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ABSTRACT

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JEL Classification: C68, D58, F17 and Q17
Keywords: agricultural value added, CGE modelling, economic welfare and trade policy reform

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Abstract

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Do Global Trade Distortions Still Harm Developing Country Farmers?

While developing country farmers contribute less than 3 percent of global GDP, they account for 43 percent of global employment, 64 percent of global agricultural value added, and a similarly large share of global poverty as measured by earnings of less than $1 a day. Raising net farm incomes is therefore a key to meeting the Millennium Development Goal of halving global poverty by 2015. If that can be done by policy reforms that also boost the efficiency of resource use and raise developing country and world GDP, so much the better. This paper asks if reducing trade policy distortions (including agricultural subsidies in high-income countries) could provide such a magic bullet.

Two decades ago, the answer to that question was unequivocally affirmative. A number of studies provided a clear picture of the adverse effects of government policies on farmers' incentives in developing countries in the 1980s. Farm subsidies and import restrictions of developed countries depressed the international prices of farm relative to non-farm products (Tyers and Anderson 1986, 1992), while developing countries' own trade and exchange rate policies further depressed their farmers' incentives (Krueger, Schiff and Valdes 1988) – as they had since at least the 1960s (Little, Scitovsky and Scott 1970; Balassa and Associates 1971). Time series data for developed and newly industrializing countries up to that time also indicated a clear tendency for national governments to gradually change from taxing to subsidizing agricultural relative to industrial production (and from subsidizing to taxing food consumers) in the course of their economic development (Anderson and Hayami 1986, Lindert 1991). Had that

tendency continued, today's developing country farmers would be even more adversely affected by richer countries' policies.

However, several developments since the mid-1980s have altered the policy environment. First, the World Trade Organization's Uruguay Round Agreement on Agriculture -- negotiated over the period 1986-94 and implemented in the subsequent ten years -- slowed and in some cases reversed the growth in agricultural protection. Second, recent accessions to WTO (especially of China and Taiwan from early 2002) added to the commitments to limit agricultural tariffs and subsidies. Third, early this decade developed countries expanded non-reciprocal preferential access to their markets for developing country exports, notably via the Africa Growth and Opportunity Act adopted by the US Congress in 2000 and the 'Everything But Arms' initiative in 2001 by the European Union (which added to EU preferences provided to former colonies in Africa, the Caribbean and the Pacific under the Lome Convention). Meanwhile, many developing countries themselves have opted to reduce their own disincentives against their farmers, as part of overall structural adjustments encouraged by international lending institutions (World Bank 2002).

Given these policy developments, is it still the case that developing country farmers are discriminated against by the patterns of trade distortions across sectors and regions? By the mid-1990s it appeared to one group of analysts that, for the sample of fifteen developing countries they examined, the problem of an anti-agricultural bias in those countries' own trade and sectoral policies had all but disappeared (Jensen, Robinson and Tarp 2002). Even if we assume the price distortions used in that study were a true reflection of policy distortions at that time, is its sample of countries

representative of all developing countries? Are there, for example, some more-advanced developing countries that have 'overshot' and adopted the potentially equally wasteful pro-agricultural policy bias of high-income economies? And how are those high-income countries' somewhat-reformed policies and preferential access agreements now affecting developing country farmers?

To answer all but the last of those questions requires extending the time series of estimates of distortions in the Krueger/Schiff/Valdes sample and expanding theirs and the Jensen/Robinson/Tarp sample to a wider range of countries. That is the focus of a new research project getting under way at the World Bank.

As a prelude to that new project, though, it is possible to answer the question in the title of the present paper using a new database for 2001 at least. Specifically, the present paper addresses two questions. First, what would be the consequences for agricultural value added (net farm incomes) if all countries were to remove their trade distortions simultaneously (as in an ideal WTO round), as distinct from just reducing their own distortions? While no-one anticipates such a radical reform, the analysis can serve as a benchmark to suggest what is at stake in the WTO's current round of multilateral trade negotiations (Anderson and Martin 2005, 2006). The second question addressed below is: for a selection of large developing countries and Sub-Saharan Africa, what contribution would their own unilateral reform make to the impact on net farm incomes of global reform?[1]

[1] The Krueger, Schiff and Valdes (1988) and Jensen, Robinson and Tarp (2002) studies focused on effects of just own-country policies, the first using partial equilibrium and the second using national

Specifically, we make use of a new variant of a model of the global economy known as GTAP-AGR (Keeney and Hertel 2005) to provide real farm income effects of moving to free trade by developing countries versus by high-income countries, and in agriculture as compared with non-agricultural sectors. We also make use of the latest GTAP database (Version 6), which has the virtue of including not only reciprocal but also non-reciprocal preferential tariffs, the latter providing exporters in many low-income countries with duty-free access to protected high-income country markets. This allows us to take into account the fact that such a reform may cause a decline in the international terms of trade for those developing countries that are enjoying preferential access to agricultural markets of high-income countries (in addition to those that are net food importers because their comparative advantage is in other sectors such as labor-intensive manufacturing).

The paper begins with an examination of current distortions, the emphasis being mainly on import tariffs since they are later shown to be far more important than agricultural subsidies. This is followed by a description of GTAP-AGR model of the global economy to be used to analyze the consequences of removing those distortions. The key results of the simulations are then presented, distinguishing between the impacts of policies of high-income and developing countries, of agricultural and non-agricultural (including services) policies and, within agriculture, of the different policy instruments and the different commodity programs. The paper concludes by highlighting the key messages and suggestion priority areas for further research.

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general equilibrium models. On the relationship between those two methodologies, and for reasons as to why the latter is superior in principle, see Bautista, Robinson, Wobst and Tarp (2001).

Key distortions in global markets

Border measures traditionally have been the main means by which governments distort prices in their domestic markets for products, with the price of tradables relative to nontradables affected by interventions in the market for foreign exchange, and the relative prices of the various tradables affected by trade taxes-cum-subsidies or quantitative trade restrictions. Product-specific domestic producer or consumer subsidies have played a more limited role (because of their much greater cost to the treasury), with a few exceptions most notably in agriculture in high-income countries (Legg 2003; OECD 2005a). With the freeing up of most foreign exchange markets over the past two decades (Hinkle and Montiel 1999), the phasing out of most export taxes (Piermartini 2004; Theile 2004), and the conversion of many non-tariff trade barriers into tariffs including for farm products (Ingco 1996), the task of measuring the extent of distortions to goods markets is made much easier in that attention can focus on import tariffs and OECD agricultural subsidies. Services regulations also could distort incentives in the agricultural and industrial sectors, so it is worth exploring their effects on farm income too -- although much controversy still surrounds their measurement and how they should be modeled.

The latest release of the GTAP dataset, Version 6, includes estimates of bilateral tariffs and of domestic and export subsidies as of 2001 for 87 countries and country groups spanning the world, and for 57 aggregated sectors of the economy. This is a

substantial improvement over Version 5 of the GTAP dataset, which relates to policies in 1997. The new protection data come from a joint CEPII (Paris)/ITC (Geneva) project. The product of this joint effort, known as MAcMaps, provides HS6 tariff level details on bilateral tariffs (incorporating all significant reciprocal and non-reciprocal preferences) including ad valorem tariff equivalents of specific and compound tariffs and key non-tariff barriers such as tariff rate quotas (TRQs).[2] The new GTAP database has lower tariffs than the previous Version 5 database because of the inclusion for the first time of non-reciprocal trade preferences and because of major reforms between 1997 and 2001 such as China's progress towards WTO accession (which alone contributed to the ratio of global exports plus imports to GDP rising from 44 to 46 percent over those four years) and the continued implementation of the Uruguay Round agreements (van der Mensbrugghe 2005).

According to this dataset, the average import tariff in high-income countries in 2001 is 20.2 percent for primary agricultural products, and 13.0 percent for processed food, compared with just 0.5 percent for other primary products and 2.1 percent for other manufactures.[3] In developing countries, by contrast, the average tariff for primary

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[2] More information on the MAcMaps database is available in Bouët et al. (2004) and at http://www.cepii.fr/anglaisgraph/bdd/macmap.htm. For details of its incorporation into the GTAP Version 6 dataset, see Dimaranan and McDougall (2005) and www.gtap.org.

[3] High-income countries include all members of the EU25, NAFTA and the OECD (except Turkey) plus Hong Kong, Singapore and Taiwan. All others (including the wealthy Middle East countries) are considered developing countries and are further split into middle- and low-income categories as defined at the bottom of Appendix Table A1.

agriculture is lower at 17.0 percent, while it is higher for the other three sectors at 19.3 percent for processed food, 2.5 percent for other primary products, and 10.0 for other manufactures. Needless to say, these averages vary considerably within those two country groups, as shown in Table 1.

These import tariff averages can be poor indicators of overall assistance to farming, even if there were no farm production or trade subsidies or any exceptional tax treatment for the sector. For example, if high-income countries' import tariffs are at near-prohibitive levels for temperate farm products but are low for tropical products such as coffee, their import-weighted average agricultural tariff could be quite low yet agricultural value added in those rich countries would have been enhanced substantially. Consider also the case of a developing country with a strong agricultural comparative advantage in all but one small farming industry, and with high tariffs to reduce import competition for that industry and for all manufacturing industries. Overall agricultural value added would be depressed by that structure of protection, yet the import-weighted average tariff protection for agriculture would be high and possibly above that for manufactures. A third case is where the non-agricultural primary sector receives a similar level of import protection as the farm sector and less than the manufacturing sector, but is much more export-focused than agriculture: trade reform may cause it to expand at the expense not only of manufacturing but also of farming. Hence it is not possible to say from the tariff data in Table 1 alone whether developing country policies now have a pro-agricultural bias, even though the ratio of agricultural to all goods tariffs in that table is well above unity for each of the regions shown. What is needed is a general equilibrium model to estimate the net effects of

own and other countries' various sectoral distortions on agricultural markets and net farm income. The latter impact, on agricultural value added, is a measure of the global general equilibrium effective rate of assistance to the primary agricultural sector, a portion of which is attributable to own-country policies.[4]

Before turning to that model, the Version 6 GTAP database needs to be augmented to include distortions to services sectors.[5] We follow Hertel and Keeney (2006) in assuming the removal of services distortions can be modeled as a technological change that reduces the cost to all sectors of imported intermediate inputs. The extent of those trade cost equivalent barriers in services are based on work by Francois, Meijl, and Tongeren (2005), who draw on the pattern of residuals from a gravity model of national imports estimated from the GTAP database. Their estimates are shown in Table 2.

The GTAP-AGR Model

We employ a new variant of the widely used GTAP model (Hertel 1997) that is specifically oriented to analyzing agricultural markets, namely the GTAP-AGR model (Keeney and Hertel 2005). We use the standard GTAP model assumptions of perfect

[4] This approach is similar to that taken by Dihel (2004) except that only own-country policies are considered in that study.

[5] We also insert a production subsidy for US cotton, following the WTO dispute settlement case which ruled that those subsidies belong in the Uruguay Round Agreement on Agriculture's amber box, rather than in the green box as notified by the US. We conservatively estimate that subsidy to be 28 percent for 2001.

competition and constant returns to scale in production activities, a Constant Difference of Elasticities (CDE) demand system which permits differential price and income responsiveness across countries, and bilateral international trade flows handled through Armington elasticities by which products are differentiated by country of origin. These Armington elasticities are region-specific, and are econometric estimates at the 57 GTAP commodity level based on the elasticity of substitution in consumption among imported goods from different sources (Hertel et al. 2003).

The GTAP-AGR model introduces a number of modifications to the way agriculture is handled in the standard GTAP model, based on recent econometric studies. First, it incorporates a region-specific elasticity of land transformation amongst agriculture uses. While land is specific to agriculture in the GTAP model, the new parameters in GTAP-AGR make land less responsive within the agricultural sector to changes in relative agriculture prices. Second, GTAP-AGR incorporates region-specific labor and capital supply elasticities in constant elasticity of transformation functions that allocate their use between agricultural and non-agricultural sectors. The limited mobility of labor allows for wage differentials between agriculture and non-agricultural sectors, and capital too is allowed to receive return differentials between agricultural and non-agricultural activities. These supply elasticities are based on estimates from the OECD (2001). Third, the GTAP-AGR model also allows for substitution among farm-owned and purchased inputs, and between the two, by calibrating each sector's constant elasticity of substitution cost function to the region-specific Allen elasticities of substitution provided by OECD estimates. Fourth, the livestock production function is modified to capture more realistic substitution possibilities in feed demand, by

modeling the substitution possibilities for feedstuffs as an additional CES nest in the sector's cost function. This livestock production function is parameterized based on a three-stage model describing the behavior of European livestock producers, composite feed mixers, and grain producers (Surry 1990). Finally, the GTAP-AGR consumer demand system is re-specified assuming separability of food from non-food commodities, and calibrated in line with a recent set of price and income elasticities from a cross-country study (Seale, Regmi and Bernstein 2003).[6]

In the simulations that follow, we use the standard GTAP closure. This assumes that the levels of each region's employment of each of the productive factors is fixed in aggregate, and that there is always equilibrium in the balance of trade which forces national investment to be equal to national savings.

To keep the sizes of the table of results reasonable, we aggregate the GTAP 6 database to 27 regions and 29 sectors, bearing in mind the need to provide some detail in the agri-food sectors. These regions and sectors are listed in Appendix Tables A1 and A2, respectively.

Effects of removing distortive goods and services policies globally

[6] While one of the benefits of using a global general equilibrium framework is the modeling of all economic agents' behaviors, and in this case also the depiction of some specifics of agricultural markets in the GTAP-AGR model, the results necessarily depend on the parameters chosen. A natural validation of the model is to see how well the model is able to replicate historical records. Support for the use of the GTAP-AGR model is provided by Valenzuela et al. (2005) who show that the model replicates reasonably well historical wheat price variability in world markets.

The estimated effects of full global trade liberalization as of 2001 on each of the four sectors' value added are summarized for the key developing country regions in Table 3 and are shown with more country detail for just agricultural value added in Table 4. Beginning with the top right-hand numbers of Table 3, these results suggest real farm incomes in developing countries are still harmed by the existing pattern of global trade distortions, and more so than any of the other goods sectors (non-agricultural primary production, food processing, and other manufacturing) and hence for non-agriculture in total. In the absence of those policies, agricultural value added would have been 5.7 percent higher on average, and higher in each of the six developing country regions shown in that table in absolute terms and relative to non-agriculture in total (see the numbers in parentheses in the final column of Table 3). There is considerable regional variation though: the averages are 12 percent higher in Latin America, 10 percent higher in East Asia (excluding Korea and Taiwan which, with Hong Kong and Singapore, we classify as high-income), 3 percent higher in Sub-Saharan Africa, and less than 2 percent higher in the three other developing country regions.

Turning to the top left-hand numbers of Table 3, it is clear that most of that gain to developing country farmers would come from the removal of agricultural tariffs and subsidies in high-income countries.[7] Net farm incomes in all developing country

[7] Decomposition of those results reveals that more than two-thirds of the gains to developing country farm incomes from high-income country agricultural policy reform would come from removal of tariffs, and that domestic rather than export subsidies contribute most of the rest.

regions, even those that are net food importers and those receiving preferential access to protected markets in high-income countries, would be boosted by such reform. By contrast, according to the GTAP Version 6 database and GTAP-AGR model used here, agricultural value added in all developing country regions would be reduced by the reform of agricultural and food policies in developing countries themselves. Columns 3 and 4 of Table 3 show that loss would be partly offset by reform in non-agricultural sectors though, with services reform making almost as much of a contribution as reform of other goods sectors (and considerably more in Sub-Saharan Africa and South Asia).[8]

Value added in the processed food sector is similarly affected, although to a lesser extent on average than in the farm sector. Value added in non-agricultural primary production is affected very much less for developing countries as a whole, but note from the final column of Table 3 that it benefits proportionately more than farming in Africa, the Middle East and the former Soviet Union. By contrast, non-food manufacturing value added would decline in all developing country regions except Asia following a move to global free trade.

The differential impacts on net farm incomes within regions from freeing trade are shown in Table 4. In East Asia it is primarily Chinese farming that would benefit while in South Asia, farming is benefited in Pakistan and Sri Lanka rather than in India

[8] The smallness of our estimated contribution of service sector distortions to value added in agricultural and other goods sectors is consistent with the findings of two other recent studies drawing on similar service distortion estimates (Dee 2004; Dihel 2004). Recall, though, that the distortions to the services sector we use (see Table 2) may well seriously underestimate the full extent of actual services distortions.

and Bangladesh. Only in a handful of the developing countries listed (Russia, Bangladesh, India and the Philippines) would farmers be worse off under full reform.

How important is own liberalization as distinct from other countries' liberalization? This is shown in Table 5 for a selection of developing countries. Farmers Argentina and especially Brazil would gain hugely from high-income agricultural reform and a little from their own and other developing countries' reforms; farmers in China also would gain a lot from high-income country reform but, as for the other developing country regions shown, they would lose a little from own reform; and farmers in South Asia and Sub-Saharan Africa also would lose a little from other developing countries' reform. In Indonesia and Sub-Saharan Africa farmers would gain overall from global liberalization; but in Bangladesh and India the farmers' gain from high-income countries' reform is not enough to offset the loss from own and other developing countries' reform -- instead it is manufacturing that would gain in those two countries, mainly from own-country reform. In Sub-Saharan Africa, the biggest proportional gain in sectoral value added is in non-agricultural primary activities (three times that for agriculture), mainly from own-country reform.

When the effects of agricultural and non-agricultural liberalizations are separated, as in Table 6, it is evident that agricultural reform by other developing countries reduces the adverse effect of own-country agricultural reform on net farm income (and conversely for non-agricultural liberalization).

The tariffs reported in Table 1 show import protection in South Asia and Sub-Saharan Africa to be half as large again in agriculture and food processing as in other manufacturing. Yet careful studies that compare domestic and border prices for some of

those countries have found very little actual protection delivered to farmers from import barriers (e.g., Mullen, Orden and Gulati 2005; Martin and Wang 2004), suggesting there may be 'water' in the agricultural tariffs that are included in the GTAP database. What would be the impact of trade reform on net farm incomes if the delivered protection rates to agriculture were in fact zero? To see how much difference that could make to the results, we re-calibrated the model assuming agricultural tariff protection in 2001 was actually zero in Bangladesh, India, and Sub-Saharan Africa other than South Africa, and then re-ran the full global liberalization simulation. The difference this makes to the net farm income results for those countries, shown in the lower part of Table 6, reveal that the earlier small gain to Sub-Saharan African farmers from global liberalization would nearly quadruple, and the small losses to farmers in Bangladesh and India would switch to a gain of around 4 percent. These simulations underscore the point that the results depend heavily on own-country agricultural protection rates, which in the current GTAP database are assumed to be fully reflected in the applied import tariff rates in the case of developing countries (whereas for high-income countries they are based on the much more thorough estimates of producer support estimates provided by OECD 2005a).

Also, the GTAP database includes almost no export taxes, yet there is evidence that some do still exist ((Piermartini 2004). In Argentina's case that were re-introduced in 2002 (OECD 2005b, Annex A). To see how much difference they could make to the effects of reform, we re-calibrated the model assuming not only that Argentina's agricultural tariff protection in 2001 was zero but also that export taxes were 20 percent for cereals, oilseeds and livestock products, 10 percent for other (including non

agricultural) primary products, and 5 percent for other processed food products and other manufacturing.[9] From that new base we then re-estimated the effects of full unilateral reform. As shown in Table 6, that database amendment makes a huge difference to the impact of unilateral reform on agricultural value added. It also raises the estimated impact of reform on non-agricultural value added, mostly because of the boost it gives to food processing.

Pending a more-thorough estimation of production and trade taxes and subsidies in developing country, how does the current estimated pattern of distortions (ignoring the amendments discussed above regarding the bottom part of Table 6) affect developing countries' shares of global markets? Their share of all agricultural and food value added would be three percentage points higher at 49 percent if global markets were fully liberalized, and their export share would be five percentage points higher at 40 percent, with the increases being largest for grains, oilseeds, beef, cotton and sugar. These changes for agriculture are much larger than those for other sectors (bottom of Table 7).

The propensity to trade agricultural commodities internationally would rise substantially following global liberalization. This is important because, by thereby 'thickening' international markets, food price fluctuations would be dampened, which would reduce concerns about vulnerability to import dependence. The extent of this global public good aspect of agricultural trade reform can be sensed from the results reported in Table 8. Rice and sugar are especially noteworthy: their global shares of production exported treble and nearly double, respectively. For all agricultural and

[9] Based on the Ministry of Economy and Production's resolutions 11/2002, 35/2002, and 532/2004.

processed food products the share would rise by one-fifth for the world as a whole, and by almost one-third for developing countries.

The converse of that rise in export propensity is an increase in imports as a share of food consumption as farmers throughout the world specialize more in what they do best. For developing countries as a group that share also rises by nearly one-third (final column of Table 8), suggesting food self-sufficiency would not change much. The latter is confirmed in Table 9: it shows an increase from 101 percent to just 102 percent for all agriculture and food for developing countries. Not surprisingly given the earlier results, the biggest rises are in rice and sugar, where DC self-sufficiency rates rise 5 or 6 percentage points.

To what extent are the effects of agricultural policies on net farm incomes due to the three key 'pillars' of agricultural support programs, namely domestic producer subsidies, export subsidies, and import tariffs? The first two are significant only in high-income countries, and Table 10 shows the removal of export subsidies would make only a minor contribution. Domestic subsidies and import tariffs are equally important to developing country net farm incomes, each contributing 45 percent of the overall impact of global trade policies. Note from the bottom of Table 10 that the relative contributions of those three 'pillars' to global welfare are quite different to their impact on agricultural value added, with import tariffs accounting for a huge 93 percent and domestic and export subsidies just 5 and 2 percent, respectively. This difference is partly explained by the fact that trade measures tax consumers in addition to boosting value added for producers, unlike domestic farm subsidies.

Finally, how do different agricultural commodity programs contribute to the global welfare cost of agricultural and food market distortions? According to our GTAP-AGR model results, rice programs are the most important, followed by beef and oilseeds and then sugar and dairy products (Table 11). High-income policies are responsible for more than four-fifths of that cost of agricultural and food policies (compared with only one-half in the case of policies affecting other manufacturing – see bottom of Table 11).

Conclusions and areas for further research

The following are the key messages that emerge from our analysis:

- The answer to the question in the title of the paper is yes, in the sense that full global liberalization of goods and services trade would raise net farm income in all six developing country regions, and more than it would raise non-agricultural value added;
- Global liberalization would not raise net farm incomes in each and every developing country, however, with our results suggesting that Bangladesh, India, the Philippines and Russia would be among the exceptions -- but only because of their own high agricultural protection rates in the GTAP database;
- With that Version 6 GTAP database, our results are not inconsistent with those of Jensen, Robinson and Tarp (2002) in that for several large developing countries (Bangladesh, China, India, Indonesia), own-country policies help rather than harm agricultural relative to non-agricultural value added, with the

harm from own non-agricultural policies being more than offset by help from own agricultural and food policies; and

- Other countries' policies have the opposite effect, of depressing agricultural value added in developing countries, with high-income country policies contributing most to that finding notwithstanding the tariff preferences provided to numerous low-income countries.

These results suggest that a multilateral move to global free trade would be good for developing country farmers. Whether that would be true too for a unilateral reform by any particular developing country depends heavily on the extent to which that country's own policies effectively assist or harm that economy's farm sector relative to its other sectors. Our measures of those effects depend very much on the levels of distortion in the GTAP database we use, as is clear from the sensitivity analysis of results reported above in Table 6. The agricultural distortions for high-income countries are reasonably reliable, thanks in large part to the carefully compiled protection estimates by the OECD (2005a and earlier). Currently available estimates of (particularly agricultural) trade distortions and subsidies in developing countries are less reliable, however. Nor are many estimates provided in the GTAP database of export taxes or tax equivalents of quantitative restrictions and bans on exports by developing countries.[10] A new project at the World Bank is seeking to provide better

[10] In recent years Argentina, for example, has been imposing non-trivial export taxes of 10 percent for rice, 23 percent for oilseeds, 20 percent for other cereals and oilseed products, and 5 percent for beef and dairy products (OECD 2005b, Annex A). partly based on Ministry of Economy and Production. Argentina , resolutions 11/2002, 35/2002, and 532/2004.

estimates of that sort, building on the earlier work of Krueger, Schiff and Valdes (1988) and the OECD's comprehensive PSE methodology and improved methods for measuring of exchange rate misalignment (Hinkle and Montiel 1999). Distortions to factor markets, particularly labor, may also have an important influence on the results for some countries if they were to be included in the model. Even more challenging is the task of improving estimates of distortions to services trade and foreign direct investment. These are the next frontiers in improving our understanding of the impact of policies on agricultural and other sectors' production, trade and value added. Only then will it be possible to generate better estimates of the poverty consequences of such reforms, building on Winters (2005) the pioneering empirical work in Hertel and Winters (2006).

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Table 1: Import-weighted average applied tariffs on goods, by region, 2001
(percent)

	Primary agriculture	Processed food	Agric. and processed food	Non-ag primary[1]	Other manuf-acturing
High-income countries[2]	**20.2**	**13.0**	**16.0**	**0.5**	**2.1**
Australia & New Zealand	1.2	8.1	5.7	3.9	5.7
United States	2.3	2.6	2.5	0.0	1.9
Canada	1.2	14.4	9.1	0.0	0.9
Mexico	10.8	12.2	11.5	4.7	4.5
European Union (EU15)	12.4	13.2	12.8	0.1	1.8
EU's 10 new entrants	9.7	18.7	15.1	0.4	3.1
European Free Trade Area	29.6	31.3	30.7	0.1	1.9
Japan	47.7	21.8	30.2	0.1	1.7
Korea & Taiwan	87.9	23.0	55.8	3.5	4.1
Hong Kong & Singapore	0.0	0.2	0.1	0.0	0.0
Developing countries	**17.0**	**19.3**	**18.1**	**2.5**	**10.0**
Middle-income countries	***17.8***	***15.6***	***16.7***	***1.1***	***9.7***
Low-income countries	***14.9***	***27.3***	***21.5***	***6.0***	***10.6***
E. Europe & Central Asia	**13.4**	**15.9**	**14.9**	**0.3**	**5.7**
Russia	14.5	12.8	13.5	0.8	9.2
Other E. Europe & C. Asia	12.5	19.1	16.1	0.3	4.1
East Asia & Pacific	**31.4**	**20.2**	**26.1**	0.8	9.8
China	49.0	18.6	37.6	0.4	12.7
Indonesia	4.3	6.3	5.0	0.4	4.9
Philippines	14.1	6.6	9.5	3.0	2.3
Viet Nam	12.6	44.4	36.6	3.8	14.5
Other East Asia & Pacific	17.9	26.1	22.6	0.6	6.9
South Asia	**18.0**	**54.7**	**33.9**	**14.5**	**22.7**
Bangladesh	7.5	21.1	12.6	20.0	19.8
India	25.6	76.6	50.2	15.0	27.3
Other South Asia	14.6	32.4	21.5	10.4	12.8
Middle East & North Africa	**9.5**	**18.0**	**13.6**	3.5	9.3
Morocco	26.5	35.5	29.3	9.0	22.0
Other M. East & N. Africa	8.3	17.4	12.8	2.5	8.7
Sub-Saharan Africa	**15.3**	**20.5**	**18.3**	**2.0**	**12.0**
South Africa	6.1	10.9	8.9	0.0	7.0
Other Sub-Saharan Africa	17.1	22.3	20.1	3.8	14.2
Latin America & Caribbean	**7.1**	**11.1**	**9.5**	**2.0**	**9.7**
Argentina	5.4	7.6	6.9	0.4	10.5
Brazil	2.4	9.0	5.0	0.4	10.9
Other Latin America & Carib.	9.0	11.7	10.7	3.5	9.1
WORLD	**18.9**	**15.0**	**16.8**	**0.9**	**4.2**

[1] Forestry, fishing, coal, oil, gas, and minerals.
[2] Intra-EU15 trade is ignored in EU and world trade in calculating import weights.
Source: Authors' compilations from the GTAP database Version 6.05

Table 2: Estimates of services trade barriers, 2001

(percent trade cost equivalents)

Region	Trade services	Transport and logistics services	Business services	Other services
High-income countries				
Australia & New Zealand	0.0	2.3	9.5	15.2
United States	0.0	22.6	1.2	16.0
Canada	0.0	22.6	1.2	16.0
Mexico	0.0	22.6	1.2	16.0
European Union (EU15)	9.6	3.2	2.9	4.6
EU's 10 new entrants	1.6	0.0	0.0	0.0
European Free Trade Area	9.6	3.2	2.9	4.6
Japan	0.0	0.0	6.3	0.0
Korea & Taiwan	0.0	0.0	6.3	0.0
Hong Kong & Singapore	0.0	0.0	6.3	0.0
Developing countries				
Eastern Europe & Central Asia	1.6	0.0	0.0	0.0
China	0.0	14.5	37.4	3.7
All other East Asia & Pacific	0.0	0.0	0.0	0.0
India	61.3	63.9	32.1	62.2
All other South Asia	0.0	0.0	0.0	0.0
Middle East & North Africa	2.3	0.0	0.0	0.0
Sub-Saharan Africa	28.3	17.5	32.8	22.6
All other Latin America & Carib	13.8	10.4	8.6	5.9

Source: Francois et al. (2005) and Hertel and Keeney (2006)

Table 3: Changes in sectoral value added from full global trade reform for different developing country regions, by trade-liberalizing component

(percent)

Change in sectoral value added in different regions:	High-income countries' agriculture and food lib.	Developing countries' agriculture and food lib.	All countries' other merchandise trade lib.	All countries' services trade lib.	Total global goods and services trade lib.[a]	
Primary Agriculture						
All developing countries	**6.7**	**-2.6**	**0.9**	**0.7**	**5.7**	**(1.8)**
Middle-income countries	8.3	-2.1	1.4	0.4	8.0	(1.3)
Low-income countries	3.8	-3.5	0.2	1.2	1.6	(3.6)
E. Europe & Central Asia	3.1	-2.2	-0.4	0.0	0.6	(-0.5)
East Asia & Pacific	8.1	-1.5	2.6	0.5	9.6	(5.0)
South Asia	2.8	-4.2	0.1	1.4	0.2	(-0.3)
MiddleEast & North Africa	6.1	-5.1	0.3	0.2	1.5	(0.8)
Sub-Saharan Africa	5.1	-4.4	0.4	1.5	2.7	(2.5)
Latin America & Carib.	12.2	-0.5	0.2	0.4	12.2	(-0.3)
Processed Food						
All developing countries	**3.6**	**-1.1**	**1.1**	**0.4**	**4.0**	
Middle-income countries	3.3	-1.9	0.9	0.2	2.5	
Low-income countries	4.5	1.3	1.5	0.8	8.3	
E. Europe & Central Asia	5.4	-7.0	0.8	0.2	-0.5	
East Asia & Pacific	1.0	5.1	2.7	0.1	8.9	
South Asia	9.4	-7.5	2.0	1.0	4.9	
MiddleEast & North Africa	6.0	-6.8	1.6	0.2	1.0	
Sub-Saharan Africa	4.9	-5.6	1.5	1.8	2.6	
Latin America & Carib.	3.4	-0.6	0.0	0.3	3.1	
Non-ag Primary						
All developing countries	**0.2**	**0.3**	**0.6**	**0.5**	**1.6**	
Middle-income countries	0.0	0.4	1.5	0.2	2.1	
Low-income countries	0.7	0.1	-1.3	1.3	0.8	
E. Europe & Central Asia	-0.2	0.9	1.7	-0.3	2.1	
East Asia & Pacific	0.9	0.3	-0.9	0.6	0.9	
South Asia	1.6	0.1	-8.7	1.4	-5.6	
Middle East & North Africa	0.1	0.4	2.9	-0.3	3.0	
Sub-Saharan Africa	0.3	-0.2	4.0	2.8	6.9	
Latin America & Carib.	-0.9	-0.1	1.2	0.5	0.7	
Other Manufacturing						
All developing countries	**-0.5**	**0.3**	**1.3**	**0.4**	**1.5**	
Middle-income countries	-0.5	0.4	0.6	0.3	0.8	
Low-income countries	-0.6	0.1	3.5	0.8	3.8	
E. Europe & Central Asia	-0.5	0.7	-2.0	-0.3	-2.0	
East Asia & Pacific	-0.3	0.2	5.3	0.3	5.5	
South Asia	-0.6	0.5	-0.9	1.8	0.8	
Middle East & North Africa	-0.4	0.5	-0.9	-0.7	-1.5	
Sub-Saharan Africa	-1.0	1.0	-3.4	2.5	-1.0	
Latin America & Carib.	-0.6	0.2	-1.6	0.5	-1.5	

[a] Numbers in parentheses show percentage change in non-agricultural value added as a consequence of full global trade reform. Source: Authors' GTAP-AGR model simulations

Table 4: Changes in agricultural (and non agricultural) value added from full global trade reform for different regions, by trade-liberalizing component

(percent)

Change in agricultural value added in different regions:	High-income countries' agriculture and food lib.	Developing countries' agriculture and food lib.	All countries' other merchandise trade lib.	All countries' services trade lib.	Total global goods and services trade liberalization[a]	
High-income countries	**-23.4**	**0.6**	**-0.2**	**0.2**	**-22.8**	**(0.2)**
Australia & New Zealand	16.2	0.5	0.7	0.2	17.7	(1.3)
United States	-15.0	0.9	-0.3	0.2	-14.2	(-0.5)
Canada	-6.9	0.2	0.5	0.3	-5.9	(-1.3)
Mexico	-8.7	0.1	-0.8	0.2	-9.2	(-0.2)
European Union (EU15)	-26.6	0.4	-0.5	0.2	-26.5	(-0.6)
EU's 10 new entrants	-1.8	1.8	-0.5	0.1	-0.4	(0.9)
European Free Trade Area	-37.4	5.4	0.4	0.1	-31.6	(-2.8)
Japan	-55.5	-0.2	0.3	0.1	-55.3	(2.6)
Korea & Taiwan	-41.0	0.0	1.0	0.2	-39.8	(6.5)
Hong Kong & Singapore	3.0	0.5	0.4	1.1	5.0	(10.5)
Developing countries	**6.7**	**-2.6**	**0.9**	**0.7**	**5.7**	**(1.8)**
E. Europe & Central Asia	**3.1**	**-2.2**	**-0.4**	**0.0**	**0.6**	**(-0.5)**
Russia	3.0	-4.5	-0.2	0.0	-1.6	(-0.5)
Other E. Europe & C. Asia	3.1	-1.6	-0.4	0.1	1.2	(-0.4)
East Asia & Pacific	**8.1**	**-1.5**	**2.6**	**0.5**	**9.6**	**(5.0)**
China	8.8	-1.8	3.4	0.6	11.0	(4.3)
Indonesia	2.3	0.1	-0.1	0.2	2.5	(4.1)
Philippines	0.9	-6.4	1.4	0.0	-4.0	(5.3)
Viet Nam	2.5	0.9	1.8	0.1	5.4	(27.5)
Other East Asia & Pacific	12.8	2.1	-0.8	0.1	14.2	(7.0)
South Asia	**2.8**	**-4.2**	**0.1**	**1.4**	**0.2**	**(-0.3)**
Bangladesh	1.7	-4.7	1.6	0.0	-1.5	(1.5)
India	2.6	-4.9	-0.2	1.8	-0.7	(-0.4)
Other South Asia	4.0	-0.7	1.0	0.2	4.6	(-0.1)
Middle East & North Africa	**6.1**	**-5.1**	**0.3**	**0.2**	**1.5**	**(0.8)**
Morocco	10.6	-11.3	1.6	0.1	1.0	(7.2)
Other M. East & N. Africa	5.8	-4.6	0.2	0.2	1.6	(0.5)
Sub-Saharan Africa	**5.1**	**-4.4**	**0.4**	**1.5**	**2.7**	**(2.5)**
South Africa	7.8	-2.6	0.1	1.2	6.5	(1.9)
Other Sub-Saharan Africa	4.8	-4.6	0.5	1.7	2.4	(2.9)
Latin America & Caribbean	**12.2**	**-0.5**	**0.2**	**0.4**	**12.2**	**(-0.3)**
Argentina	14.3	3.8	0.5	0.6	19.2	(0.7)
Brazil	39.1	1.9	0.7	0.8	42.5	(-0.6)
Other Latin America & Carib.	13.3	-2.8	0.4	0.3	11.2	(-0.9)

[a] Numbers in parentheses show percentage change in non-agricultural value added as a consequence of full global trade reform.

Source: Authors' GTAP-AGR model simulations

Table 5: Changes in sectoral value added from own, other countries' and global full trade liberalization of all goods and services, selected developing countries and Sub-Saharan Africa

(percent)

	Own unilateral Liberalization	Other developing countries' liberalization	High-income countries' liberalization	Total global liberalization
Brazil				
Primary Agriculture	1.6	1.9	38.9	42.5
Processed Food	0.5	-0.5	22.8	22.9
Non-agric Primary	3.5	0.9	-9.7	-5.4
Other Manufacturing	-2.3	-0.4	-2.4	-5.1
Argentina				
Primary Agriculture	1.2	3.4	14.6	19.2
Processed Food	0.5	0.7	4.5	5.7
Non-agric Primary	1.8	2.0	-2.0	1.8
Other Manufacturing	-1.7	-0.4	0.9	-1.2
China				
Primary Agriculture	-2.2	1.4	11.9	11.0
Processed Food	1.7	1.0	1.7	4.5
Non-agric Primary	1.8	-0.6	0.6	1.7
Other Manufacturing	2.0	1.1	1.6	4.7
Indonesia				
Primary Agriculture	-2.4	2.0	2.9	2.5
Processed Food	0.1	10.0	2.4	12.5
Non-agric Primary	-0.3	-0.9	-0.7	-1.9
Other Manufacturing	2.0	0.3	4.1	6.4
Sub-Saharan Africa (excl. S. Africa)				
Primary Agriculture	-2.4	-0.4	5.2	2.4
Processed Food	-2.7	-0.2	5.1	2.2
Non-agric Primary	6.2	-0.2	0.5	6.6
Other Manufacturing	2.3	-1.2	-2.9	-1.8
India				
Primary Agriculture	-4.1	-0.5	3.8	-0.7
Processed Food	-7.3	1.2	13.4	7.3
Non-agric Primary	-7.6	0.0	1.8	-5.8
Other Manufacturing	0.9	-0.7	0.1	0.3
Bangladesh				
Primary Agriculture	-2.7	-1.4	2.6	-1.5
Processed Food	-5.5	0.3	-0.7	-5.9
Non-agric Primary	-5.7	-1.3	-0.4	-7.4
Other Manufacturing	8.3	-2.2	1.1	7.2

Source: Authors' GTAP-AGR model simulations

Table 6: Changes in agricultural value added from own, other countries' and global full trade liberalization of agricultural and non-agricultural products, selected developing countries and Sub-Saharan Africa

(percent)

	Agricultural liberalization			Non-agricultural liberalization			Total liberalization		
	Own	Other developing countries	High - income countries	Own	Other developing countries	High - income countries	Own	Other countries	All countries [a]
Brazil	-0.6	2.5	39.1	2.2	-0.6	-0.2	1.6	40.9	42.5 (-0.6)
Argentina	-0.2	4.0	14.3	1.4	-0.6	0.3	1.2	18.0	19.2 (0.7)
China	-2.0	0.2	8.8	-0.2	1.2	3.1	-2.2	13.2	11.0 (4.3)
Indonesia	-2.1	2.2	2.3	-0.3	-0.3	0.6	-2.4	4.9	2.5 (4.1)
Sub-Saharan Africa, ex. SA	-4.7	0.1	4.8	2.3	-0.5	0.4	-2.4	4.8	2.4 (2.9)
India	-5.2	0.2	2.6	1.1	-0.8	1.3	-4.1	3.5	-0.7 (-0.4)
Bangladesh	-4.7	0.0	1.7	2.0	-1.3	1.0	-2.7	1.2	-1.5 (1.5)
If zero national agric & food tariffs in the following countries, effects there are as follows:									
Argentina[b]	34.4	4.3	16.0	0.3	-0.6	0.3	34.7	20.0	54.7 (6.9)
Sub-Saharan Africa, ex. SA	0.0	-0.2	4.5	2.2	-0.5	0.4	2.2	4.3	6.5 (3.7)
India	0.0	-0.3	2.7	1.2	-0.8	1.3	1.2	2.9	4.1 (-0.2)
Bangladesh	0.0	0.0	1.7	2.1	-1.4	1.0	2.1	1.2	3.3 (1.2)

[a] Numbers in parentheses show percentage changes in non-agricultural value added as a consequence of full global trade reform.
[b] In Argentina's case, we first altered the GTAP database not only to set all its agricultural and food import tariffs to zero but also to simulate the imposition from 2002 of export taxes, set at 20 percent for cereals, oilseeds and livestock products, 10 percent for other (including non agricultural) primary products, and 5 percent for other processed food products and all other manufacturing; then from that new base we estimated the effects of full unilateral reform.

Source: Authors' GTAP-AGR model simulations

Table 7: Developing countries' shares of global output, value added and exports before and after full global liberalization of goods and services, by product

(percent)

	Developing Countries' share of global					
	Value of Output		Value Added		Value of Exports	
	Base	Full liberalization	Base	Full liberalization	Base	Full liberalization
Rice	71	92	75	93	66	73
Wheat	72	73	54	70	23	34
Coarse grains	63	63	49	63	29	33
Fruit & veg.	71	73	72	75	47	54
Oilseed products	52	52	52	59	50	61
Sugar	53	59	54	60	67	75
Cotton	73	75	70	76	48	60
Other crops	51	51	47	48	60	59
Beef & sheepmeat	36	41	37	45	17	47
Pork & poultry	46	47	56	58	24	21
Wool	80	81	34	35	20	29
Dairy products	31	31	74	76	9	13
Other food products	31	31	24	24	32	31
All agric and food	**43**	**45**	**46**	**49**	**35**	**40**
Non-agric primary	61	61	62	62	72	72
Other manufacturing	26	25	21	21	24	26
Services	16	16	14	15	18	18

Source: Authors' GTAP-AGR model simulations

Table 8: Share of production exported and of consumption imported, world and developing countries, before and after full global liberalization of goods and services, by product

(percent)

	Share of production exported						Share of consumption imported	
	World		High-income countries		Developing countries		Developing countries	
	Base	Full liberalization	Base	Full liberalization	Base	Full liberalization	Base	Full liberalization
Rice	3.3	10.8	3.8	35.7	3.1	8.5	3.2	4.2
Wheat	16.9	19.1	45.6	46.1	5.4	9.0	14.2	15.9
Coarse grains	13.7	15.2	26.1	27.7	6.3	8.0	10.4	12.0
Fruit & veg.	10.6	11.4	19.5	19.8	7.0	8.3	3.4	4.2
Oilseed products	15.1	20.4	15.5	16.7	14.8	23.7	15.0	24.0
Sugar	5.1	9.7	3.5	6.0	6.5	12.3	5.2	6.5
Cotton	20.7	20.9	40.7	33.4	13.5	16.7	17.1	17.4
Other crops	18.9	21.2	15.3	17.7	22.3	24.5	10.6	15.1
Beef & sheepmeat	6.8	9.4	8.8	8.5	3.2	10.7	4.6	5.0
Pork & poultry	7.7	9.2	10.9	13.6	3.9	4.1	4.0	5.6
Wool	16.2	16.6	65.3	60.8	4.1	6.0	9.4	10.3
Dairy products	6.2	8.1	8.2	10.3	1.7	3.4	6.4	8.2
Other food products	10.2	11.3	10.1	11.3	10.5	11.3	7.7	9.8
All agric and food	**9.6**	**11.7**	**11.1**	**12.8**	**7.7**	**10.2**	**6.8**	**8.7**
Non-agric primary	30.7	31.4	22.2	22.5	36.1	37.0	14.6	15.8
Other manufacturing	28.4	30.6	29.0	30.3	26.7	31.6	26.6	32.5
Services	3.5	3.7	3.4	3.6	4.0	4.2	4.9	5.2

Source: Authors' GTAP-AGR model simulations

Table 9: Self-sufficiency by product and region, 2001 baseline and after full liberalization of goods and services globally

(production as a percent of production plus net imports)

	High-Income countries		Developing countries		Sub-Saharan Africa		Latin America & Carib.		China		India	
	Base	Full Lib.	Base	Full Lib	Base	Full Lib	Base	Full Lib	Base	Full Lib	Base	Full Lib
Rice	99	60	100	105	86	72	96	94	101	116	103	106
Wheat	131	123	91	92	48	50	91	90	98	99	103	106
Coarse grains	107	106	96	96	101	101	112	115	103	107	101	101
Fruit & veg.	87	84	104	105	125	126	127	135	101	102	99	96
Oilseed products	98	98	100	100	94	104	129	133	81	59	95	80
Sugar	98	90	101	107	109	125	121	143	84	81	102	103
Cotton	108	98	96	99	232	289	101	101	98	99	90	91
Other crops	85	87	115	112	139	139	141	127	114	105	107	107
Beef&sheepmeat	100	95	99	106	100	108	103	119	97	96	106	153
Pork & poultry	100	101	100	98	98	94	105	102	100	99	99	95
Wool	124	119	95	95	104	106	110	107	87	91	88	84
Dairy products	102	102	95	95	83	82	98	98	93	90	100	100
Other food prod	98	98	103	102	100	98	109	109	103	103	115	115
All agric&food	**98**	**97**	**101**	**102**	**104**	**104**	**110**	**114**	**100**	**101**	**101**	**101**
Non-ag primary	68	68	132	134	172	174	131	134	96	95	79	77
Other manuf.	98	99	97	99	80	81	87	85	106	108	98	101
Services	100	100	99	99	98	98	100	99	98	98	100	100

Source: Authors' GTAP database 6 calculations and GTAP-AGR model simulations

Table 10: Contribution to regional and global agricultural value added, and to global economic welfare, of fully removing agricultural subsidies and tariffs globally, by policy instrument

(percent)

	Agricultural liberalization component				
	High–income countries' liberalization of:			Developing countries' import market access lib'n	All countries' import market access lib'n
	Export subsidies	Domestic support	Import market access		
Contribution to value added:					
High-income countries	3	44	56	-3	53
Developing countries	10	45	106	-61	45
World	**7**	**45**	**87**	**-39**	**48**
Contribution to global welfare (equivalent variation in income):	**2**	**5**	**79**	**14**	**93**

Source: Authors' GTAP-AGR model simulations

Table 11: Contribution of different products to the global welfare gain from agricultural and food sector reform, and all sectors' reform

(percent)

(a) agric and food sector reform	Share of agric. and food welfare contribution	Share of welfare contribution due to high-income country policies
Rice	37	97
Wheat	3	134
Coarse grains	4	111
Fruits and vegetables	2	40
Oil Seeds products	13	31
Sugar	8	92
Cotton	0.1	425
Other crops	2	-49
Beef and sheep products	14	91
Pork and poultry products	4	64
Wool	0.2	64
Dairy products	5	119
Other Food products	8	54
Total, Agriculture and food	**100**	**82**
(b) all sectors' reform	Share of all sectors' welfare contribution	
Agriculture and food	30	82
Non-agric primary	0	-18
Other manufacturing	7	49
Sub-total, All commodities	**47**	**69**
Services	53	72
Total, all products	**100**	**70**

Source: Authors' GTAP-AGR model simulations

Appendix Table A1: Regional aggregation used

Modeled region	Original GTAP database region
High-income countries	
Australia & New Zealand	Australia; New Zealand
United States	United States
Canada	Canada
Mexico	Mexico
European Union (EU15)	Austria; Belgium; Denmark; Finland; France; Germany; United Kingdom; Greece; Ireland; Italy; Luxembourg; Netherlands; Portugal; Spain; Sweden
EU's 10 new entrants	Cyprus; Czech Republic; Hungary; Malta; Poland; Slovakia; Slovenia; Estonia; Latvia; Lithuania
European Free Trade Area	Switzerland; Rest of EFTA
Japan	Japan
Korea & Taiwan	Korea; Taiwan
Hong Kong & Singapore	Hong Kong; Singapore
Developing countries	
E. Europe & Central Asia	
Russia	Russian Federation
Other E. Europe & C. Asia	Albania; Bulgaria; Croatia; Romania; Rest of Former Soviet Union; Turkey; Rest of Europe
East Asia & Pacific	
China	China
Indonesia	Indonesia
Philippines	Philippines
Viet Nam	Viet Nam
Other East Asia & Pacific	Malaysia; Thailand; Rest of SE Asia; Rest of East Asia; Rest of Oceania
South Asia	
Bangladesh	Bangladesh
India	India
Other South Asia	Sri Lanka; Rest of South Asia
Middle East & North Africa	
Morocco	Morocco
Other M. East & N.Africa	Rest of Middle East; Tunisia; Rest of North Africa
Sub-Saharan Africa	
South Africa	South Africa
Other Sub-Saharan Africa	Botswana; Madagascar; Malawi; Mozambique; Tanzania; Uganda; Zambia; Zimbabwe; Rest of South African CU; Rest of SADC; Rest of Sub-Saharan Africa
Latin America & Caribbean	
Argentina	Argentina
Brazil	Brazil
Other Latin America & Carib.	Colombia; Peru; Venezuela; Rest of Andean Pact; Chile; Uruguay; Rest of South America; Central America; Rest of FTAA; Rest of Caribbean

Post-simulation aggregated developing country regions, by income classification

Middle-income countries: China, Argentina, Brazil, Other Latin America & Carib., Russia, Other E. Europe & C. Asia, Morocco, Other M. East & N. Africa, South Africa

Low-income countries: Indonesia, Philippines, Viet Nam, Other East Asia & Pacific, India, Bangladesh, Other South Asia, Other Sub-Saharan Africa.

Appendix Table A2: Sectoral aggregation used

Post-simulation commodity aggregation	CGE Modeled sector	Original GTAP database sectors
Rice	Paddy rice	Pdr
	Processed rice	Pcr
Wheat	Wheat	Wht
Coarse grains	Cereals	Gro
Fruit & vegetables	Fruits & vegetables	v_f
Oilseed products	Oilseeds	Osd
	Oils & fats	Vol
Sugar	Sugar raw	c_b
	Sugar processed	Sgr
Cotton	Plant-based fibers	Pfb
Other crops	Crops nec	Ocr
Beef & sheep products	Livestock	Ctl
	Meat products	Cmt
Pork & poultry products	Other animal products	Oap
	Other meat products	Omt
Wool	Wool & silk-worm	Wol
Dairy products	Milk raw	Rmk
	Dairy	Mil
Other food products	Other food products	Ofd
	Beverages & tobacco	b_t
Other primary	Fishing	Fsh
	Other primary	frs, coa, oil, gas, omn
Other manufacturing	Textiles & W. apparel	tex, wap, lea
	Manuf. of primary	lum, ppp, p_c, crp, nmm, i_s, nfm, fmp
	Other manufactures	mvh, otn, ele, ome, omf
Services	Utility & construction	ely, gdt, wtr, cns
	Trade & transport	trd, otp, wtp, atp
	Communic. & financial	cmn, ofi, isr, obs
	Other services	ros, osg, dwe

Post-simulation aggregated sectors

Primary Agriculture: Paddy rice, Processed rice, Wheat, Cereals, Fruits & vegetables, Oilseeds, Sugar raw, Sugar processed, Fibers, Crops nec, Livestock, Other animal products, Milk raw, Wool & silk-worm.
Processed Food: Meat products, Other meat products, Dairy, Other food products, Oils & fats, Beverages & tobacco.
Non-agric Primary: Fishing, Other primary.
Other Manufacturing: Textiles & Wearing apparel, Manufacture of primary, Other manufactures.
Services: Utility & construction, Trade & transport, Communication & financial, Other services