Estimating the Benefits of Trade Reform: Why Numbers Change

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Much attention has been paid to the World Bank's analyses of multilateral trade reform. According to our latest estimates, full liberalization of world merchandise trade would increase global income in 2015 relative to the baseline by $290 to $460 billion, with higher percentage gains for developing countries (0.8 to 2.0 percent) than for high-income countries (Anderson and others 2005). These numbers are significantly lower than earlier World Bank estimates (World Bank 2001, 2003), which put the global gains of full merchandise trade reform at some $400 billion per year in 2015. This note examines why the numbers of have changed and, more generally, why estimates of gains from reform can vary widely.

The answer lies in a mixture of factors: new data on tariffs, incorporation of recent major reforms in trade policy (notably in China), inclusion of preferential trade arrangements, and new poverty elasticities with respect to growth. Beyond these methodological issues, it is important to distinguish the scenario under analysis—whether it is full liberalization (the basis of all calculations and the benchmarks of this note) or partial reforms; whether the analysis is static or dynamic (and includes a productivity response); and whether the scenario includes services (which are usually omitted).

Underlying most estimates are many assumptions that can result in gross over- or underestimates of the effects of merchandise trade reform. As factors contributing to overestimation in the World Bank estimates (and common to many other studies) one might cite the optimistic supply response, the optimism embodied in the baseline,[1] the failure to take into account baseline policy changes and the loss of quota rents, the degree of protection,[2] overstatement of the relation between income growth and poverty reduction, and closure effects.[3] The assumptions that might lead to underestimation include low Armington elasticities and market shares,[4] the failure to consider market structure (procompetition effects) and scale economies, neglect of positive productivity effects, and product aggregation. As well, the baseline may bias the estimate downward, as it probably understates the increase in trade openness—even with constant trade policies—as the global economy pushes forward. Most multilateral trade analyses have also largely ignored reform of services trade, which is generally believed to be highly distorted but is difficult to deal with empirically.

This note introduces the new numbers generated by the World Bank's global trade model, known as LINKAGE.[5] The basic model has not undergone any major

change, but changes in the underlying database and the baseline scenario have altered key numbers from earlier estimates, though by and large the main findings still hold. The next section will describe the key changes to the database and baseline. This will be followed by a section on the impact of global merchandise trade reform. A final section will describe how these results line up with some other prominent exercises.

Changes to the database and baseline

GTAP release 6.0

Since the early 1990s, global general equilibrium trade models have increasingly relied on a single database developed, maintained, and updated by the Global Trade Analysis Project (GTAP) located at Purdue University.[6] The GTAP database is a multisectoral and multiregional global social accounting matrix (SAM). It integrates national input–output tables, bilateral trade flows from COMTRADE, and different sources of data on trade protection and domestic support into a single, consistent global SAM. GTAP has just issued its latest release, 6.0, that divides economic activity into 57 sectors and 87 countries and composite regions—70 of which are individual countries.[7] There are two major changes in GTAP6 compared with the previous release. First, it has a new base year—2001 rather than 1997. This represents a change in the relative structure of the global economy, with some countries/sectors growing more rapidly than others, and also greater trade, since growth in trade generally outpaces output.[8]

The second change is the source of GTAP's protection data. Whereas in the past protection data generally came from TRAINS/IDB and, for agricultural protection, the Agricultural Market Access Database, the new data comes mostly from MAcMap—a joint product of the Centre d'Etudes Prospectives et d'Informations Internationales in Paris (CEPII) and the International Trade Centre (ITC) in Geneva.[9] MAcMap is the result of a huge effort to provide a more comprehensive picture of trade protection. The database is collated at the Harmonized Tariff System 6-digit level and incorporates preferential arrangements—both reciprocal and nonreciprocal. It also provides the ad valorem equivalent of specific tariffs and an estimate of the tariff equivalent of TRQs. Finally, it contains effective tariff rates, MFN tariffs, and bound rates. It is thus possible to measure the relative importance of preferential access and the "binding overhang" between bound and applied rates.

In summary, the new database provides a more recent snapshot of the global economy with a 2001 base year instead of 1997 and a more comprehensive picture of trade protection, particularly through the incorporation of preferences.

The tariff rates on goods under GTAP5 and GTAP6 are summarized in table A-1. The two data sets are not compatible since they come from different sources and reflect the use of different methodology. Thus, even though tariffs in 2001 appear to

be lower in general than the 1997 assessment, the effect cannot be confidently attributed to a lowering of tariff barriers during the four-year interval. Clearly, the incorporation of preferences into the dataset will have made a significant difference. One example is the Middle East and North Africa, where tariffs on agriculture and food are now evaluated at 14 percent compared with 61 percent in the previous release.

The largest modifications have been made to tariffs on agriculture and food. At the global level they are down nearly 10 percentage points from GTAP5 to GTAP6, and this holds across both developed and developing regions. The changes in the manufacturing sectors are much less pronounced, with a drop of some 2.5 percentage points in textile and clothing and about 1.5 percentage points for all other goods.

These apparent tariff changes suggest that assessments of the gains from global reform should be reduced from those devised on the basis of the GTAP5 database. The expected gains from agricultural reform—as a contributor to the overall gains—also should be reduced. Two factors, however, could influence the results in the other direction, toward greater gains. First, the size and structure of the global economy, different in 2001, could raise the overall gains from trade reform. In particular, the most heavily protected economies have been growing more rapidly than the less protected, while trade has advanced more rapidly than output. Second, the average tariffs may conceal higher peak tariffs the replacement of which could produce larger gains than might appear in estimates prepared on the basis of average tariffs.

Baseline reforms

The current analysis, like past analyses, is predicated on a baseline scenario that takes the global economy from the base year, now 2001, though a future year, typically 2015. The baseline scenario relies on a number of assumptions—most related to supply-side variables such as labor supply, savings behavior (and hence capital stocks), and productivity. The baseline can also incorporate changes to policies, which, in past exercises, were fixed at their base-year levels, with no change in tax or subsidy rates.[10] The new baseline incorporates some policy changes that reflect some (but not necessarily all) existing commitments. The major commitments include the implementation of the final phases of the Uruguay Round, including the elimination of the textile and clothing quotas,[11] the expansion of the European Union to include the 10 new member countries, and the commitments made by China in its WTO accession agreement. Of these elements, the most significant are China's commitments and the removal of the textile and clothing quotas. Their impact will be described below. China's tariffs on agriculture and food are estimated to be reduced by nearly three-quarters (38 percent to 10 percent) and in manufacturing by 50 percent (19 percent to 10 percent in textiles and clothing and 11 percent to 5 percent in other sectors).

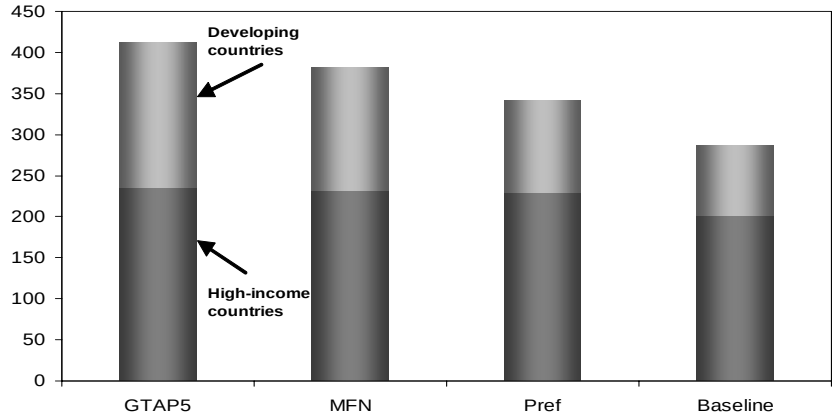
Global trade reform

Global welfare

The new estimate of the global welfare impact from full merchandise trade reform—including the elimination of domestic support and export subsidies—is $287 billion, about 30 percent lower than the previous estimate of $413 billion, which was based on GTAP5 (figure 1). Under the new scenario, developing countries garner only 30 percent of the global gains in dollar terms, but continue to gain more in percentage terms (relative to their baseline income) than rich countries.

It is possible to decompose the change into three distinct components—the change in the database, the impact of preferences, and the impact of the baseline policy changes. The GTAP database is available with two different tariff structures. The standard database reflects applied tariffs including all preferences—reciprocal and nonreciprocal. The alternative database assumes that the preferential rates are not used and that imports enter under the applied MFN rate. This latter database, which assumes zero utilization of preferences, is closer than the new standard to the last release of the GTAP5 database.

Figure 1. Global gains from full merchandise trade reform under various scenarios



Note: The three right columns are all based on the GTAP6 data base. MFN assumes application of MFN tariff rates. Pref assumes application of preferential tariff rates. Baseline includes preferential tariffs and existing policy commitments, such as China's WTO accession and elimination of the textile and clothing quotas. The "Baseline" column represents the World Bank's current baseline estimate of the gains from full merchandise trade reform.

Source: World Bank simulations.

In dollar terms, assuming the MFN tariff rates obtain, global gains decline from $413 billion in 2015 to $382 billion. While it would be easy to justify the decline by declaring that it reflects reforms undertaken between 1997 and 2001, it is not possible to make this statement simply by comparing tariff schedules between GTAP5 and GTAP6, because the tariff data have been processed using different methodologies. There are two ways to assess the level of reform between 1997 and 2001. The most convincing would be tariff line by tariff line—though the problem of aggregation cannot be ignored if some lines show an increase and others a decrease. The second would be to reproduce a tariff database using the same methodology as was used in the construction of GTAP5. With this caveat in mind, had there been no tariff reform one would expect the global gains to *increase* between 1997 and 2001, for two reasons. The first is inflation—though the change in exchange-rate valuations makes this explanation less than straightforward. The second is the increase in trade openness in most regions, as trade growth typically outpaces income growth. This would tend to increase the distortion induced by a given tariff rate.

On a percentage basis, the global gain, comparing the MFN-based GTAP6 with GTAP5, declines by 0.2 percentage points—from 1.1 percent of baseline income to 0.9 percent (in 2015). The gains to developing countries drop by somewhat more than for high-income countries—from 1.7 to 1.5 percent in the case of the former, and from 0.8 to 0.7 percent in the case of the latter—possibly indicating greater trade reform in developing countries.

A subsequent scenario—using the standard preference-inclusive GTAP6 database—shows the impact of assuming full utilization of available preferences. In this case, the dollar gains from full liberalization drop to $341 billion (from $382 billion). For developing countries, this implies a gain of 1.1 percent from full merchandise trade reform—a rather substantial drop from the gains that appear when using the MFN-based tariffs (1.5 percent) and from GTAP5 (1.7 percent)—which basically assumed MFN tariffs. For the rich countries, there is relatively no impact from assuming application of the preference-based tariffs.

Finally, our new standard baseline also includes quantifiable policy-reform commitments—final implementation of the Uruguay Round, including elimination of apparel and textile quotas, expansion of the European Union to 25 countries, and China's WTO accession commitments. This brings the estimate of the global gains from merchandise trade reform to $287 billion in 2015—equivalent to a gain in global income of 0.7 percent. It also further reduces the gains for developing countries—with the overall gains now at only 0.8 percent of their baseline income—or nearly one-half of the estimate obtained using GTAP5. The most significant drop is for China, which sees its gain fall from 0.6 percent to only 0.2 percent, because the substantial gains from WTO accession are already reflected in the baseline.

One must not conclude from the downward revision of the gain that merchandise trade reform is less important today than it was a year or two ago. First, the lower projected gains reflect gains already secured between 1997 and 2001, as well as those anticipated from existing commitments. Second, the counterfactual scenario against which the new full-reform scenario is being compared is one of consolidated gains. However, a failure to complete the Doha negotiations or a rise in trade tensions could lead to backsliding in trade policy commitments. In agriculture, the rich countries have hardly curtailed domestic support even as they have carried out their commitments to the letter. And though the apparel and textile quotas are now history, there is strong pressure to prevent the structural changes most analysts had predicted would occur from the phaseout. Finally, there is currently no strong domestic constituency for reform in the key stakeholder states that have moved multilateral liberalization forward in the past.

Regional impacts

The impacts of the various baseline assumptions vary across regions (figure 2). Moving from the MFN tariff rates to the preferential rates has significant impacts for Bangladesh, the Middle East and North Africa, and Sub-Saharan Africa, among others. In Africa, the selected Sub-Saharan countries (SSS) regional grouping that includes an eight-country aggregation of small countries sees its global gains drop by 55 percent when the preferential tariff data base is used rather than the MFN-based data base. Bangladesh would actually suffer a loss from global merchandise trade reform against a baseline scenario that incorporated preferential tariffs, because it derives such significant benefits from existing preferences.

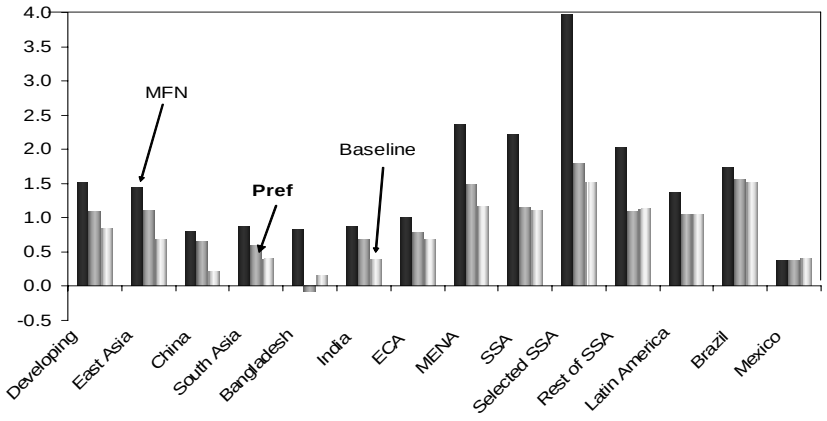
The World Bank's final baseline scenario—using the preferential tariffs and incorporating commitments—has different implications in different regions. For China, and the East Asia and Pacific region in aggregate, the incorporation of policy commitments lowers significantly the gains from global reform since a sizeable portion of the reform gains will be reflected in the baseline scenario. South Asia is also affected by the baseline policy changes—but in different ways. India gains less from global reform when the policy commitments are incorporated in the baseline, i.e. it derives positive gains from the baseline policy changes. Bangladesh on the other hand sees more gains from global trade reform when the policy commitments are included. This signifies that it loses from the policy reforms in the baseline, perhaps a consequence of its loss of quota rents from the elimination of the quotas on apparel.

Decomposition

At the global and subregional level, nearly two-thirds of the gains against the new standard baseline are generated by free trade in agriculture and food (table 1). This percentage is somewhat higher than with the former baseline; it also reflects a

Figure 2. Regional impact of alternative scenarios using GTAP6 database

Percent change in real income in 2015 from global merchandise trade reform



Note: The three columns are all based on the GTAP6 data base. MFN assumes application of MFN tariff rates. Pref assumes application of preferential tariff rates. Baseline includes preferential tariffs and existing policy commitments, such as China's WTO accession and elimination of the textile and clothing quotas. The "Baseline" column represents the World Bank's current baseline estimate of the gains from full merchandise trade reform.
Source: World Bank simulations.

relative rotation between the subregions. Under GTAP5, only about 58 percent of the global gains came from agriculture. But for developing countries, agriculture represented 72 percent of their total gains—of which 53 percent came from their own liberalization of agriculture. Another way to say this is that of the $177 billion in gain garnered by developing countries in the previous global reform scenario, $94 billion came from their own agricultural reform. With the new baseline—which incorporates significant reforms already made—the developing countries' own agricultural reform generates only $27 billion in (additional) gain—or only about one-third of their total gain. The rotation also implies that developing countries have about the same amount at stake from rich country reform in agriculture as from their own reform.

Dynamic vs. static effects

Although the standard LINKAGE model is dynamic, the dynamic effects of trade reform are relatively limited. They come mainly through two channels. First, higher growth and incomes raise saving rates and therefore investment and the stock of capital. Second, the price of capital goods declines as tariff rates are set to zero.

Table 1. Decomposition of gains from full merchandise trade reform by sector and region

Change in real income in 2015

	Allocation of gains					
	To developing	To developed	Global	To developing	To developed	Global
	GTAP6 standard baseline					
	Billions of dollars			*Percent of regional gain from total*		
Reform by developing countries						
Agriculture and food	28	19	47	33	9	17
Manufacturing	15	66	81	17	33	28
All	43	85	128	50	42	45
Reform by developed countries						
Agriculture and food	26	109	135	30	54	47
Manufacturing	17	7	24	18	3	8
All	43	116	159	50	57	55
All countries liberalize:						
Agriculture and food	54	128	182	63	64	63
Manufacturing	32	73	105	37	36	37
All	86	201	287	100	100	100
	GTAP5 standard baseline					
	Billions of dollars			*Percent of regional gain from total*		
Reform by developing countries						
Agriculture and food	94	41	135	53	17	33
Manufacturing	6	135	141	4	57	34
All	100	176	276	57	75	67
Reform by developed countries						
Agriculture and food	34	68	102	19	29	25
Manufacturing	43	–8	35	24	–3	8
All	77	60	137	43	25	33
All countries liberalize:						
Agriculture and food	128	109	237	72	46	57
Manufacturing	49	127	176	28	54	43
All	177	236	413	100	100	100

Source: World Bank simulation.

Therefore countries obtain more from the same nominal level of investment. If the average tariff on capital goods is 10 percent and all capital goods are imported, then the investment rate climbs by 10 percent with tariff reform (assuming no change in nominal savings)—a "static" dynamic gain.[12] The final section of this note compares static dynamic gains with the comparative static version of the model. It shows that static dynamic gains raise the global gain from merchandise trade reform by roughly 23 percent with respect to the pure comparative static gains.

In an alternative scenario, we allow productivity to be influenced by changes in trade. In a true endogenous growth model, changes in productivity would be influenced by changes in research and development and by the technology embodied in imports, either better intermediate inputs (such as agricultural chemicals and seeds) or better equipment. Other channels also have been identified in the literature as possibly affecting productivity. Among these are the procompetitive effects of imports (for example, through rationalization and scale economies), and the procompetitive effects of exporting (learning by doing, matching international standards, overcoming threshold effects, and so on). We have chosen to illustrate dynamic effects through the latter channel (procompetitive effects of exporting) by assuming that a share of productivity can be explained by a trade openness measure defined by the sectoral ratio of exports to output. This is calibrated in the baseline simulation. In the corresponding shock simulation, productivity will increase with the export-to-output ratio.[13] For manufacturing, the elasticity is set at 1; for agriculture, one-half.[14]

The productivity assumption leads to a sizeable increase in the gains from trade reform, particularly for developing countries (table 2). At the global level, the gains from trade increase from $287 billion to $461 billion—a rise of 1.1 percent in global income compared to 0.7 percent with static gains alone. But for developing

Table 2. Full liberalization of global merchandise trade, without and with productivity growth, 2015

Change in real income in 2015 relative to baseline				
	Fixed productivity		Flexible productivity	
	US$ billions	Percent	US$ billions	Percent
High-income countries	202.0	0.6	261.0	0.8
Developing countries	86.0	0.8	200.0	2.0
Middle-income countries	70.0	0.8	145.0	1.8
Low-income countries	16.0	0.8	55.0	2.8
World total	287.0	0.7	461.0	1.1

Source: World Bank Simulations.

countries, the gains rise from 0.8 percent to 2.0 percent and from $86 billion to $200 billion. The main reason the dynamic gains are so much higher for developing countries is that their tariffs are considerably higher, thus the changes in trade structure will be greater. And even if agricultural distortions are high in rich countries, agriculture as a share of GDP is much lower; therefore the increase in productivity in agriculture has less impact, economy-wide, than in developing countries. Low-income countries gain the most on a percentage basis, because on average they have the highest tariff levels.

The dynamic gains are lower in relative terms compared to previous World Bank estimates (2001, 2003). Developing countries' gains are 2.3 times higher in the new estimates, compared with 3.2 times higher in previous estimates (World Bank 2001). There are two main reasons. The first is consistent with what has already been developed: The combination of lower base-year tariffs and incorporation of preferences and policy changes has lowered trade barriers from the levels estimated previously. One therefore anticipates fewer policy-driven changes in the export-to-output ratio and in the resulting changes in productivity. This is particularly true in agriculture, especially in China, from which a significant portion of the dynamic gains were coming. Those productivity gains are now captured in the baseline simulation. The second reason is because we have lowered from 0.75 to 0.5 the elasticity of productivity and trade openness in agriculture from the previous level.

Poverty impacts

The linkages between trade and poverty are complex. The theoretical aspects of those linkages are developed in detail in McCulloch and others (2001). Hertel and Winters (2005) contains an impressive number of country case studies. The simplest way to abstract the relationship is to derive the trade-induced change in GDP and then apply the so-called poverty elasticity to determine the change in the headcount index and then the number of poor. That operation assumes no change in the distribution of income. In previous World Bank estimates (2001, 2003), and in this note, we use a modified version of this simple approach. We equate the rise in the income of the poor to the food wage of unskilled workers—departing from the assumption of distribution neutrality. (Given the comparative advantage of developing countries in unskilled goods, unskilled wages usually will rise more than other factor prices.) We also take the price of food and clothing as the relevant price index for most households, because food and clothing are their main consumption items.

Under these assumptions, and given a baseline poverty forecast and income poverty elasticity, the number of poor living on $1 a day or less would drop by 32 million with global merchandise trade reform, compared to the baseline forecast of 622 million, or a global reduction of roughly 5 percent (table 3). For the $2 a day poverty line, the drop in the number of poor would be 66 million people, compared

Table 3. Poverty impacts under various scenarios

	GTAP6 baseline	Full reform	World Bank (2003) poverty baseline	With World Bank (2003) poverty baseline	Plus with World Bank (2003) change in real wage	Plus with World Bank (2003) poverty elasticity
Poverty headcount in 2015	(1)	(2)	(3)	(4)	(5)	(6)
			$1 a day measure			
Percent						
East Asia and Pacific	0.9	0.8	2.3	2	1.5	1.8
Europe and Central Asia	0.4	0.3	1.3	1.1	1.1	1.2
Latin America and the Caribbean	6.9	6.6	7.6	7.2	7.4	7.2
Middle East and North Africa	0.9	0.7	1.2	1	0.5	0.7
South Asia	12.8	12.5	16.4	15.9	15.6	15.3
Sub-Saharan Africa	38.4	36	42.3	39.7	38.8	34.5
Developing country total	10.2	9.7	12.5	11.8	11.4	10.8
Millions of people	**Level**	**Change**	**Level**		**Change**	
East Asia and Pacific	18.6	2.2	44.1	4.8	15.0	9.7
Europe and Central Asia	1.7	0.2	5.9	0.7	0.9	0.5
Latin America and the Caribbean	42.9	2.1	45.9	2.2	1.4	2.4
Middle East and North Africa	3.5	0.7	4.3	0.8	2.7	1.9
South Asia	215.9	5.6	267.8	7.0	12.7	17.3
Sub-Saharan Africa	339.5	21.1	365.7	22.7	30.1	67.7
Developing-country total	622.0	31.9	733.8	38.2	62.7	99.4
Poverty headcount in 2015			**$2 a day measure**			
Percent						
East Asia and Pacific	11.3	10.1	18.2	16.3	12.2	14.2
Europe and Central Asia	5.2	4.8	10.3	9.5	9.4	9.4
Latin America and the Caribbean	19.6	19.0	20.5	19.8	20.1	19.4
Middle East and North Africa	11.9	10.4	10.2	8.9	5.8	5.8
South Asia	54.2	53.6	59.2	58.6	58.1	55.4
Sub-Saharan Africa	69.2	66.9	70.7	68.3	67.6	57.6
Developing-country total	32.0	30.9	36.4	35.0	33.3	31.6
Millions of people	**Level**	**Change**	**Level**		**Change**	
East Asia and Pacific	229.8	23.6	354.2	36.4	115.2	77.7
Europe and Central Asia	24.7	1.8	47.6	3.5	4.1	4.0
Latin America and the Caribbean	121.8	4.1	124.0	4.2	2.6	6.4
Middle East and North Africa	45.7	6.0	37.7	4.9	16.2	16.3
South Asia	912.2	9.6	968.3	10.2	18.6	62.5
Sub-Saharan Africa	612.2	20.4	611.8	20.4	27.1	113.3
Developing-country total	1946.3	65.6	2143.6	79.7	183.7	280.2

Note: Column (1) represents the most recent poverty baseline for 2015. Column (2) represents the impact of global reform on poverty—in levels for the headcount index, and as a change in the number of poor in millions. For example, the total headcount index falls from 10.2% in the baseline to 9.7% after the reform. This translates into 32 million fewer persons living under the $1 a day poverty line. Column (3) represents an earlier baseline forecast (World Bank 2003). Columns (4) through (6) show the changes in poverty from global reform under various assumptions: (4) using the previous poverty forecast; (5) using the previous poverty forecast and the previous change in the real wage; and (6) using the previous poverty forecast and the previous change in the real wage and a uniform poverty elasticity of 2.

Source: World Bank Simulations.

to a baseline forecast of nearly 2 billion people, a decline of 3.4 percent.

These estimates are significantly below similar estimates generated two years ago (World Bank 2003). Table 3 attempts to reconcile the new estimates with the old.

A first key difference is the change in the baseline poverty forecast. This can be seen by comparing column (3)—the old forecast—with column (1), the current forecast. The $1 a day poverty forecast for 2015 is down by more than 100 million persons, largely because of a revision to the forecasted headcount index, with relatively sharp declines across all regions.[15] Global trade reform applied to the poverty forecast contained in World Bank (2003) would accentuate, modestly, the decline in the number of poor (column 4)—for example to 38 million instead of 32 million for the $1 a day indicator, with the largest absolute change in the East Asia and Pacific region.

The second key difference comes from the impact of the shock on the food wage. Given the change in the dataset—notably the incorporation of preferences and policy commitments—the change in the food wage under the new dataset and baseline is smaller than with the previous results.[16] Using the change in the food wage from the previous reports, the change in the $1 a day number of poor from full reform would be 63 million, not 38 million; and 184 million versus 80 million for the $2 /day indicator.

In the new estimate, we use a revised and region-specific set of income-poverty elasticities. In previous reports, we used a uniform world average[17]—initially for lack of better information. The regional $1/day poverty elasticities are more varied, ranging from around 0.9 for Sub-Saharan Africa to over 3 for East Asia. For $2/day, the global elasticity is less than 2, and the range is from 0.5 in Sub-Saharan Africa to 2.0 in East Asia. Column (6) shows the impact of using a uniform elasticity of 2 rather than the region-specific elasticities. For the $1/day poverty line, the number of poor lifted out of poverty by global trade reform would rise to nearly 100 million.

Of the three changes in the new poverty-impact estimate, the single most important—at the global level—is the change to region-specific elasticities, followed by the change to the impact on the food wage, with the change in the poverty forecast playing only a modest role. The change to region-specific elasticities is particularly important in the context of a dynamic scenario. Given that poverty will be reduced significantly in East Asia, where the income-poverty elasticity is also highest, the average poverty elasticity—weighted by the number of poor—is declining over time as the number of poor becomes more concentrated in low-elasticity regions.

This also raises the important relevance of the time dimension in modeling trade reform. The poverty impacts will depend crucially on assumptions about the baseline level of poverty. If, for example, a comparative static model is used, and the changes to poverty are calculated relative to the base-year level of poverty—say 2001—then the number of poor lifted out of poverty will be much higher than in a

realistic forward-looking scenario, where the number of poor in many regions will be much lower in the baseline. In the case of China, using the base year poverty level would imply a reduction of the number of poor of 14.4 million, versus only 1.2 million in our standard forward-looking forecast.

Comparison with GTAP-based models

One of the most widely used models for trade policy analysis is the one developed and supported by GTAP and known as the GTAP model.[18] In many respects it is quite similar to the Bank's LINKAGE model. Most studies using the GTAP model implement the model in comparative static mode, in which there is no time dimension and typically all factor stocks are maintained at their base-year levels. A policy shock involves perturbing one or more policy instruments, re-solving for the new equilibrium, and then comparing the results of the policy simulation with the baseline data. (The baseline data may include a so-called presimulation shock, such as China's WTO accession commitments.)

Model parameters are typically chosen to reflect some medium- or long-term horizon. For example, capital mobility may be fairly restricted for a medium-term horizon, but fairly free if the analyst has a longer-term horizon in mind, that is, one where adjustments have time to work themselves out.

In order to compare LINKAGE and GTAP model results, we must simulate LINKAGE as a comparative static model. This has two effects. First, the dollar-based results will be smaller because they will reflect the economy of 2001 and not that of a projected 2015. Second, the results will tend to be smaller because dynamic effects are ignored. The comparative static simulation is run with different sets of parameters to show the influence of those parameters and to converge toward a behavioral model that is close to the GTAP model.

The model runs test the influence of two key sets of parameters. The first are the Armington parameters, which measure the degree of substitution between domestic goods and imports. The second set reflects the degree of mobility of land. The standard LINKAGE model uses its own set of Armington trade elasticities that have evolved over time based on previous studies, but that have been more or less constant over the last few years (and in recent World Bank estimates). Those elasticities are in the mid-to-high range of those used in global models—between 4 and 6. GTAP has revised its Armington elasticities upward—they had been in the 2–4 range. The new estimates are based on more recent econometric evidence and are closer to the LINKAGE elasticities.[19] The LINKAGE elasticities are still higher—an average of 35 percent overall. All else equal, this will raise the gains from global reform relative to the GTAP model.

On land mobility, GTAP assumes a relatively low degree of land transformation.[20] GTAP has a transformation elasticity of 1, whereas the default assumption in LINKAGE is perfect mobility. LINKAGE moreover allows the overall land supply to fluctuate

with land prices—with low supply elasticities for countries with land constraints.

We first scale back the dynamic gains to the 2001 base year to make comparisons easier. The so-called static gain of $287 billion in 2015—from the standard dynamic scenario—is equivalent to $156 billion relative to the 2001 economy.[21] The regional impacts will not add up to the global because the regions are growing at different rates in the baseline. The second column of table 4 shows the impact of global merchandise trade reform in a pure comparative static framework, but using the standard LINKAGE elasticities. A comparison of columns 1 and 2 provides an assessment of the static dynamic gains. Essentially, these come from two sources. The first is the increase in savings and investment generated by higher growth and a reduction in the price of capital goods (from the elimination of tariffs), which combine to raise the capital stock and therefore contribute to the dynamic gains. The second effect comes from the nature of the dynamic baseline itself. The baseline has countries growing at different rates, assumes an increase in the trade-to-GDP ratio, and incorporates other structural changes that would tend to increase the gains from trade reform over time, particularly for developing countries, where the comparative static gains are considerably lower than the static dynamic gains.

The impact of using the GTAP trade elasticities is shown in the third column of table 4. Given that these are lower than the standard LINKAGE elasticities, one would anticipate a decline in the gains from global trade reform. The global gains are about 30 percent lower, but the gains to developing countries are lower by 55 percent. Lowering land mobility, in addition to the lower Armington elasticities in column 4, eviscerates the gains to developing countries, with three of the six regional aggregates

Table 4. Global merchandise trade reform in a comparative static framework

	Scaled dynamics (1)	**Comparative static** (2)	**GTAP trade elasticities** (3)	**+GTAP land elasticity** (4)
High-income countries	109.8	103.7	77.9	75.8
Developing countries	43.9	23.7	10.6	2.0
East Asia and Pacific	9.4	6.9	3.7	0.6
South Asia	2.2	–1.2	–2.1	–1.5
Europe and Central Asia	3.5	3.9	2.3	1.9
Middle East and North Africa	8.1	3.8	2.2	1.6
Sub-Saharan Africa	2.8	0.7	0.2	–0.1
Latin America and the Caribbean	17.9	8.1	4.0	–0.5
World	156.4	127.4	88.5	77.8

Source: World Bank simulations.

showing losses. Reducing land flexibility lowers the ability of some of the developing regions to respond to new agricultural market opportunities—particularly Sub-Saharan Africa and Latin America.

Conclusions

This note describes some of the key changes to the World Bank's assessment of global merchandise trade reform over the last year and compares those changes with earlier assessments. Our assessment of the gains from global merchandise trade reform—global and regionally—are lower now for two main reasons:

1) Adoption of a new base year incorporating reforms between 1997 and 2001.
2) The baseline scenario now accounts for the use of trade preferences and for significant policy reforms—notably, elimination of the apparel and textile quotas and China's WTO accession commitments.

These two factors have different effects across developing countries. The incorporation of preferences lowers the estimate of overall gains from global reform for countries in Sub-Saharan Africa and other low-income countries, whereas incorporation of policy reforms in the baseline largely reduces estimated gains to China.

Perhaps inevitably, the focal point of trade analysis has been the so-called welfare gain (or gain in real income). But therein lies a frustration, since so many other factors are changing—most of which have more policy relevance than the overall gains. For example, identifying who wins and who loses will drive the political dynamics of trade

Table A1. Average tariffs—GTAP5 versus GTAP6

Percent

	Agriculture and food		Textile and clothing		Other industry		Total merchandise trade	
	GTAP5	*GTAP6*	*GTAP5*	*GTAP6*	*GTAP5*	*GTAP6*	*GTAP5*	*GTAP6*
World average	**27.2**	**16.7**	**12.8**	**10.2**	**5.5**	**4.2**	**7.5**	**5.2**
High-income	26.6	16.0	10.1	7.5	2.9	1.9	4.8	2.9
Australia, Canada, New Zealand	15.9	7.4	13.1	10.7	2.2	1.9	3.0	2.3
United States	10.8	2.4	11.2	9.8	2.4	1.8	2.9	1.8
European Union	22.4	13.9	10.4	5.2	4.2	2.2	6.0	3.2
Japan	50.3	29.4	11.6	9.7	1.6	1.4	9.2	5.2
Korea and Taiwan	49.4	55.0	7.6	9.2	5.7	4.1	8.8	7.6
Developing countries	28.1	17.7	18.5	17.0	10.6	9.0	12.5	9.9
East Asia and Pacific	27.8	26.3	22.7	17.8	10.9	9.3	12.2	10.5
China	38.8	37.6	24.1	19.4	13.8	12.1	15.6	13.6
South Asia	24.4	33.9	29.5	20.1	24.9	22.0	24.8	23.5
India	25.9	50.3	29.2	26.6	21.7	25.6	22.0	28.1
Europe and Central Asia	18.5	14.8	12.7	10.7	7.4	4.8	8.8	6.0
Middle East & North Africa	61.0	14.1	20.2	27.1	10.9	9.1	18.2	9.8
Sub-Saharan Africa	27.5	18.2	23.7	23.7	13.1	11.6	14.7	12.6
Latin America and Caribbean	16.2	10.3	14.5	11.3	9.7	7.5	10.3	7.7

Note: Averages are weighted using import shares. EU average excludes intra-EU trade.

reform more than the overall income gain.[22] Digging deep into the model results to elucidate the key mechanisms behind the gains and losses, undertaking sensitivity analysis to test the robustness of the conclusions to key assumptions, and comparing results across models will increase our appreciation of the importance of trade reform and improve the credibility of these modeling exercises. Notwithstanding their limitations, this class of models has become an important part of the analysis of global policy issues, with trade policy foremost among them.

Notes

1. For example, the changing net trade position of Sub-Saharan Africa.
2. By ignoring preferences, for example.
3. Lump-sum taxation to replace lost tariff revenues is considered to be distortion-free, but it is not a realistic option in most countries. There will be additional costs to alternative fiscal measures.
4. Prohibitive tariffs typically mean that initial trade shares are zero. Most models cannot create market shares if the shares are zero initially.
5. The model's specification is provided in van der Mensbrugghe (2005).
6. See www.gtap.org.
7. Input–output tables do not exist for the composite regions. They are assigned proto-typical economic structures scaled to the published national accounts. The trade data accurately reflects the information from COMTRADE.
8. There are also valuation changes, because all national data is converted to a single currency, the U.S. dollar.
9. See Bouët and others (2004) for more information.
10. The only change was the household direct tax rate, which evolved to maintain a fixed fiscal deficit. Public expenditures are assumed to grow at the same rate as GDP in the baseline.
11. The textile and clothing quotas are implemented using export-tax equivalents. These introduce a price wedge between the producer price in the source country and the consumer price in the destination country. However, unlike an import tariff, the revenue accrues to the exporting country. The wedges have been calibrated to existing information on the price of auctioned quotas.
12. A brief note on terminology: comparative static gains are the gains from global reform based on the static base-year structure of the economy, i.e. 2001 in the case of GTAP6. The 'static' dynamic gains are based on a dynamic baseline, in the present case through 2015, which incorporates changes in the structure of the global economy over a 14-year period. Among other things, the global economy will be much larger (50 percent if it grows on average by 3 percent per annum). We call these 'static' dynamic gains because there is no influence of the reforms on productivity. Finally, the 'dynamic' gains arise from allowing for a linkage between the reforms and productivity
13. For example, if productivity in a given sector is 2 percent in the baseline and the export-to-output ratio increases by 10 percent in that sector, then sectoral productivity will increase to 2.08, an elasticity of 0.4, because only 40 percent of sectoral productivity is linked to openness.
14. The agricultural elasticity is lower than in previous studies. Because the existing empirical evidence relates to manufacturing, we have made a modest assumption in agriculture by halving the elasticity.
15. The poverty forecast relies on two main elements. The first is the long-term economic forecast. This has not changed appreciably over the last few years, although better-than-

expected performance between 2001 and 2005 has led to some upward revision. The second is the estimate of the income poverty elasticity. This is constantly evolving as new household surveys become available and the methodology is improved.

16. Both the unweighted and population-weighted average change is about 50 percent.

17. The standard estimate at the world level is an elasticity of 2; that is, for each percentage-point increase in developing-country income, the headcount index declines by 2 percent.

18. See Hertel (1997) for more details.

19. We considered moving to the new GTAP elasticities but decided against doing so for two reasons. First, the new GTAP elasticities were close enough to the standard LINKAGE elasticities. Therefore, the advantage of comparability of results over time and across LINKAGE model simulations outweighed the advantages of using a new set of econometrically estimated parameters. Second, the ranking of some of the new GTAP elasticities were puzzling and raised questions about the robustness of the estimates. For example, sugar and oil seeds have a lower substitution elasticity than other crops or clothing.

20. Both models use a constant-elasticity-of-transformation function to allocate aggregate land across sectors based on relative returns to land.

21. I.e. apply the percentage gain in 2015 to the level of global GDP in 2001.

22. See for example Anderson and others (2005).

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