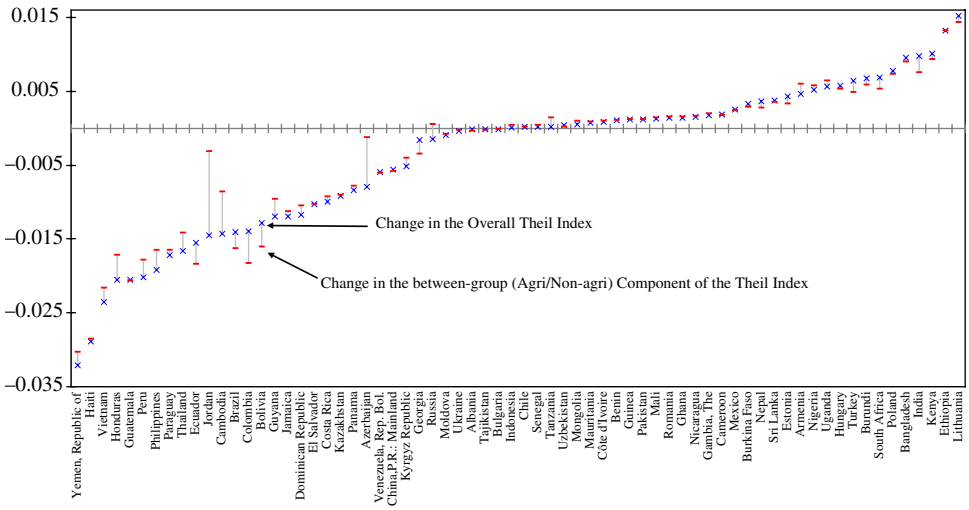


FIGURE 10
Most of the Distributional Changes are Attributable to the Between Component



(depicted by a star) and the changes attributable to movements in the non-agricultural income premium (little horizontal bar). Since the 'between' effect is very close to the total distributional effect for the majority of countries, we can conclude that the total change in income distribution in these economies is mainly the outcome of changes in mean incomes of the agricultural and non-agricultural sectors.

5. CONCLUSIONS AND POLICY MESSAGES

Trade distortions in agriculture and food represent the last major bastion of protection and have proven to be the main point of contention in recent multilateral trade negotiations. Using a newly developed data set and methodological approach for evaluating the poverty and inequality effects of policy reforms – the GIDD – this paper has evaluated the potential impacts of the removal of agriculture trade distortions on the global income distribution.

There are three main messages emerging from our analysis. First, the liberalisation of agriculture and food markets is unlikely to have large effects on global poverty. Our results show that the incidence of extreme poverty could rise by 0.2 per cent, while moderate poverty is likely to fall by 0.3 per cent.

The second message is that these small aggregate changes are produced by a combination of offsetting trends at the regional and country levels. With the elimination of all agriculture trade distortion, extreme poverty is reduced in all regions but in the Middle East and North Africa, where it is almost stable, and

in South Asia, where it increases considerably. Since about 50 per cent of all poor people live in South Asia, the worsening of poverty in this region counterbalances all the gains in the other parts of the world and an additional 9 million people fall into poverty. At the moderate poverty line, 14 million people escape poverty and most regions benefit from lower poverty incidence with the exclusion of Eastern Europe and Central Asia and Middle East and North Africa. Many non-agriculture households in South Asia are clustered below the 2-dollar-a-day poverty line and trade reform-related improvement in their incomes, versus the agricultural incomes' decline, explain the difference in global poverty results when the 1-dollar- or the 2-dollar-a-day lines are used.

The third message is that the distributional changes because of agricultural trade reform are also likely to be mild, but exhibit a strong regional pattern. Inequality is likely to fall in regions such as Latin America, which are characterised by high initial inequality, and rise in regions like South Asia, characterised by low initial inequality. In addition, the decrease in inequality between agriculture and non-agriculture groups is offset by a higher within group inequality, which mainly originates from a widening of incomes within the agriculture sector. Inequality within countries varies within a wide interval ranging from increases of up to 3 Gini points to reduction of 2 Gini points. The majority of countries, around 60 per cent of those included in the sample, experience an increase of inequality.

These results suggest that allocative efficiency gains combined with distributional shifts originating from the removal of agriculture trade restrictions are not enough to significantly alleviate poverty at the 1-dollar-a-day threshold nor at a higher poverty line. The pattern of global incomes change triggered by such trade reform, as simulated by the model used in this paper, is complex and cannot be simplistically reduced to a boost in growth rates of agriculture. The latter remains an essential component in the strategy for poverty eradication, and trade liberalisation can only play a constructive but somewhat limited role.

There are several important caveats to our analysis. First, it should be emphasised that, although poverty reduction is a most worthy goal, it should not be the only, or even the first, metric with which to measure trade policy. Trade reform cannot be expected to benefit all constituents and can only do so in the presence of other complimentary policies. Second, our analysis is confined to examination of the effects of static efficiency gains only and does not consider the potential growth effects of trade liberalisation. Although our results show that the static gains from agriculture trade reform may not contribute to reduction in extreme poverty and may do little to combat moderate poverty, they do not imply that this pattern of trade liberalisation cannot be an effective tool for poverty reduction. Finally, our micromodel considers only

changes in labour income: while this is the most important income source for households at or near the poverty line, accounting for changes in other factor returns may yield results of a different magnitude.

APPENDIX

TABLE A1
Changes in Moderate Poverty

Region	*Number of Poor (in Thousands)*	*Share of Global Poverty*	*Simulated Number of Poor (in Thousands)*	*Δ (Simulated − Observed)*
East Asia	888,988	36.1	882,473	−6,515
Eastern Europe	42,194	1.7	41,641	−553
Latin America	104,573	4.2	100,044	−4,528
Middle East	11,425	0.5	11,720	294
South Asia	1,084,989	44.0	1,081,615	−3,374
Sub-Saharan Africa	331,264	13.4	331,203	−61
Global	2,463,434	100.0	2,448,696	−14,737

Note:
The simulations are based on the Global Income Distribution Dynamics's results.

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