DISCUSSION PAPER SERIES

No. 7749

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INTERNATIONAL TRADE AND REGIONAL ECONOMICS

Centre for Economic Policy Research

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Available online at: **www.cepr.org/pubs/dps/DP7749.asp**

ISSN 0265-8003

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Discussion Paper No. 7749
March 2010

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CEPR Discussion Paper No. 7749

March 2010

ABSTRACT

Would Freeing Up World Trade Reduce Poverty and Inequality? The Vexed Role of Agricultural Distortions

Trade policy reforms in recent decades have sharply reduced the distortions that were harming agriculture in developing countries, yet global trade in farm products continues to be far more distorted than trade in nonfarm goods. Those distortions reduce some forms of poverty and inequality but worsen others, so the net effects are unclear without empirical modeling. This paper summarizes a series of new economy-wide global and national empirical studies that focus on the net effects of the remaining distortions to world merchandise trade on poverty and inequality globally and in various developing countries. The global LINKAGE model results suggest that removing those remaining distortions would reduce international inequality, largely by boosting net farm incomes and raising real wages for unskilled workers in developing countries, and would reduce the number of poor people worldwide by 3 percent. The analysis based on the Global Trade Analysis Project (GTAP) model for a sample of 15 countries, and ten stand-alone national case studies, all point to larger reductions in poverty, especially if only the non-poor are subjected to increased income taxation to compensate for the loss of trade tax revenue.

JEL Classification: D30, D58, D63, F13, O53 and Q18
Keywords: farm trade policy, income inequality, poverty and price distortions

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Submitted 10 March 2010

This is a product of a World Bank research project on Distortions to Agricultural Incentives. The authors are grateful for helpful comments from workshop participants, and for funding from World Bank Trust Funds provided by the governments of the Netherlands (BNPP) and the United Kingdom (DfID) and from the Australian Research Council. The views expressed are the authors' alone and not necessarily those of the World Bank and its Executive Directors, nor the countries they represent, nor of the institutions providing funds for this research project.

Would Freeing Up World Trade Reduce Poverty and Inequality? The Vexed Role of Agricultural Distortions

1. INTRODUCTION

For decades, earnings from farming in many developing countries have been depressed by a pro-urban, anti-agricultural bias in own-country policies as well as by governments of richer countries favoring their farmers with import barriers and subsidies. Both sets of policies reduced national and global economic welfare, inhibited economic growth, and added to inequality and poverty because no fewer than three-quarters of the world's billion poorest people still depend directly or indirectly on farming for their livelihood (World Bank 2007). During the past two to three decades, numerous developing country governments have reduced their sectoral and trade policy distortions, while some high-income countries also have begun reforming their protectionist farm policies. Yet myriad policy measures continue to distort world food markets, and in many and complex ways (Anderson 2009). In some developing country setting they raise food prices for consumers and the earnings of farm households, in other settings they lower them; but in most situations there is a mixture of winners and losers in both rural and urban areas, not least because many farm households receive some of their income from non-farm sources. The only feasible option for discerning the net impacts of price-distorting policies on poverty and inequality is to undertake quantitative analysis using economy-wide models with up-to-date price distortion data and ideally detailed household information on the earning and spending profiles of different groups of people, both rural and urban.

The need for undertaking poverty and inequality analysis remains strong notwithstanding the contributions of policy reforms over the past quarter-century. Partly as a result of those policy reforms and the consequent growth of incomes in many developing countries, the number of people living on less than $1 a day nearly halved over the 1981-2005 period, and their share of the global population fell from 42 to 16 percent (Table 1). Yet that number of extremely poor people was still almost 900 million in 2005, and it may have risen above that following the eruption of the global financial crisis that began in 2008. Moreover, most of the improvement has been in Asia (especially China), while in Sub-Saharan Africa the incidence of poverty was little lower in 2005 than in 1981, at around 40 percent (amounting to 300 million people in 2005). Despite the success of China, it still had over 100 million people on less than $1 a day in 2005, 90 percent of whom were rural. And in India the number of extreme poor remains stubbornly close to 300 million – and 74 percent rural, even with large subsidies to their farmers.

Less pressing than extreme poverty but nonetheless still important to the welfare of individuals is the extent of income inequality. In the past it was just inequality at the local level that affected individuals' utility, but the information and communication technology revolution has increased awareness of income differences not only within local regions but also nationally and indeed internationally. At the national level, there are concerns about rural-urban inequality as well as inequality within each of those broad geographic zones. Within rural areas, for example, differences in incomes can be vast between landless unskilled farm workers, subsistence farmers, the larger commercial farmers, and non-farm workers in rural towns.

Assessing what has happened to the world's income distribution in recent decades depends on one's focus. Milanovic (2005) points to three possibilities. One is *intercountry* inequality, which compares country-level average incomes where each country has an equal

weight in the world distribution regardless of population size, in which case income distribution appears to have become more unequal. The second is *international* inequality, which still compares country average incomes but this time weighting by the populations of countries, in which case income inequality appears to have decreased although mostly due to the fast growth in populous China and India (Bourguignon, Levin and Rosenblatt 2004, and Atkinson and Brandolini 2004). And the third possible focus is *global* inequality, which involves comparing individual incomes regardless of country of citizenship, thus taking into account within-country inequality which is ignored by the international inequality approach where individuals are deemed to earn their country's average income. Rapid growth in the large emerging economies has tended to offset the increase in inequality within countries and so, by this last definition, global inequality appears to have remained roughly constant since the late 1980s.[1]

In the light of the evidence currently available, the question this paper focuses on is: how much scope is there to further reduce poverty and inequality in the world, and in specific developing countries, by getting rid of remaining distortions to incentives facing producers and consumers of tradable goods unilaterally or globally?

Empirical studies undertaken as background for the World Trade Organization's on-going Doha round of multilateral trade negotiations suggest that in 2001, when that round was launched, policy-driven distortions to agricultural incentives contributed around two-thirds of the global welfare cost of merchandise trade barriers and subsidies (see, e.g., Anderson and Martin 2005). While such empirical studies did not have access to

[1] A study by Sala-i Martin (2006) found that GDP per capita disparities between countries have shrunk as economies have converged. See also the analyses based on household survey data rather than GDP per capita, such as by Milanovic (2002, 2006). A recent review of the global poverty and inequality evidence is available in Ferreira and Ravallion (2008).

comprehensive estimates of distortions to farmer and food consumer incentives in developing countries other than applied tariffs on imports, a more recent study that draws on a new database of distortions to agricultural incentives has confirmed that earlier result: Valenzuela, van der Mensbrugghe and Anderson (2009) suggest agricultural price and trade policies as of 2004 accounted for 60 percent of the global welfare cost of those and other merchandise trade policies. This is a striking result, given that the shares of agriculture and food in global GDP and trade are only 3 and 6 percent, respectively. The contribution of farm and food policies to the welfare cost of global trade-distorting policies for just developing countries is estimated by those authors to be even greater, at 83 percent – of which a little more than one-third is due to policies of developing countries themselves. Even so, the estimates of price distortions that went into that modeling study show that many developing countries protect their less-competitive farmers from import competition, so some of that subset of farmers might be hurt if all markets were opened (Anderson 2009, Ch. 1).

Table 2 summarizes the changing extent of price distortions in developing and high-income countries. It shows that the rate of assistance to farmers relative to producers of non-farm tradables has fallen by one-third for high-income countries since the latter 1980s (from 51 to 32 percent) while in developing countries it has all but disappeared (rising from -41 percent in the early 1980s to +1 percent in 2000-04). The latter trend for developing countries is mainly because of the phasing out of agricultural export taxes, since assistance via import restrictions has risen over the period shown. Thus in both high-income and developing countries there is now a large gap between their nominal rates of assistance (NRAs) for import-competing and export agriculture, as well as a continuing large gap (albeit smaller than in the 1980s) between the relative rates of assistance in the two groups of countries. In the light of that evidence, the above question to be addressed here can be expressed more specifically, for any developing country of interest, as: how important are its own policies

compared with those of the rest of the world in affecting the welfare of the poor in that country, and what do agricultural policies in particular contribute to those outcomes? Clear answers to this question are crucial to guide countries in their national policymaking and as they negotiate bilateral and multilateral trade agreements.

Now is an appropriate time to address this multi-faceted question for at least two policy 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. The other is that poorer countries are striving to achieve their United Nations-encouraged Millennium Development Goals by 2015, the prime ones being the alleviation of hunger and poverty.

There are also several analytical reasons as to why now is the time to focus more thoroughly on this issue. One is that methodologies to address it have advanced at a rapid pace recently, involving microsimulation modeling based on household survey data in conjunction with economy-wide computable general equilibrium (CGE) modeling. Prominent examples include the studies in Hertel and Winters (2005, 2006) and Bourguignon, Bussolo and da Silva (2008). Household income information is increasingly important for poverty and inequality analysis because farm households and rural areas of developing countries are rapidly diversifying their sources of income beyond what agricultural land and farm labor can generate, including from part-time off-farm work and remittances (Otsuka and Yamano 2006, Otsuka, Estudillo and Sawada 2009). Hence the earlier close correspondence between net farm income or agricultural GDP and farm household welfare is fading, even in some low-income countries (Davis, Winters and Carletto 2009).

Second, the compilation of national household surveys that are comparable for cross-country analysis has progressed rapidly such that there are now recent surveys for more than 100 countries available at the World Bank. That dataset (www.worldbank.org/prospects/gidd)

has already begun to be used in conjunction with the World Bank's Linkage model of the global economy to assess global income distribution issues (e.g., Bussolo, De Hoyos and Medvedev 2008).

Third, the World Bank has recently compiled a very comprehensive new global database that updates and expands substantially our understanding of the distortions to agricultural incentives in developing countries in particular.[2] Those estimates have since been expressed so as to make them usable in national and global economy-wide models (Valenzuela and Anderson 2008). They differ from the usual ones employed by trade modelers of developing country policies in that they are based on direct domestic-to-border price comparisons rather than (as with the GTAP dataset, see Badri Narayanan and Walmsley 2008) on applied rates of import tariffs and other key border measures.

A first attempt to exploit those new methodologies and databases has recently been undertaken to assess the relative impacts on national, regional and global poverty and inequality of agricultural and non-agricultural trade policies at home and abroad. This paper summarizes the working papers that have emerged from that research project (see www.worldbank.org/agdistortions).

At the outset it should be made clear that agricultural and trade policies are far from the first-best policy instruments for achieving national poverty or income distribution objectives; that is the prerogative of domestic social welfare and income tax policy measures. However, if empirical studies reveal that national trade-related policies are worsening particular countries' poverty or inequality, they provide yet another reason – on top of the usual national gains-from-trade reason – for those countries to reform their policies unilaterally. Should the inequality and poverty alleviating effects of national trade-related

[2] That distortions database is documented fully in Anderson and Valenzuela (2008) and is based on the methodology summarized in Anderson et al. (2008) and detailed in Appendix A of Anderson (2009).

policy reforms be contingent on the rest of the world also reforming, that provides a further reason for that country to participate actively in promoting multilateral trade negotiations under the World Trade Organization (WTO). And should global modeling studies reveal that multilateral trade reform would alleviate global inequality and poverty, it underlines the importance of bringing the WTO's Doha Development Agenda (DDA) expeditiously to a successful conclusion with ambitious agricultural reform commitments.

A negative finding (e.g., that trade liberalization or farm subsidy cuts would increase poverty in a particular country) need not be a reason to shun welfare-enhancing reform, but rather to use the results to provide guidance as to where tax or social programs need to be better targeted so that all groups in society share in the economic benefits from such reform (see Ravallion 2008). Global reform results also provide bargaining power to developing countries seeking aid-for-trade side payments to alleviate any increase in poverty projected to result from multilaterally-agreed trade reform.

The paper begins with an outline of the analytical framework and the common empirical methodology adopted by the global and national case studies being summarized. It then compares modeling results from both global and national models, before mentioning some caveats and drawing out policy implications. The findings are based on three studies that each use a global model to examine the effects of farm and non-farm price and trade policies on global poverty and its distribution within and across many identified countries, plus ten individual developing country studies spanning the three key regions of Asia (where nearly two-thirds of the world's poor live), Sub-Saharan Africa and Latin America.

2. ANALYTICAL FRAMEWORK

In order to adequately capture poverty and inequality effects of price-distorting policies, careful consideration must be given to its impacts on household income and expenditure. Many farm households in developing countries rely on the farm enterprise for virtually all of their income, and in the world's poorest countries the share of national poverty concentrated in such households is large. The fact that the poorest households in the poorest countries are concentrated in agriculture means those households are likely to benefit from farm producer price increases engendered by trade policy reform, other things equal. However, the outcome is not certain because poor households also spend the majority of their income on staple foods (Cranfield *et al.* 2003), so if food prices rise as a consequence of reform then this adverse effect on household expenditure may more than offset the beneficial effect of higher earnings. The urban poor also would be adversely affected by a rise in consumer prices of staple food. However, it is possible that a trade reform that induced a rise in food prices may also raise the demand for unskilled labor (according to the relative factor intensities of production in the economy's expanding sectors), which – depending on how intersectorally mobile labor is – could raise the income of poor households more than it raises the price of their consumption bundle.

The approach adopted in the present study to operationalize the above theory is a variant on the path-breaking approach pioneered by Hertel and Winters (2005, 2006) in their study of the poverty consequences of a prospective Doha round agreement under the WTO. The present study contrasts with that earlier one in three respects. First, here the focus is on the impacts of agricultural domestic and trade policies, distinguishing them from the impacts of other merchandise trade policies. A second distinction is that we examine inequality as

well as poverty. Third, we focus on the effects of current policies, i.e. of full (not partial) global liberalization, whereas Hertel-Winters focused mainly on the multilateral partial reform proposals that were on the table as of 2005. The country case studies examine unilateral reforms that individual developing countries might implement, not just multilateral trade reform. The effects of unilateral actions are compared with what full liberalization abroad would generate, so as to be able to assess the relative importance domestically for each nation of own-country policies as distinct from those of other countries (over which the country has influence only indirectly via trade negotiations).

The national CGE models are able on their own to estimate the effects of unilateral reform of agricultural or all merchandise trade-distorting policies. For the national modeler to estimate the effects of other countries' policies, however, requires input from a global model. The World Bank's Linkage model is chosen here for that purpose. It too is calibrated to 2004, based on Version 7 of the GTAP global protection database (Badri Narayanan and Walmsley 2008) apart from the replacing of its applied agricultural tariffs for developing countries with the more comprehensive set of distortion estimates from Valenzuela and Anderson (2008).

There are various ways of transmitting the results derived from a global CGE model such as Linkage to a single-country CGE model. Like Hertel and Winters (2006), we adopt the approach developed by Horridge and Zhai (2006). For imports, Horridge and Zhai propose the use of border price changes from the global model's simulation of rest-of-world liberalization (that is, without the focus developing country). For the focus developing country's exports, the shift in its export demand curve following liberalization in the rest of the world is given in percentage changes by $x=(1/\sigma).q$ where x is the percentage vertical shift in the export demand curve, σ is the elasticity of substitution between the exports of country i and those from other countries, and q is the percentage change in the quantity of exports under the scenario with liberalization in the rest of the world excluding the focus country.

All the CGE models referred to below are comparative static, and they assume constant returns to scale and perfectly competitive homogeneous firms and product markets. In all cases other than South Africa (and to a smaller extent for Argentina and Nicaragua), unemployment is assumed to be unaffected by the trade policy regime. These assumptions are imposed simply because of insufficient data and empirical evidence to impose alternative ones across all the countries being modeled. This use of a standard set of assumptions reduces the risk that differences across countries in results are driven by different assumptions about investment behavior or the degrees of monopolistic competition, firm heterogeneity, economies of scale, or aggregate employment response to trade policy changes (see Helpman, Itskhoki and Redding 2009). Such specifications almost certainly lead to underestimation of the welfare gains that would accrue from trade reform though. In particular, without dynamics the models will not generate a growth dividend from freeing up markets or from eventual productivity/efficiency gains from trade. That dividend could be very substantial (Winters 2007). Moreover, since economic growth is the predominant way in which poverty is reduced in developing countries (see the literature review in Ravallion 2006), the absence of dynamics implies that the results from this study will grossly underestimate the potential poverty alleviating consequences of liberalization – and might in some situations indicate poverty increases when in fact they would be decreases once the growth consequences are incorporated.

All the country case studies, and two of the global modeling studies surveyed below, make use of household survey data in addition to a social accounting matrix (SAM). The SAM is the basis for the data in the CGE model, while the household survey data are used in microsimulation modeling.

Typically the experiments are performed in two stages. The first stage involves the imposition on the national CGE model of the policy shock (either unilateral liberalization, or

an exogenous shock to border prices and export demand provided by the Linkage model). This generates changes in domestic product and factor markets. The consequent changes in consumer and factor prices are then transmitted to the microsimulation model to see how they alter the earnings of various household types (according to the shares of their income from the various factors) and their cost of living (according to the shares of their expenditure on the various consumer products). That in turn provides information on changes in the distribution of real household incomes and hence in inequality, and in the number of people below any chosen poverty line such as US$1 a day.

All country case studies ran a common set of simulations so as to make it possible to compare the inequality and poverty effects in each country of own-country versus rest-of-world policies affecting markets for agricultural (including lightly processed food) goods versus other merchandise. The other two global studies referred to in the next section use the same 2004 global protection dataset but implement global reform shocks each using a different global model but with national household survey data attached in order to undertake microsimulations. In most cases additional simulations were also run, often to illustrate the sensitivity of the results to key assumptions pertinent to that particular case study.

Even though the models surveyed here are all standard perfectly competitive, constant-returns-to-scale, comparative static, economy wide CGE models, they nonetheless differ somewhat in order to capture important realities (such as labor market characteristics or data limitations) in their particular setting. However, to ensure their comparability, they all aimed to conform to a common set of factor market assumptions and closure rules in addition to using 2004 as their base and undertaking a common set of simulations using the same global distortions dataset. Specifically, all modelers assumed the following: a fixed aggregate stock of factors (including no international mobility), with the exception of labor in the Argentine, Nicaraguan and South African studies where some aggregate employment

responsiveness to trade policy is allowed because of high unemployment in the baseline; possibly some sector-specific capital and labor, but most capital and labor types are assumed to be intersectorally mobile with a common flexible rate of return or wage (except in the Argentine case where the labor market is modeled with a switching regime between employment or wage adjustments); and land is assumed to be specific to the agricultural sector but mobile across the different crop and livestock activities within that sector. The key agreed macroeconomic closure rules that each case study aimed to adopt are a fixed current account in foreign currency, to avoid foreign debt considerations, and fixed real government spending and fiscal balance, so as to not affect household utility other than through traceable changes in factor and product prices and taxes. Fiscal balance is achieved by using a uniform (generally direct income) tax to replace net losses in revenue from abolishing sectoral trade taxes and subsidies.

3. SYNOPSIS OF EMPIRICAL FINDINGS: GLOBAL MODEL RESULTS

This section summarizes the results from three global models (denoted Linkage, GIDD and GTAP). The following section then brings together the results from ten more-detailed national case studies, before the lessons learned from both sets of analyses are drawn together. It would be surprising if all the studies came to the same conclusions, but the strength of this blend of somewhat different global and national models is that it is more likely to expose the various determinants of the measured effects in different settings than if only a single type of model was employed.

(a) Linkage Model Results

Anderson, Valenzuela and van der Mensbrugghe (2010) use the World Bank's global Linkage model (van der Mensbrugghe 2005) to assess the market effects of the world's agricultural and trade policies as of 2004 on individual countries and country groups, so as to be able to say something about international inequality (in the Milanovic (2005) sense, taking into account the economic size of countries) and poverty (using a simple elasticities approach). This model also provides the basis for estimating the effects of rest-of-world policies on the import and export prices and demand for the various exports of any one developing country, for use by each of the ten country case studies discussed in the next section.

The Linkage model results suggest that developing countries would gain nearly twice as much as high-income countries in welfare terms if 2004 agricultural and trade policies were removed globally (an average welfare increase of 0.9 percent, compared with 0.5 percent for high-income countries – bottom of column 1 of table 3). Thus in this broad sense of a world of just two large country groups, completing the global reform process would reduce international inequality. 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 an 8 percent increase 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).

Bearing in mind that three-quarters of the world's poorest people depend directly or indirectly on agriculture for their main income, and that farm sizes are far larger in high-income than in developing countries, the Linkage study also looks at the extent to which

agricultural and trade policies in place as of 2004 reduced rewards from farming in developing countries and thereby added to international inequality in farm incomes. It finds that net farm incomes in developing countries would rise by 5.6 percent, compared with 1.9 percent for non-agricultural value added, if those policies were eliminated (bottom of final two columns of table 3). This suggests that inequality 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. That is, inequality between farm and nonfarm households within high-income countries would increase; however, inequality between farm households in developing and those in high-income countries would reduce substantially. These inequality results would not be very different if only agricultural policies were to be removed (c.f., columns 2 and 3 of table 3), underscoring the large magnitude of the distortions from agricultural, as compared with non-agricultural, trade policies.

This study also reports that 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 3.5 percent. However, the most relevant consumer prices for the poor, including those many poor farm and other rural households who earn most of their income from their labor and are net buyers of food, relate just to food and clothing. Hence deflating by a food and clothing price index rather than the aggregate CPI provides a better indication of the welfare change for those workers. As shown near the bottom of the final column of table 4, for all developing countries the real unskilled wage over all developing countries would rise by 5.9 percent with that deflator. That is, inequality between unskilled wage-earners and the much wealthier owners of capital (human or physical) within developing countries would reduce with full trade reform.

The above results for real factor rewards and net farm income suggest that poverty, as well as international and intra-developing country inequality, could be alleviated globally by agricultural and trade policy liberalization. The authors of that study go a step further to explicitly assess reform impacts on poverty even though the Linkage model has only one single representative household per country. They do so using the elasticities approach, which involves taking the estimated impact on real household income and applying an estimated income to poverty elasticity to estimate the impacts on the poverty headcount index for each country. They focus on the change in the average wage of unskilled workers deflated by the food and clothing CPI, and assume those workers are exempt from the direct income tax imposed to replace the lost customs revenue following trade reform (a realistic assumption for many developing countries).

Under the full merchandise trade reform scenario, table 5 reports that 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 is much higher in China and in Sub-Saharan Africa, each falling around 4 percent. It is even higher in Latin America (7 percent) and South Asia other than India (10 percent). By contrast, the number of extreme poor in India (though not in the rest of South Asia) is estimated to rise, by 4 percent.[3] Under the more moderate definition of poverty—those living on no more than US$2 per day—the number of poor in developing countries would fall by nearly 90 million compared to an aggregate baseline level of just under 2.5 billion in 2004, or by 3.4 percent (notwithstanding the number in India below $2 a day still increasing, but by just 1.7 percent).

[3] The rise in India is partly because of the removal of the large subsidies and import tariffs that assist Indian farmers, and partly due to the greater imports of farm products raising the border price of those imports.

(b) GIDD Model Results

Bussolo, De Hoyas and Medvedev (2010) make direct use of the global CGE Linkage model described above but then combines this with the newly developed Global Income Distribution Dynamics (GIDD) tool (Bussolo, De Hoyos and Medvedev 2008). GIDD is a framework for *ex ante* analyses of the income distributional and poverty effects of changes in macroeconomic, trade and sectoral policies or trends in global markets, and thus offers an alternative to the elasticity approach described in the two previous paragraphs. It complements a global CGE analysis by providing global micro-simulations based on standardized household surveys. This tool pools information from most of the currently available household surveys covering 1.2 million households in 73 developing countries. Household information from developed countries and Eastern Europe's transition economies completes the dataset. Overall, the GIDD sample covers more than 90 percent of the world's population (see www.worldbank.org/prospects/gidd).

The key input into the micro-simulation model are results for labor income changes obtained from the Linkage model. Two liberalization scenarios are examined: full liberalization of agricultural and lightly processed food markets without and with liberalization of nonfarm goods markets. Neither is shown to have large effects on global poverty according to GIDD. The results summarized in table 6 show the incidence of extreme poverty (US$1 per day) rising by 1.0 percent (0.5 percent from each of farm and non-farm full global trade reform), while moderate poverty (US$2 per day) is likely to *fall* by a similar amount (0.9 percent from agricultural reform alone and by 0.8 percent when nonfarm reform is included).

These small aggregate global changes are produced by a combination of offsetting trends between farm and nonfarm households (Table 7). At the $1 a day extreme poverty

level, global liberalization would raise the share of farm households in the world's total poor households by 1 percentage point (from 76 to 77 percent), and also the incidence of poverty among the world's farm households (from 32 to 33 percent), while the incidence among the world's nonfarm households would drop slightly to 8 percent. However, at the moderate poverty line of $2 a day, both agricultural and all merchandise trade liberalization globally *lower* the poverty incidence, by nearly 1 percent, and they reduce it for farm as well as non-farm households (compare the last two columns of table 7).

There are several possible reasons this sign of the effect on extreme poverty (but not on moderate poverty) differs from the Linkage model results summarized I the previous sub-section. One is that GIDD poverty data refer to 2000 whereas the Linkage poverty numbers relate to 2004. A large share of the developing country population was bunched around the extreme poverty line in 2000, but by 2004 poverty had shrunk quite a bit at least in East Asia. Another reason has to do with the fact that the GIDD results are based on changes just in labor income, rather than in income from all factors of production. Furthermore, the assumption of full labor mobility implies that rural unskilled workers "share" the gains from increased agricultural prices with their less-poor urban counterparts.

The GIDD results suggest there could also be considerable inequality changes following global trade reform. Indeed, table 7 shows that agricultural incomes would increase by twice as much as nonfarm household incomes in the all-goods reform scenario (0.8 percent compared to 0.4 percent) and by five times as much in the agriculture-only reform (1.1 percent compared to just 0.2 percent). While that reduction in the non-agricultural income premium on its own would reduce inequality, income dispersion within the agricultural sector is also found to increase, such that the final change in global inequality would be close to zero (column 1 of table 7).

(c) GTAP Model Results

Hertel and Keeney (2010) draw on the widely used global economy-wide model of the Global Trade Analysis Project (GTAP). Their study adopts the same price distortions as the other studies surveyed here, and runs the same scenarios, but generates its own world price changes from the GTAP model for the multilateral trade reform scenarios. Those prices changes alter border prices for the various countries in the GTAP model, a subset of which have attached to them detailed household survey data. This permits the authors to say something about poverty impacts across a range of diverse economies using an alternative internally consistent framework to that employed by Bussolo, De Hoyos and Medvedev (2010). While the number of their countries with household survey data is much smaller, the income data are richer, making it possible to capture the distributive effects of all factor income changes rather than being restricted to just labor income shocks as in the GIDD Model.

This multi-country study focuses on 15 developing countries: five Asian (Bangladesh, Indonesia, Philippines, Thailand, and Vietnam), four African (Malawi, Mozambique, Uganda, and Zambia), and six Latin American countries (Brazil, Chile, Colombia, Mexico, Peru, and Venezuela). Overall, it concludes that removing current farm and trade policies globally would tend to reduce poverty, and primarily via agricultural reforms (table 8). The unweighted average for all 15 developing countries is a headcount decline in extreme poverty (<$1 a day) of 1.7 percent. The average fall for the Asian sub-sample is twice that, however – and it is in Asia where nearly two-thirds of the world's extremely poor people live (although their sample did not include China and India). Turning to their results for specific countries, it is the agricultural-exporting developing countries in the sample, namely Chile, Thailand and Vietnam, where the most poverty alleviation would occur (column 3 of table 8). The majority

of the 15 countries studied experience small poverty increases from non-agricultural reforms, although the unweighted average across the fifteen countries suggests a slight decrease, primarily due to a strong decline in Vietnam (column 2 of table 8). The magnitude of the estimated extreme poverty alleviation in both Asia and Latin America is somewhat larger than the average reductions estimated using the GIDD model. These GTAP model results are thus closer to the Linkage model results in the first part of this section of the paper.

The authors explore the relative poverty-friendliness of agricultural trade reforms in detail, examining the differential impacts on real after-tax factor returns of agricultural versus non-agricultural reforms. Their analysis is extended to the distribution of households by looking at stratum-specific poverty changes. They find that the more favorable impacts of agricultural reforms are driven by increased returns to peasant farm households' labor as well as higher returns for unskilled work off-farm. They also find that liberalization of food grain markets represents the largest contribution to poverty reduction, and that removing import tariffs in those commodity markets dominates the poverty-increasing impacts of subsidy removal by high-income countries.

The final column of table 8 reports the percentage change in the national poverty headcount when the poor are not subject to the income tax rise required to replace trade tax revenue following trade reform. This assumption represents a significant implicit income transfer from non-poor to poor households and thus generates a marked difference in the predicted poverty alleviation. Trade reforms go from being marginally poverty reducing in most of the 15 cases to being poverty reducing in all cases and by a considerable magnitude. It reduces the poverty rate by roughly one-quarter in Thailand and Vietnam, for example. Overall, the regional and total average extent of poverty alleviation is around four times larger in this scenario than when the poor are also assumed to be levied with income taxes to replace lost trade tax revenue. The unweighted average poverty headcount reduction for the

three regions shown in the final column of table 8 are remarkably similar to the population-weighted averages from the Linkage model reported in table 5 above with a similar tax-replacement assumption: the latter's 17 percent for Asia excluding China and India and 6.4 percent for Latin America are just slightly above the GTAP model's 14 percent and 5.7 percent, while their 3.7 percent for Sub-Saharan Africa is just below the 4.5 percent obtained for the Hertel and Keeney sample.

4. SYNOPSIS OF EMPIRICAL FINDINGS: NATIONAL MODEL RESULTS

We turn now to see how the results from ten more-detailed individual country case studies compare with the above results from global models.[4] Like the three global models, they focus on price-distorting policies as of 2004, even though the database for their CGE models and their household survey data typically date back a little earlier in the decade. They all include more sectoral and product disaggregation than the global models, and have multiple types of households and types of labor. All of the national studies include micro-simulations drawing on model results, as in the GIDD and GTAP global models.

The national results for real GDP and household consumption suggest that GDP would increase from full global trade reform, but only by 1 or 2 percent, in all ten countries

[4] The ten national studies are for Argentina (Cicowiez, Diaz-Bonilla and Diaz-Bonilla (2010), Brazil (Ferreira Filho and Horridge (2010), China (Zhai and Hertel 2010), Indonesia (Warr 2010a), Mozambique (Arndt and Thurlow 2010), Nicaragua (Sanchez and Vos 2010), Pakistan (Cororaton and Orden 2010), Philippines (Cororaton, Corong and Cockburn 2010), South Africa (Herault and Thurlow (2010), and Thailand (Warr 2010b).

(except in the case of Argentina when export taxes are also removed in its full liberalization).[5] Given falling consumer prices, real household consumption would increase by considerably more in most cases, Argentina again being the notable exception (for reasons discussed below). Generally these numbers are a little larger than those generated by the global Linkage model, but they are still generally much lower than would be the case had the authors used dynamic models. They therefore share the feature of the global models of underestimating the poverty-alleviating benefits of trade reform, given the broad consensus in the literature that trade liberalization increase growth, which is in turn a major contributor to poverty alleviation.

The comparative tables 9 and 10 summarize the national results for the incidence of extreme poverty and income inequality, respectively, resulting from own-country, rest-of-world or global full liberalization of agricultural or all goods trade. Some authors ran only six of the nine simulations shown in this table, but those that ran all nine found their results to sum up almost exactly, to one decimal place. We therefore have inferred the three missing results in the other country studies by assuming that the agriculture-only and nonagriculture-only results sum to the all-goods reform results. The inferred numbers are shown in italics in tables 9 and 10. In each case the total effects on poverty and inequality are subdivided into rural and urban.[6]

One should not necessarily expect the unweighted averages of the poverty results for each region to be similar to those generated by Hertel and Keeney (2010), because only half of the ten national case studies were included among the 15 countries sampled by Hertel and

[5] Results for Argentina are included only in the urban part of tables 9 and 10 because its household survey does not include rural areas. However, it should be kept in mind that Argentina is the most urbanized developing country in the sample, with only 8 percent of the population in rural areas in 2007. Hence even if the poverty effects in rural areas had the opposite sign it might not offset the urban sector results very much.

[6] Using national or $1 a day poverty lines, except for China for which results are available only for $2 a day.

Keeney. Nonetheless, the latter's unweighted averages of national poverty effects for each of the key developing country regions are reported in brackets in the last 4 rows of table 9(c), to make it easy to compare with the unweighted regional averages for the national case studies. In all but three of those twelve comparisons for global liberalization (agricultural, non-agricultural and all merchandise), the projected regional average poverty reductions from global liberalization are larger from the available sample of national case studies than from Hertel and Keeney's 15-country sample. Perhaps this suggests the poverty elasticities used in the latter study (and hence also in the Linkage model, since it generated similar results) are too small given the greater possibilities for adaptation reflected in most of the household models.[7]

As for the individual country results, poverty is reduced in all countries by both global agricultural and, with the exception of the Philippines, non-agricultural liberalization (table 9(c)). When all merchandise trade is liberalized, the extent of reduction ranges from close to zero to about 3.5 percentage points, except for Pakistan where it is more than 6 points.[8] On average nearly two-thirds of the alleviation is due to non-farm trade reform, with the important exception of Brazil where agricultural reform is the major contributor to its large pro-poor outcome. The latter result is despite the presence of tariff protection for Brazil's poor import-competing farmers, and is a consequence of the increase in demand for unskilled labor following liberalization, which evidently outweighs the poverty impact of removing farm tariffs. The contribution of own-country reforms to the fall in poverty appears to be

[7] Hertel and Keeney use stratum-specific poverty elasticities to map average income changes from all sources to poverty impacts.

[8] The Pakistan results were generated assuming replacement of trade taxation with a rise in direct income taxes. Only urban, non-poor households pay direct taxes in Pakistan, so the removal of tariffs decreases the after-tax incomes of the urban non-poor and means the benefits of trade reform go mainly to the poor.

equally as important as rest-of-world reform on average, although there is some considerable cross-country divergence in the extent of this for both farm and non-farm reform.

The poverty alleviation is sub-divided in parts (a) and (b) of table 9 into rural and urban sources. A glance at the final column of that part of the table reveals that rural poverty is cut much more than urban poverty in every case. That is true for both farm and non-farm trade reform, and for own-country as well as rest-of-world reform. Since the rural poor are much poorer on average than the urban poor (see Bussolo, De Hoyos and Medvedev 2010, Figure 1), this would lead one to expect trade reform to reduce inequality also.

Indeed, the results at the bottom of Table 10(c) for this sample of countries show that inequality would decline in all three developing country regions following full trade liberalization of all goods, or just agricultural products, and both for own-country and rest-of-world reform. The effect of non-farm trade reform on its own is more mixed, providing another reason to urge trade negotiators not to neglect agricultural reform in trade negotiations. Rest-of-world and global agricultural reform both lead to a reduction in inequality in every country in the sample except Thailand (plus Argentina and the Philippines slightly for global reform), whereas unilateral agricultural reform reduces (or leaves constant) inequality in a small majority of countries with Argentina, China, the Philippines and Thailand being the exceptions (but the latter effects are small). Non-farm global reform increases inequality slightly in three countries. In the case of Indonesia the inequality-increasing impact of non-farm reform more than offsets the egalitarian effect of farm trade reform, whereas both types of reform increase inequality in the case of the Philippines and Thailand.

Inequality within the rural or urban household grouping is not altered very much by trade reform as compared with overall national inequality (compare parts (a) and (b) with part

(c) of table 10). This underlines the point that trade reform would tend to reduce urban-rural inequality predominantly rather than inequality within either region.

Several of the national studies investigate impacts of reforms that could complement trade reforms, most notably different approaches to deal with the elimination of trade tax revenues. If these revenues can be recouped through taxes that do not bear on the poor, then the impacts of reform for poverty reduction are more favorable. The China study focuses on the vitally important issue of reducing the barriers to migration out of agriculture, by improving the operation of land markets and reducing the barriers to mobility created by the hukou system. These measures, and international trade liberalization that increases China's market access, are found to reduce poverty such that a combination of these measures would benefit all major household groups.

Argentina is a special case in several respects. One is that the authors of that study (Cicowiez, Diaz-Bonilla and Diaz-Bonilla 2010) had access only to an urban household survey, so were unable to say anything about the effect of policy reform on rural poverty or urban-rural income inequality. Secondly, Argentina imposed export taxes on farm products in late 2002 and has increased them a number of times since then. Removing them as part of a move to free trade would clearly benefit farmers and rural areas but would raise the price of food in urban areas. Together these features cause global trade reform to reduce Argentine urban poverty and inequality but only if the country's export taxes are not included in its reform. When export taxes are eliminated as well, the results in tables 9(b) and 10(b) show that urban inequality would hardly change but urban poverty would rise. It would rise—despite the country's non-farm reform reducing urban poverty—because of the strong negative impact on the urban poor of higher food prices as a result of export tax removal. In a global reform scenario in which export taxes are left unchanged, the authors found both

poverty and inequality would fall in Argentina, because it would generate less unemployment than when export taxes also are removed.

5. WHAT HAVE WE LEARNED?

As found in previous studies, whether based on *ex post* econometrics (as in Harrison 2007) or *ex ante* economy-wide simulation (as in Hertel and Winters 2006), so this study also finds mixed results that are not easy to summarize, particularly with regard to the poverty effects. There is nonetheless a high degree of similarity in the most important sign: the estimated national extreme poverty effect of freeing all merchandise trade globally. It happens to be the effect for which there is the most overlap between the studies summarized above. Those signs agree in all but one-seventh of the cases shown; and, apart from India, there is no case where the majority of the signs indicate reform would increase poverty.

This beneficial impact of full liberalization of global merchandise trade on the world's poor would come more from agricultural than non-agricultural reform; and, within agriculture, more from the removal of substantial support provided to farmers in developed countries than from developing country policy reform. According to the economy wide models used in the present study, such reform would raise real earnings of unskilled workers in developing countries, most of whom work in agriculture. Their earnings would rise relative to both unskilled workers in developed countries and other income earners in developing countries. This would thus reduce inequality both within developing countries and between developing and developed countries, in addition to reducing poverty.

According to the Linkage model results, the number of extremely poor people in developing countries (on less than $1 a day) is estimated to fall by 2.7 percent with global opening of all goods markets, and by 4 percent in China and Sub-Saharan Africa, but to rise by 4 percent in India (or by 1.7 percent if the more moderate $2 a day poverty level is used). The GIDD model suggests that the decline in moderate poverty would be less than the Linkage model's estimate, and that extreme poverty would actually rise by 1 percent globally with full global trade reform (almost all due to India), but recall that the GIDD model only takes into account labor income effects. The 15-country results from the GTAP model are more in line with those of the Linkage results. They suggest that the poverty-reducing effect in Asia and Latin America of global reform would be twice as large as the estimates from the GIDD model, and that in Africa there would be a small decline (rather than a small rise) in poverty. The ten national case studies all find global trade liberalization to be poverty alleviating (if the removal of export taxes is not part of the full liberalization for Argentina), regardless of whether the reform were to involve only agricultural goods or all goods, with the benefit coming roughly equally from reform at home and abroad. They also find that rural poverty would be cut much more than urban poverty in all cases, whether from reform at home or abroad and whether or not it included non-farm goods.

Global trade liberalization would reduce international inequality as between developing and high-income countries, both in total and for just farm households, according to the Linkage model. But it cannot be guaranteed that every developing country would be better off unless there is a strong economic growth dividend from reform (not captured in the comparative static modeling used in the present study). The message emerging from the GIDD analysis is less optimistic, in that it finds inequality would change little with full global reform (it falls in Latin America and rises in South Asia), mainly because of increased income dispersion within the agricultural sector and despite a reduction in the farm-nonfarm

household income gap. The analysis based on the GTAP model, which reinforced the findings from the Linkage model with respect to poverty, does not provide inequality effects.

Full trade liberalization of all goods, or just of agricultural products, also would cause inequality to decline within each of the three developing country regions covered by our sample of countries, and both for own-country and rest-of-world reform. Inequality within the rural or urban household grouping would not alter much following full trade reform, suggesting that trade reform's predominant impact would be to reduce urban-rural inequality.

The mechanism through which governments adapt to the fall in tariff revenue is also shown to be crucial. If it is assumed the poor do not have to bear any of the burden of replacing trade taxes, instead of sharing it proportionately, the estimated degree of poverty alleviation is about four times greater in the 15 countries studied with the GTAP model.

Results from the three global analyses all indicate that removing remaining agricultural policies would have much stronger impacts on poverty and inequality than would non-agricultural trade reforms. A weighted average across the ten country case studies would probably come to a similar conclusion. This contrasts with reforms over the past three decades: Valenzuela, van der Mensbrugghe and Anderson (2009, table 13.12) estimate that global non-farm trade policy reforms between the early 1980s and 2004 boosted value added in developing country agriculture more than twice as much as global agricultural policy reforms lowered it, and so could be expected to have had a dominant impact on past alleviation of poverty and inequality.

The ten national case studies also shine some light on the relative importance of domestic versus rest-of-world reform for those countries. The contribution of own-country reforms to the fall in poverty appears to be equally as important as rest-of-world reform on average, although there is some considerable cross-country divergence in the extent of this, both for farm and non-farm reform.

6. CAVEATS

The impacts of agricultural and other trade reform are complex, simultaneously affecting product and factor markets, government budgets and external trade. The studies included in this survey provide a broad range of *ex ante* modeling perspectives, including both global and national models. Considerable attention has been devoted to capturing poverty effects through the use of recent microsimulation and poverty elasticity approaches, and to using the same price distortion estimates, the same global model for getting rest-of-world border shocks for the ten national models, and similar behavioral assumptions, tax replacement assumptions and model closures. Nonetheless, there is ample scope for further exploration of this issue through additional comparisons, including in the form of drilling down into each modeling result to explore its origins.

The reforms considered here refer only to liberalization of goods trade. Freeing global trade in services is also likely to bring gains to most national economies, including their farmers. Freeing capital would add to those gains (Prasad et al. 2007), as would freeing the international movement of low-skilled labor from developing to higher-income countries (World Bank 2006). How those reforms would interact with farm and other goods trade reforms, in terms of their impacts on global poverty and inequality, is bound to be complex and so awaits the development of more-sophisticated global simulation models.

Another key challenge that remains is to capture the growth effects of liberalization and, in particular, their general equilibrium distributive (poverty and inequality) consequences. This area of research has only recently begun to be addressed in the empirical literature, building on the gains made in the theoretical endogenous growth literature in the 1990s. Existing partial equilibrium analysis strongly suggests that the trade-growth-poverty

nexus is extremely important, possibly much more important than the static reallocative impacts captured in the current set of studies. There is every reason to believe that, once dynamics are included in models, they will reinforce the basic finding of this study that agricultural and other merchandise trade policy reform is poverty and inequality reducing.

A further modeling change is to introduce a stochastic dimension so as to capture changes in the *probability* of falling into poverty. This is important if greater openness changes the risk of food price spikes: an upward spike could cause a food-deficit household to starve, for example. Such general equilibrium empirical modeling that contains sufficient sectoral and household detail to be useful for poverty analysis, even without a dynamic component, is still in its infancy. However, this field may develop rapidly in response to the demand for climate change studies, an early prototype being Ahmed, Diffenbaugh and Hertel (2009).

There is huge scope also for exploring empirically the possible effects of complementary domestic reforms that could accompany agricultural price and trade policy reforms. This is strongly illustrated in the China case study by Zhai and Hertel (2010), which showed that if labor market reform were to accompany trade reform the poverty alleviation would be several times greater. Even in the extreme case of India, the latter reforms would probably not increase poverty if more-efficient transfer mechanisms were in place and high-payoff infrastructure investments were made. The politics of having first-best domestic policies in place are not necessarily any less complex than those associated with trade policies, however, which underscores the need for comprehensive political economy analysis that does not limit its focus just to border policy measures.[9]

[9] A beginning has been made to political econometric analysis of the World Bank's agricultural distortions database in Anderson (2010).

7. POLICY IMPLICATIONS

The above empirical findings have a number of policy implications. First and foremost, the generally attractive results in terms of poverty and inequality alleviating effects from trade policy reforms, whether unilateral or multilateral, provide yet another reason as to why it is in the interests of countries to seek further liberalization of national and world markets.

Second, a recurring theme in the national case studies is that the gains in terms of poverty and inequality alleviation, in addition to the standard aggregate real income gains associated with trade liberalization, are generally much greater from global reform than from just own-country reform. In the Indonesia study, for example, unilateral trade liberalization is expected to reduce poverty only very slightly, but liberalization by the rest of the world is expected to lower poverty very substantially. In the Philippines, domestic reform alone from current levels of protection may marginally increase poverty rates, whereas rest-of-world liberalization would almost fully offset that (and more than offset it in the case of just agricultural reform).

Third, the results of this set of studies show that the winners from trade reform would overwhelmingly be found among the poorer countries and the poorest individuals within countries. However, it is also clear that even among the extreme poor, some will lose out. Hence the merit of compensatory policies, ideally ones that focus not on private goods but rather on public goods that reduce under-investments in pro-growth factors such as rural human capital.

Fourth, the strongest benefits would come from agricultural reform, underscoring the economic and social importance of securing reforms for that sector in addition to

manufacturing, notwithstanding the political sensitivities involved. There are more-direct and hence more-efficient domestic policy instruments that could meet government's poverty and hunger Millennium Development Goals than trade policies, but generally they are more of a net drain on treasury finances. This is particularly so for those governments of low-income countries which still rely heavily on trade tax revenue. One solution to that dilemma is to expand aid-for-trade funding as part of official development assistance programs.

Finally, the finding from most of the national case studies that domestic reform on its own can be a way of reducing poverty and inequality suggests that developing countries should not hold back on domestic reforms while negotiations in the World Trade Organization's Doha Round and other international accords continue. It also suggests that developing countries have little to gain, and potentially much to lose from a poverty alleviating perspective, from negotiating exemptions or delays in national reforms in the framework of WTO multilateral agreements.

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Table 1: Global poverty and inequality, by region, 1981 to 2005

(number and percent of people on less than $1/day in 2005 PPP)

	1981	**1987**	**1993**	**1999**	**2005**	*Share of poor (%) who are rural, 2002*	Index of income inequality (Gini coefficient) 2004[a]
No. of people (million)**:**							
Sub-Saharan Africa	157	202	247	299	299	*69*	n.a.
East Asia and Pacific	948	598	600	425	180	*85*	0.37
of which China	*730*	*412*	*444*	*302*	*106*	*90*	*0.36*
South Asia	387	384	341	359	350	*75*	0.35
of which India	*296*	*285*	*280*	*270*	*267*	*74*	*0.33*
Latin America and Caribbean	27	35	34	40	28	*34*	0.52
Rest of world	9	9	15	23	22	*50*	n.a.
WORLD	**1528**	**1228**	**1237**	**1146**	**879**	***74***	**n.a.**
East+South Asia's share of world	*87*	*80*	*76*	*68*	*60*		
Share of population (percent):							
Sub-Saharan Africa	40	42	44	46	39		
East Asia and Pacific	69	39	36	24	10		
of which China	*74*	*38*	*38*	*24*	*8*		
South Asia	42	37	29	27	24		
of which India	*42*	*36*	*31*	*27*	*24*		
Latin America and Caribbean	7	8	7	8	5		
WORLD	**42**	**30**	**27**	**23**	**16**		

[a] Gini coefficient is the population-weighted cross-country average of national Gini coefficients in the region for the nearest available year to 2004.

Source: Chen and Ravallion (2008) except for rural share (Ravallion, Chen and Sangraula 2007) and Gini coefficient (PovcalNet 2008).

Table 2: Nominal rates of assistance to tradable agricultural and non-agricultural products, and the relative rate of assistance[a] focus regions, 1980 to 2004

(percent)

	1980-84	1985-89	1990-94	1995-99	2000-04
Africa					
NRA agric. exportables	-35	-37	-36	-26	-25
NRA agric. imp-competing	13	58	5	10	2
NRA agric. tradables	-14	0	-15	-9	-12
NRA non-agric. tradables	2	9	3	2	7
RRA	-13	-8	-17	-10	-18
South Asia[c]					
NRA agric. exportables	-28	-21	-16	-12	-6
NRA agric. imp-competing	38	63	25	15	27
NRA agric. tradables	2	47	0	-2	13
NRA non-agric. tradables	55	40	19	15	10
RRA	-33	5	-16	-15	3
China and Southeast Asia[c]					
NRA agric. exportables	-50	-41	-21	-2	0
NRA agric. imp-competing	1	15	3	13	12
NRA agric. tradables	-35	-28	-12	5	7
NRA non-agric. tradables	21	23	20	10	6
RRA	-43	-42	-26	-4	2
Latin America					
NRA agric. exportables	-27	-25	-11	-4	-5
NRA agric. imp-competing	14	5	19	13	21
NRA agric. tradables	-13	-11	4	6	5
NRA non-agric. tradables	19	17	7	7	5
RRA	-27	-24	-3	-1	-1
All developing countries[c]					
NRA agric. exportables	-41	-36	-19	-6	-3
NRA agric. imp-competing	17	38	23	22	23
NRA agric. tradables	-21	-16	-4	4	7
NRA non-agric. tradables	35	27	17	10	6
RRA	-41	-34	-18	-5	1
High-income countries					
NRA agric. exportables	12	22	16	8	7
NRA agric. imp-competing	58	71	62	54	51
NRA agric. tradables	43	56	48	37	34
NRA non-agric. tradables	3	3	3	2	1
RRA	38	51	45	34	32

Source: Anderson and Valenzuela (2008), based on estimates reported in the project's national country studies.

a. The relative rate of assistance (RRA) is defined as $100*[(100+NRAag^t)/(100+NRAnonag^t)-1]$, where $NRAag^t$ and $NRAnonag^t$ are the percentage NRAs for the tradables parts of the agricultural and non-agricultural sectors, respectively (and $NRAag^t$ is the weighted average of the NRAs for the exporting and import-competing sub-sectors of agriculture).

Table 3: Effects of full global liberalization of agricultural and all merchandise trade on national economic welfare and real GDP, by country and region, using the Linkage model

(percent change relative to benchmark data)

	All sectors' policies	*Agricultural policies*		*All sectors' policies*	
	Economic welfare(EV)	Agric GDP	Non-ag GDP	Agric GDP	Non-ag GDP
East and South Asia	0.9	-0.3	0.7	0.5	2.9
of which China	*0.2*	*2.8*	*0.2*	*5.7*	*3.0*
India	*-0.2*	*-6.1*	*1.4*	*-8.3*	*-0.3*
Africa	0.2	0.1	0.8	-0.9	0.0
Latin America	1.0	36.3	2.8	37.0	2.3
All developing countries	**0.9**	**5.4**	**1.0**	**5.6**	**1.9**
Eastern Europe &Central Asia	1.2	-4.4	0.3	-5.2	0.3
All high-income countries	0.5	-13.8	0.2	-14.7	0.1
World total	**0.6**	**-1.0**	**0.4**	**-1.2**	**0.5**

Source: LINKAGE model simulations from Anderson, Valenzuela and van der Mensbrugghe (2010).

Table 4: Effects of full global merchandise trade liberalization on real factor prices, by country and region, using the Linkage model

(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**
East and South Asia	3.4	3.0	-1.8	3.2	4.6	4.8
Africa	4.7	4.3	0.1	4.4	5.8	6.9
Latin America	1.4	1.9	21.1	4.5	2.4	4.1
All developing countries	**3.0**	**2.9**	**1.6**	**3.5**	**5.5**	**5.9**
Eastern Europe & Central Asia	3.2	2.6	-4.5	1.7	4.2	4.5
High-income countries	1.0	0.5	-17.9	0.2	3.3	3.3
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: LINKAGE model simulations from Anderson, Valenzuela and van der Mensbrugghe (2010).

Table 5: Effects of full global merchandise trade liberalization on the incidence of extreme poverty using the Linkage model

	Average unskilled wage change, real[a] *(%)*	Baseline headcount		New levels, $1/day		New levels, $2/day		Change in number of poor from baseline levels		Change in number of poor from baseline levels	
		$1/day (%)	$2/day (%)	Headcount (%)	Number of poor, million	Headcount (%)	Number of poor, million	$1/day, million	$2/day, million	$1/day, %	$2/day, %
East Asia	*4.4*	9	37	8	151	34	632	-17	-52	-10.3	-7.6
China	*2.1*	10	35	9	123	34	440	-5	-12	-4.0	-2.7
Other East Asia	*8.1*	9	50	6	29	42	192	-12	-40	-30.1	-17.1
South Asia	*-1.9*	31	77	32	454	78	1124	8	8	1.8	0.7
India	*-3.8*	34	80	36	386	82	883	15	15	4.2	1.7
Other South Asia	*4.0*	29	94	26	68	92	241	-8	-7	-9.9	-2.7
Sub Saharan Africa	*5.3*	41	72	39	287	70	508	-11	-14	-3.8	-2.7
Latin America	*4.1*	9	22	8	44	21	115	-3	-6	-6.8	-4.7
Middle East & North Africa	*14.3*	1	20	1	3	13	40	-2	-19	-36.4	-32.7
Developing country total	***5.9***	**18**	**48**	**18**	**944**	**46**	**2462**	**-26**	**-87**	**-2.7**	**-3.4**
Developing excl. China	*6.5*	21	52	20	820	50	2022	-21	-74	-2.5	-4.7
East Europe & Central Asia	*4.5*	1	10	1	4	9	43	-0	-4	-6.8	-8.0

[a] Nominal unskilled wage deflated by the food and clothing CPI

Source: LINKAGE model simulations from Anderson, Valenzuela and van der Mensbrugghe (2010).

Table 6: Effects of removing agricultural and all merchandise trade distortions on the incidence of poverty using the GIDD model, by region

(a)extremely poor (<$1 a day)	Share of global poverty (%)	Change in no. of poor from global trade reform of: Agriculture only (million)	(%)	All merchandise (million)	(%)
East Asia	24	-6.4	-2.8	-6.3	-2.8
South Asia	50	15.4	3.3	18.2	3.9
Sub-Saharan Africa	21	-1.0	-0.5	0.5	0.3
Latin America	4	-2.8	-6.9	-3.5	-8.7
Global[a]	**100**	**5.0**	**0.5**	**8.9**	**1.0**
(b)moderately and extremely poor (<$2 a day)	(%)	(million)	(%)	(million)	(%)
East Asia	33	-12.8	-1.6	-13.2	-1.7
South Asia	46	-3.6	-0.3	-2.0	-0.2
Sub-Saharan Africa	14	0.1	0.0	1.1	0.3
Latin America	4	-4.8	-4.6	-5.7	-5.4
Global[a]	**100**	**-22.1**	**-0.9**	**-19.8**	**-0.8**

[a] Includes Middle East & North Africa, Eastern Europe & Central Asia, and high-income countries, which together account for no more than 2 percent of the world's poor.

Source: Bussolo, De Hoyos and Medvedev (2010).

Table 7: Effects of removing agricultural and all merchandise trade distortions on global poverty and inequality of farm and non-farm households

(percentage point change)

Initial levels:	Gini coefficient (%)	Real average monthly income (2000, US$ PPP)	$1 a day poverty incidence (%)	$1 a day poverty share (%)	$2 a day poverty incidence (%)	$2 a day poverty share (%)
Agricultural	0.45	65	31.5	76	73.8	70
Nonagricultural	0.63	320	8.3	24	26.7	30
All households	**0.67**	**204**	**18.9**	**100**	**48.2**	**100**
Agricultural liberalization, difference from baseline (percentage points):						
Agricultural	0.7	1.1[a]	0.86	1.1	-0.86	0.5
Nonagricultural	-0.1	0.2[a]	-0.29	-1.1	-0.90	-0.5
All households	**-0.1**	**0.3[a]**	**0.23**	**0.0**	**-0.88**	**0.0**
All merchandise trade liberalization, difference from baseline (percentage points):						
Agricultural	0.8	0.8[a]	1.09	1.0	-0.66	0.6
Nonagricultural	-0.2	0.4[a]	-0.19	-1.0	-0.95	-0.6
All households	**-0.0**	**0.4[a]**	**0.39**	**0.0**	**-0.82**	**0.0**

[a] Changes in average income are expressed in percentages.

Source: Source: Bussolo, De Hoyos and Medvedev (2010).

Table 8: Effects of full global liberalization of agricultural and all merchandise trade on the incidence of extreme poverty using the GTAP model

(percentage point change using $1 a day poverty line)

	Default tax replacement			Alternative tax replacement (poor are exempt)
	Agriculture-only reform	Nonagriculture-only reform	All merchandise reform	All merchandise reform
Asia				
Bangladesh	-0.3	0.5	0.3	-5.3
Indonesia	-1.1	0.5	-0.6	-5.2
Philippines	-1.4	0.4	-1.0	-6.4
Thailand	-11.2	0.9	-10.3	-28.1
Vietnam	-0.5	-5.3	-5.7	-23.6
Africa				
Malawi	-1.6	-0.3	-1.9	-5.6
Mozambique	-1.2	0.2	-1.0	-4.3
Uganda	-0.0	0.1	0.1	-6.0
Zambia	-0.0	0.1	0.1	-2.0
Latin America				
Brazil	-2.5	0.4	-2.2	-10.0
Chile	-4.8	0.1	-4.6	-12.3
Columbia	-0.7	0.6	-0.1	-4.1
Mexico	0.8	0.4	1.1	-0.5
Peru	-0.6	-0.2	-0.8	-5.2
Venezuela	0.2	0.7	0.9	-2.1
Unweighted averages:				
-Asia	**-2.9**	**-0.6**	**-3.5**	**-13.7**
-Africa	**-0.7**	**0.1**	**-0.7**	**-4.5**
-Latin Amer	**-1.3**	**0.3**	**-1.0**	**-5.7**
-All 15 DCs	**-1.7**	**-0.1**	**-1.7**	**-8.0**

Source: Hertel and Keeney (2010, table 5).

Table 9: Impact of reform on the incidence of extreme poverty

(percentage point change using national or $1 a day poverty line)

(a) rural poverty

	Base	Agriculture-only reform			Nonagriculture-only reform			All merchandise reform		
	(%)	Unilateral	R of W	Global	Unilateral	R of W	Global	Unilateral	R of W	Global
China($2/day)	58	0.3	-1.4	*-1.1*	*0.2*	*-0.5*	*-0.3*	0.5	-1.9	*-1.4*
Indonesia	29	0.1	-1.1	-1.1	*-0.2*	*-3.2*	*-3.3*	-0.1	-4.3	-4.4
Pakistan	38	-1.4	-0.1	-1.5	*-6.2*	*-1.1*	*-7.1*	-7.6	-1.2	-8.6
Philippines	49	0.0	-0.6	-0.3	*0.6*	*-0.3*	*0.2*	0.6	-0.9	-0.1
Thailand	30	0.3	-1.6	-1.3	*-3.8*	*0.7*	*-3.1*	-3.5	-0.9	-4.4
Mozambique	36	-1.6	0.0	*-1.6*	*-0.5*	*-1.5*	*-2.0*	-2.1	-1.5	-3.6
South Africa	17	-0.3	-0.3	*-0.7*	*-0.8*	*0.0*	*-0.8*	-1.1	-0.4	-1.4
Argentina										
Brazil										
Nicaragua	63	-0.7	*0.3*	-0.4	*-0.6*	*-0.3*	*-0.9*	-1.3	*0.0*	-1.3

(b) urban poverty

	Base	Agriculture-only reform			Nonagriculture-only reform			All merchandise reform		
	(%)	Unilateral	R of W	Global	Unilateral	R of W	Global	Unilateral	R of W	Global
China($2/day)	3	0.0	0.0	*0.0*	*0.0*	*-0.1*	*-0.1*	0.0	-0.1	*-0.1*
Indonesia	12	-0.1	-0.3	-0.4	*-0.1*	*-1.7*	*-1.8*	-0.2	-2.0	-2.2
Pakistan	20	-2.4	-0.1	-2.7	*4.7*	*-1.4*	*3.1*	2.3	-1.5	0.4
Philippines	19	0.8	-0.9	-0.2	*1.2*	*-0.7*	*0.3*	2.0	-1.6	0.1
Thailand	6	0.0	-0.8	-0.7	*-3.3*	*0.2*	*-3.2*	-3.3	-0.6	-3.9
Mozambique	37	-0.5	0.0	*-0.5*	*-0.4*	*-1.3*	*-1.7*	-0.9	-1.3	*-2.2*
South Africa	4	-0.1	-0.2	*-0.3*	*-0.4*	*0.0*	*-0.4*	-0.5	-0.2	*-0.7*
Argentina	13	1.3	0.1	1.5	*-0.4*	*-0.1*	*-0.5*	0.9	0.0	1.0
Brazil										
Nicaragua	27	0.3	*-0.5*	-0.2	*-1.0*	*1.4*	*0.4*	-0.7	*0.9*	0.2

Table 9 (continued): Impact of reform on the incidence of extreme poverty
(percentage point change using national or $1 a day poverty line)

(a) total poverty

	Base	Agriculture-only reform			Nonagriculture-only reform			All merchandise reform		
	(%)	Unilateral	R of W	Global	Unilateral	R of W	Global	Unilateral	R of W	Global
China($2/day)	36	0.2	-0.8	*-0.6*	*0.1*	*-0.4*	*-0.3*	0.3	-1.2	*-0.9*
Indonesia	23	-0.0	-0.8	-0.8	*-0.1*	*-2.7*	*-2.8*	-0.1	-3.5	-3.6
Pakistan	31	-1.6	-0.1	-1.8	*-3.6*	*-1.2*	*-4.6*	-5.2	-1.3	-6.4
Philippines	34	0.4	-0.6	-0.1	*0.7*	*-0.3*	*0.2*	1.1	-0.9	0.1
Thailand	14	0.1	-1.1	-0.8	*-3.5*	*0.4*	*-3.3*	-3.4	-0.7	-4.1
Mozambique	36	-1.3	0.0	*-1.3*	*-0.4*	*-1.4*	*-1.8*	-1.7	-1.4	*-3.1*
South Africa	10	-0.2	-0.3	*-0.5*	*-0.6*	*-0.1*	*-0.6*	-0.8	-0.3	*-1.1*
Argentina										
Brazil	31	-0.5	-2.3	-2.8	-0.4	-0.1	*-0.5*	*-0.9*	*-2.4*	-3.5
Nicaragua	41	-0.1	*-0.2*	-0.3	*-0.9*	*0.8*	*-0.1*	-1.0	*0.6*	-0.4
Unweighted averages:										
-Asia	***28***	***-0.2***	***-0.7***	*(-2.9)***-0.8***	***-1.2***	***-0.8***	*(-0.6)***-2.2***	***-1.5***	***-1.6***	*(-3.5)***-3.0***
-Africa	***32***	***-0.8***	***-0.2***	*(-0.7)***-0.9***	***-0.5***	***-0.7***	*(0.1)***-1.2***	***-1.3***	***-0.9***	*(-0.7)***-2.1***
-Latin Am.	***36***	***-0.3***	***-1.3***	*(-1.3)***-1.6***	***-0.7***	***0.4***	*(0.3)***-0.3***	***-1.0***	***-0.9***	*(-1.0)***-2.0***
-All 9 DCs	***43***	***-0.4***	***-0.6***	*(-1.7)***-1.0***	***-0.9***	***-0.6***	*(-0.1)***-1.5***	***-1.3***	***-1.2***	*(-1.7)***-2.6***

[a] Numbers in italics for individual countries are implied assuming linearity holds; numbers do not always add because of either rounding or interaction effects

Source: Country case studies in Parts II to IV of Anderson, Cockburn and Martin (2010) plus (in the case of the unbolded numbers in brackets in the final 4 rows), from Hertel and Keeney (2010) as reported in the last 4 rows of table 8 above.

Table 10: Impact of reform on the incidence of income inequality

(percentage point change in Gini Coefficient)

(a) rural

	Base	Agriculture-only reform			Nonagriculture-only reform			All merchandise reform		
	(%)	Unilateral	R of W	Global	Unilateral	R of W	Global	Unilateral	R of W	Global
China	0.32	0.0	-0.2	*-0.2*	*0.0*	*0.0*	*0.0*	0.0	-0.2	*-0.2*
Indonesia	0.29	0.0	0.0	0.0	*0.1*	*0.0*	*0.1*	0.1	0.0	0.1
Pakistan	0.26	-0.1	-0.0	-0.1	*0.3*	*0.0*	*0.3*	0.2	-0.0	0.2
Philippines	0.43	0.2	-0.1	0.1	*0.3*	*0.0*	*0.1*	0.5	-0.1	0.2
Thailand	0.33	0.0	0.5	0.5	*0.4*	*0.0*	*0.4*	0.4	0.5	0.9
Mozambique										
South Africa	0.63	-0.1	-0.1	*-0.2*	*-0.3*	*0.0*	*-0.3*	-0.4	-0.1	*-0.5*
Argentina										
Brazil										
Nicaragua										

(b) urban

	Base	Agriculture-only reform			Nonagriculture-only reform			All merchandise reform		
	(%)	Unilateral	R of W	Global	Unilateral	R of W	Global	Unilateral	R of W	Global
China	0.26	0.0	0.1	*0.1*	*0.0*	*-0.1*	*-0.1*	0.0	0.0	*0.0*
Indonesia	0.36	0.0	-0.1	-0.1	*0.3*	*0.3*	*0.6*	0.3	0.2	0.5
Pakistan	0.40	-0.1	-0.0	-0.1	*-1.9*	*0.0*	*-1.9*	-2.0	-0.0	-2.0
Philippines	0.48	0.3	-0.2	0.1	*0.1*	*0.0*	*0.1*	0.4	-0.2	0.2
Thailand	0.15	0.1	0.6	0.7	*0.5*	*0.0*	*0.5*	0.6	0.6	1.2
Mozambique										
South Africa	0.62	-0.1	-0.1	*-0.2*	*-0.5*	*0.0*	*-0.5*	-0.6	-0.1	*-0.7*
Argentina	0.50	0.3	-0.1	0.2	*-0.2*	*-0.1*	*-0.3*	0.1	-0.2	0.0
Brazil										
Nicaragua										

Table 10 (continued): Impact of reform on the incidence of income inequality
(percentage point change in Gini Coefficient)

(c)total

	Base	Agriculture-only reform			Nonagriculture-only reform			All merchandise reform		
	(%)	Unilateral	R of W	Global	Unilateral	R of W	Global	Unilateral	R of W	Global
China	0.44	0.1	-0.4	*-0.3*	*0.0*	*-0.1*	*-0.1*	0.1	-0.5	*-0.4*
Indonesia	0.34	0.0	-0.1	-0.1	*0.2*	*0.2*	*0.4*	0.2	0.1	0.3
Pakistan	0.34	-0.1	-0.0	-0.2	*-3.2*	*-0.1*	*-3.1*	-3.3	-0.1	-3.3
Philippines	0.51	0.3	-0.2	0.1	*0.1*	*0.0*	*0.1*	0.4	-0.2	0.2
Thailand	0.34	0.1	0.7	0.8	*0.4*	*0.0*	*0.4*	0.5	0.7	1.2
Mozambique	0.48	-1.2	-0.1	*-1.3*	*-0.3*	*0.2*	*-0.1*	-1.5	0.1	*-1.4*
South Africa	0.67	-0.1	-0.1	*-0.2*	*-0.4*	*0.0*	*-0.4*	-0.5	-0.1	*-0.6*
Argentina										
Brazil	0.58	-0.2	-1.4	*-1.6*	0.1	-0.1	*0.0*	*-0.1*	*-1.5*	-1.7
Nicaragua	0.53	-0.1	*0.1*	0.0	*-0.1*	*-0.2*	*-0.3*	-0.2	*-0.1*	-0.3
Unweighted averages:										
-Asia	***0.39***	***0.1***	***-0.0***	***0.1***	***-0.5***	***0.0***	***-0.5***	***-0.4***	***-0.0***	***-0.4***
-Africa	***0.58***	***-0.7***	***-0.1***	***-0.8***	***-0.4***	***0.1***	***-0.3***	***-1.0***	***-0.0***	***-1.0***
-Latin Am.	***0.56***	***-0.2***	***-0.7***	***-0.8***	***0.0***	***-0.2***	***-0.1***	***-0.2***	***-0.8***	***-1.0***
-All 9 DCs	***0.59***	***-0.2***	***-0.2***	***-0.4***	***-0.3***	***-0.0***	***-0.3***	***-0.5***	***-0.2***	***-0.7***

[a] Numbers in italics are implied assuming linearity holds; numbers do not always add because of either rounding or interaction effects

Source: Country case studies in Parts II to IV of Anderson, Cockburn and Martin (2010).