

# Liberalizing Agriculture by OECD Countries: Welfare, Growth and Distributional Impact in Developing Countries

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## Abstract

Although it is often argued that liberalization provides opportunities for growth and development in all over the world, there are divergent views about the effects of agricultural trade liberalization on growth and income distribution in developing countries. The developing countries' main complaint in this regard is that trade distorting activities in agriculture by developed countries adversely affecting their exports and consequently growth, and income and employment of the people therein. There is a general perception among the policymakers and academia that the developing countries would gain much from the removal of existing distortion in the agricultural market because of the tremendous importance of the agricultural sector in their economies. The current paper has analyzed the effect of trade liberalization in agriculture on welfare, growth and income distribution in developing countries, using a computable general equilibrium (CGE) model and indicates that the effect is not similar for all the developing countries.

**Keywords:** Trade liberalization, Agriculture, GTAP, CGE Model

## 1. Introduction

Agriculture is the most important sector of the economies of developing countries. The sectoral contribution of agriculture to GDP is within the range of 30 to 60 percent in about two thirds of the developing countries. It is also providing employment to the large segment of the population ranging from 40 to 90 percent in most of the developing countries and the principle sources of foreign exchange amounting 25 to 95 percent in three fourth of developing countries (FAO 2002, p. 7). Thus a sustainable agriculture is the fundamental to ensure food security, poverty alleviation and overall growth and development in developing countries. Strong backward and forward linkages between agriculture and non agriculture sector further stimulate growth and development. In most of the developing countries agro and agro based products are the main export items. An increase in trade of these items is expected to contribute not only to growth of agriculture sector but also to manufacture and service sectors, because of strong linkages between these sectors. Although trade provides the opportunity of economies of scale, specialization and utilization of abundant factors, the relationship between trade and growth are complicated. In economic literature there are divergent views about the effects of agricultural liberalization on growth and income distribution in developing countries. Although it is often argued that liberalization provides opportunities for growth and development in all over the world, the developing countries, and particularly the least developed countries (LDCs) have yet to get any benefits of trade liberalization. In fact, the share of agricultural export by LDCs as a percentage of world agricultural export has been declined from 3.2 percent in 1970-79 to 1.9 percent in 1980-89 and a more 0.9 percent in 2000-04 (FAO 2007, p. 5).

The negotiations of liberalization in agriculture were initiated in the "Doha Round" of the World Trade Organization (WTO). But the governments of the member countries were far away from the Agreement on Agriculture (AoA) which sets the quantitative targets for reduction in trade distorting activities i.e., import tariff, domestic support and export subsidies. While significant progress has been made in liberalizing manufacturing products among developed member countries, little progress has been made on export interest to developing countries (Orden et al. 2002). The Cancun Ministerial meeting also failed because of the inflexibility on the part of the developed countries to withdraw hefty subsidies given to agriculture in these countries through various means. The developing countries' main complaint in this regard is that such subsidies in the developed countries keep the prices of their farm products low acting as a kind of barrier against the entry of such commodities from the developing countries. In cases where a developing country is dependent on the export of one or two major agricultural commodities such as cotton in some of the Sub-Saharan African nations, the tariff wall against its entry into the developed countries may be very high adversely affecting their exports and consequently growth, and income and employment of the people therein.<sup>1</sup>

There is a general perception among the policymakers and academia that the developing countries would gain much from the removal of existing distortion in the agricultural market because of the tremendous importance of the agricultural sector in their economies (Koning & Andersen 2007, pp. 1-2). However, policy interests are not similar among developing countries. Some net exporters of agricultural commodities, such as Brazil and Argentina, would benefit from trade liberalization and multilateral removal of domestic support. In contrast, the net food importing countries, such as Egypt and Middle East countries, benefit from existing distortion because it depressed the world price of food imports (Fabiosa et al. 2005, p. 318). Against this backdrop one pertinent question may be raised: whether trade liberalization in agriculture by the developed countries will affect them similarly? For countries which are net food importers the question is more specific. Will they benefit from such withdrawal as a food importing country? The paper tries to address these questions using computable general equilibrium (CGE) model. This paper also analyzed the effect of trade liberalization in agriculture on growth and income distribution in developing countries.

The paper is organized as follows. Following the introduction section 2 gives an overview of the trade liberalization under WTO agreement on agriculture. Section 3 analyzes the linkages between trade liberalization and growth in developing countries. Implications of agricultural trade liberalization using a computable general equilibrium model are analyzed in section 4 while section 5 draws the conclusion.

## **2. Trade Liberalization under WTO Agreement on Agriculture**

The establishment of WTO in 1995 first introduced the rules of international trade in agricultural commodities under the Uruguay Round Agreement on Agriculture (AoA). The support to agriculture is provided in more than one way in the developed countries. There is the usual tariff against imports from the developing countries thus discouraging competition within the domestic market. Export subsidy is provided for exporting certain farm goods. Output price support is a major element of the support while subsidy is provided also for lowering the price of inputs. All these are to be withdrawn according to certain formula under AoA. Therefore, the AoA has three supports namely market access, domestic support and export competition under which all WTO member countries except LDCs are committed to reduce the trade distorting activities according to following schedule.

[Insert Table 1 here]

The Article 4 of the AoA affirmed that all barriers to imports should be subject to tariffs only. Therefore, before implementing the tariff reduction schedule, countries had to convert all non-tariff measures to their tariff equivalents – a process called tariffication. After completing the tariffication and establishing the tariff equivalents, tariff reduction were applied to bound tariffs. Developed countries were committed to reduce tariff by an average of 36 percent with a 15 percent minimum tariff cut for any specific product, over a six year period. Developing countries had lower targets of 24 percent reduction with a 10 percent minimum tariff cut over ten years. Similar efforts were made to reduce the distorting effect of domestic support. All sort of domestic supports were classified into three categories by the degree of distortion: the Amber Box, the Blue Box and the Green Box.<sup>2</sup> Amber Box supports became the core of the negotiation and are subject to WTO reduction commitments. Supports in this category are expressed in terms of Aggregate Measurement of Support (AMS) which includes all support in one single figure. The developed countries were committed to reduce AMS by 20 percent within six years, while developing countries to reduce it by 13 percent within ten years. Countries with no Amber Box supports agreed not to use supports over a de minimis level of 5 percent (10 percent for developing countries) of the total value of agricultural production. The AoA decided to treat export subsidies separately from domestic support. The developed countries were to reduce the value and volume of export subsidies by 36 percent and 24 percent respectively over a period of six years. For developing countries, the value and volume of export subsidies to be reduced by 24 percent and 10 percent respectively over a ten year period (Table 1). The LDCs are exempted from all the reduction commitments (ActionAid 2004, pp. 3-5).

While the AoA made some significant progress in specifying initial commitments on reduction of tariffs and domestic supports, developed countries has shown no willingness to reduce subsidies and other protectionist measures in agriculture. The total support provided to agriculture in the OECD countries, measured by Total Support Estimate (TSE), increased from US\$ 374 billion in 1996 to US\$ 382 billion in 2005. The support provided to producers was US\$ 280 billion in 2005. More than 70 percent of farm support in OECD countries is provided in the form of trade distorting market price support and payments linked to production. In 2005, the respective value of TSE in EU and USA were US\$ 153 billion and US\$ 105 billion respectively (Mouhamad 2008, pp. 3-7). EU tops the list in providing the farm support. Of the worldwide total producers support, EU provided 40 percent of the total. The respective shares of USA, Japan and Korea had been 21, 20 and 7 percent. The support to farmers in these countries is such that in Switzerland, Norway, Korea and Japan for every one hundred dollars of farm earning, 60-70

dollars is a hand out from the government. In EU, it is 35 dollars while in the USA and Canada these are lower at around 20 dollars. In some countries such as Norway, Japan and South Korea the level of support provided to agriculture more or less matched its contribution to GDP in those countries (Asaduzzaman 2004, p. 929).

The WTO negotiations notwithstanding, the fact remains that despite some noises by some countries and groupings, the level of support is likely to remain the same in some disguise or other. For that matter, there are EU proposals to decouple some of the support from production decisions. However, others contend that if farmers are given money not to produce, they will remain in farming and over-produce. In USA, the signs are more ominous. With the Farm Security & Rural Investment Act 2002 in USA farmers have been given guaranteed prices for rice, wheat, corn, soyabean & cotton for a period of six years. This is highly trade-distorting, to say the least, and this in a country which preaches free-market principles to others.

### **3. Linkage between Trade Liberalization and Growth in Developing Countries**

Poverty reduction is the main objective of the government policy in most of the developing countries. In the current globalized world it is widely accepted by the policymakers and academia that trade liberalization can enhance economic growth and reduce poverty through redistribution of income and wealth (Dollar 1992; Dollar & Kraay 2004; Sachs & Warner 1995; Michaely et al. 1991; Onafowora & Owoye 1998). In contrary, some argue that in short run trade liberalization is harmful for growth and poverty reduction, and increase inequality in the developing countries (Weller & Hersh 2002; Sala-I-Martin 1997; Anwar 2002; Akmal et al. 2007). Open economy usually leave the poor segment of the population behind the poverty line. This is because developing countries usually suffer from negative adjustment and distributional effects from trade liberalization. The linkage between trade liberalization and growth is not simple. Although there are some empirical evidences for the argument that liberalization enhance economic growth and reduce poverty by increasing income, it is not widely accepted nor proved. At the same time also there is no proof that liberalization is of destructive to growth (Winters et. al. 2004, p. 74). Liberalization has both direct and indirect effect on economic growth and income distribution. Following export-led growth strategy, it is expected that export growth can generate economic growth and foster poverty reduction. If protectionist measures are beneficial for the wealthy segment of population, then liberalization generally distribute income and wealth in favor to poor. But the assumption behind this conception is less relevant in the current globalized world (CUTS 2004, p. 1).

In a liberalized world commodity prices are determined by the world market prices. A change in border prices arising from trade liberalization directly transmitted to domestic market. This change in prices may affect the terms of trade which is considered as the primary determinant of growth of a country (Chemingui & Thabet 2008, p. 9). Now the question is whether the changes in price are really transmitted down to the poor segment of the population. If it does not the effect of liberalization on distribution of income are likely to be weak. Liberalization is also often related with the creation and destruction of the local market. While liberalization can create opportunities to produce large numbers of commodities because of increased demand in world market and positive terms of trade effects, at the same time some industries may cease to exist as a result of increased import competition. When liberalization creates markets a country can experience welfare gain form technological change and diffusion of knowledge. But when liberalization destroys markets poor people suffer from substantial income loss (Winters et. al. 2004, pp. 87-89). The changes in prices also change the wages of workers. According to Stolper-Samuelson model an increased price of labour intensive commodities will increase the wage of workers in that industry. But the Stolper-Samuelson model is only true if all market are functioning properly (Chemingui & Thabet 2008, p.9). Furthermore, even if unskilled-labour wages is increase as a result of increased prices it will have positive distributional effect only if poor household are depends on the unskilled-labour wage earners (Winters et. al. 2004, p. 97).

In recent years, agricultural trade liberalization and its impact on growth and distribution in developing countries have attracted growing attention. A recent study by Pereira et. al. (2010) simulated the WTO agricultural production and export subsidy reduction requirement, and the application of the Harbinson approach, and Swiss formula to reduce import tariffs.<sup>3</sup> The paper concludes that Brazil and China experience a positive GDP growth rate while India shows a negative GDP growth rate in all scenarios, except in that which replicates the Uruguay Round. Brockmeier & Pelikan (2008) reveals that the heights of the agricultural tariff cuts and the kind of tiered formula applied are most important for the outcome of the Doha Round. While manufacturing protection has declined worldwide following substantial reforms of trade policies, most industrial countries still protect agriculture at high level (Aksoy & Beghin 2005, p. 1). Trade protection usually introduces anti-agricultural bias, so removal of price controls on agriculture will raise the income of poor farmers in rural area. But higher food prices and removal of consumer subsidies may hurt rural landless (in the short-run) and urban poor consumers (Anwar 2002, p. 6). From the preceding discussion it is obvious that the effect of agricultural trade liberalization on growth and distribution in

developing countries is not clear-cut. The effects on developing countries depends crucially on which countries (developed or developing) are liberalizing their agriculture and in what extent. At the same time the effects might be different depending on the agricultural activities of different developing countries.

#### **4. Implications of Agricultural Trade Liberalization – A CGE Analysis**

In this section Global Trade Analysis Project (GTAP) model and data have been used to find out the implications of agricultural trade liberalization on developing countries. GTAP is a multi-country Computable General Equilibrium (CGE) model which confines different aspects of global economic activities. This is a linearized comparative static model for CGE analysis. GTAP provides opportunities to policy makers and academicians to use the global model and database for policy formulation and implementation.

##### *4.1 An Overview of GTAP Model<sup>4</sup>*

In GTAP model each region has a single representative household. The income of these households mainly depends on factor income and tax revenue. The allocation of expenditure of these households is classified as private expenditure, government expenditure and savings, according to a Cobb-Douglas aggregate utility function. In GTAP, private consumption and government consumption expenditures are described by Constant Difference of Elasticities (CDS) expenditure function and Cobb-Douglas function respectively. Constant Elasticity of Substitution (CES) function is applied to substitute same type of domestic and foreign produced goods.

In case of production, GTAP model applies constant returns to scale production function. Leontief and CES function is applied to describe the technology. Two broad categories of inputs are used to maximize profits by producers; these are intermediate inputs and primary factors. For a given level of output the input allocation assumed to be done efficiently to minimize the total cost of production. The factor movement is restricted among the region but intermediate input can be used from domestically produced or imported input goods. The GTAP database covers all the bilateral trade, transport and protection data that link 113 country/regional economic databases. These transport and protection data drive a wedge between prices in regions, i.e., the same products may be more expensive in one region than in another because of the protection. International trade is modelled by tracing all bilateral flows. In GTAP, international capital flows are governed by a global bank. This bank collects savings and uses these for international investments. Since savings are pooled by the global bank before being used for investments there is no tracing of bilateral capital flows. The version 7 of GTAP database (which is used to analyze the impact of agricultural trade liberalization in this paper) represents the world economy in 2004. This version has 113 regions, 57 commodities and 5 factors of production.

##### *4.2 Region and Commodity Aggregation*

The main objective of this paper is to assess the impact of agricultural trade liberalization by OECD countries on developing countries. Keeping this view in mind OECD countries and developing countries are separated as different regions. Developing countries are divided into five regions namely East and South East Asia (ESEA), South Asia (SA), Latin America and Caribbean (LAC), Middle-East and North Africa (MENA) and Sub-Saharan Africa (SSA). The strategy for this aggregation is to separate developing countries according to different stage and patterns of development to analyze how the countries are affected by liberalization. In case of commodity aggregation agricultural commodities are separated from manufacturing and service sector. Therefore, 57 commodities are aggregated into 3 namely Agriculture, Manufacturing and Service (Table 2). There are five factors of production in GTAP model which are kept unchanged. The factors of production include land, unskilled labor, skilled labor, capital and natural resources.

[Insert Table 2 here]

##### *4.3 Simulation Scenarios*

In this paper four simulations have been performed to examine the agricultural trade liberalization by OECD countries. Full liberalization of all agricultural support by OECD countries is considered in simulation 1 where OECD countries eliminated all three types of agricultural support i.e., import tariff, domestic support and export subsidies of their agricultural production and trade. Simulation 2 implements a 50 percent liberalization of all agricultural support by OECD countries. However, an instant policy that removes all agricultural supports is not plausible for a country. Therefore, two more simulations have been designed by eliminating some of these supports. Simulation 3 eliminates import tariff and input subsidies while only import tariff is eliminated in simulation 4. Simulation scenarios are summarized in Table 3.

[Insert Table 3 here]

##### *4.4 GTAP Simulation Results of Agricultural Trade Liberalization*

In this section, the results of GTAP simulation are presented and analyzed. In GTAP welfare effects are measured as equivalent variation (EV) which is equal to the difference between expenditure required to obtain the new level of

utility at initial prices and the initial expenditure. The equivalent variation associated in each region with the simulation scenarios is considered here both as total variation, and in its components arising from the changes in the terms of trade, resource allocation and investment-saving effect, and is presented in Table 4. It shows that only MENA countries experiences high welfare loss from the first two simulations. The total welfare loss for MENA countries is 941 million US dollar in simulation 1, in which OECD countries completely liberalized their agriculture sector. In case of partial agricultural trade liberalization (50 percent reduction of all sort of agricultural support) by OECD countries, designed in simulation 2, MENA countries experiences a loss of welfare of around 475 million US dollar. However, in simulation 3, where OECD countries completely eliminated import tariff and input subsidies in agriculture, MENA countries experience welfare gain amounting US dollar 200 million. Elimination of import tariff by OECD countries is welfare enhancing for MENA countries while removal of input subsidies are welfare worsening, which is also confirmed from the results of simulation 4. Therefore, tariff elimination effect outweighs the removal of input subsidies effect and MENA countries experience a positive welfare gain in simulation 3. ESEA, LAC and SSA countries experience a substantial welfare gain in almost all the simulations. The welfare gain is higher in simulation 1 and simulation 3 for these countries. ESEA and SSA countries experience highest welfare gain in simulation 3 which is around 2601 million US dollar and 522 million US dollar respectively while for LAC countries, the welfare gain is highest in simulation 1 amounting US dollar 2931 million. The different groups of developing countries experience different welfare effects based on their trade pattern of agricultural commodities. Furthermore, tariff and subsidies have diverse effects on different country groups. Removal of subsidies affects positively to the net importers of agricultural commodities while removal of tariff by OECD countries affects positively to those developing countries which exports agriculture to OECD countries. MENA countries are net importers of agricultural commodities and withdrawal of agricultural tariff and all sort of domestic subsidies by OECD countries is negatively affecting those countries as depicted in simulation 1 and 2. When all sort of domestic subsidies are removed by OECD countries, subsidy effect outweighs tariff effect and MENA countries experiences negative welfare effects. However, when only input subsidies are removed by OECD countries tariff effect outweighs subsidy effect resulting net welfare gain for MENA countries. ESEA, LAC and SSA countries are net exporter of agricultural commodities, thus experience a positive welfare gain in all the simulations. SA does not experience a substantial welfare loss because it comprises both net exporting and net importing countries of agricultural commodities. Therefore, the net welfare gain by exporting countries and net welfare loss of importing countries offsets each other.

[Insert Table 4 here]

The sources of welfare gain also reported in table 4 which is mainly attributed to allocative efficiency, terms of trade (TOT) effect and investment-saving (I-S) effect. Allocative efficiency refers to the efficient sector-wise allocation of scarce resources to produce the optimal combination of output. TOT effect refers the changes in relative prices of exports and imports and I-S effect refers the changes in price of capital goods and savings (Raihan & Razzaque 2007, p. 20). It is expected that the reduction of agricultural distortion by OECD countries would increase the allocative efficiency of developing countries. However, Table 4 shows that, in first two simulations, all the developing country groups except LAC experience loss in terms of allocative efficiency. This is because liberalization by OECD countries failed to reallocate the resources from the inefficient sectors to the more efficient sectors and also because of the pre-existing distortion in other sectors (manufacturing and service sectors) of these countries. For this reason, resource reallocation between agricultural sector and other distorting sectors results a net loss in terms of allocative efficiency. Unlike first two simulations MENA countries and SSA countries experience an increase in allocative efficiency in simulation 3. These opposite results are achieved because, efficient agricultural sub-sectors in MENA and SSA country group become more competitive as a result of elimination of tariff and only input subsidies by OECD countries. However, as reflected in last simulation, only input subsidy elimination by OECD countries does not have any positive allocative efficiency for developing country. The second component of welfare change is terms of trade (TOT) effects. Agricultural trade liberalization raises the food price in international market (Table 5). This price movement improves the TOT for countries that are net exporters of protected farm products, while net food-importing countries are expected to lose. The net exporters of agricultural commodities experience a positive TOT effects because of the increased world price of agricultural commodities. As expected the TOT effects is positive for all developing country groups except MENA countries in first two simulations. TOT gains for ESEA, SA, LAC and SSA are 3362 million US dollar, 74 million US dollar, 2744 million US dollar and 307 million US dollar respectively in first simulation. MENA countries which is net food importer, experience a loss of US dollar 304 million in simulation 1. In simulation 3 the TOT effect for MENA countries is US dollar 147 million, generated by relative price increase in exportable agricultural sub-sectors in MENA countries. The I-S effect on welfare is similar to TOT effect, since each region exports capital goods to the

global bank and imports savings from the global bank. The I-S effect is substantially negative only for ESEA countries, as reported in Table 4.

[Insert Table 5 here]

Table 5 reports the macroeconomic impact of agricultural trade liberalization on developing countries. It is observed from the table that all the developing country groups experience an increase in real GDP as a result of increased agricultural output. Liberalizing agriculture by OECD countries increases the price of agricultural commodities in world market. Therefore, imports of agriculture become more expensive and exports of agriculture become more profitable in developing countries. In such a situation, producers get incentives to produce more to substitute import and promote export in agricultural commodities. This have a positive effect on real GDP growth rate and it can be argued that agricultural liberalization by OECD countries is growth enhancing for developing countries. It should be mentioned here that the developing countries achieved higher growth rate when OECD countries completely liberalized its agricultural sector as depicted in simulation 1. It is observed form the table that all the developing country groups experience an increase in exports while agricultural imports are both increased and decreased across country groups and simulations. These changes in export and import along with the changes in world price of agricultural commodities effects the balance of trade situation in developing countries. Balance of trade situation improves in ESEA and SA while it becomes worsen in LAC, MENA and SSA countries in almost all the simulations. Now let us consider the changes of wage in developing countries as a result of liberalized measures taken by OECD countries. From Table 5 it is observed that both skilled and un-skilled workers experience an increase in wage rate. However, the wage increase in un-skilled worker is higher than the wage increase in skilled worker. In most of the developing countries poor household are mainly depends on the income from un-skilled worker. Therefore, the simulation results of present analysis depict that the income distribution resulting from agricultural trade liberalization is in favor of poor household in developing countries.

## 5. Conclusion

The paper analyzes the impact of agricultural trade liberalization on welfare, growth and income distribution in developing countries. To perform the agricultural trade liberalization all three types of agricultural supports i.e., import tariff, domestic support and export subsidies have been considered. For the purpose of present analysis developing countries are categorized into five groups. The analytical tool has been used in this paper is a global CGE model. The simulation results depict that the welfare effects are not similar across these country groups. A complete liberalization of agriculture by OECD countries is welfare enhancing for net agricultural commodity exporters while net food importing countries experience a welfare loss. These results are only possible when OECD countries remove all types of subsidies and tariff. The removal of a specific type of agricultural subsidy and tariff by OECD countries might have different effect on developing countries depending on the nature of each effect and which one is outweighs other. Furthermore, countries where firm use imported agricultural inputs from developed countries, may not necessarily increase welfare as it was expected. Because, in such a case rising prices in agriculture do boost farm gate price and also export prices in developing countries. Therefore, the effects are not as clear as assumed. It is also observed that agricultural liberalization by OECD countries is growth enhancing for developing countries as a result of increased agricultural output. However, developing countries achieved higher growth rate when OECD countries completely liberalized its agricultural sector. There is also a pro-poor distributional effect of income as a result of complete liberalization in agriculture by OECD countries.

The modeling framework has been used here is a neo-classical full employment model. But developing countries are in general labor surplus with high unemployment in un-skilled labor. The neoclassical closure used in this model is full employment and flexible wage rate. The simulation results show that wage rates will increase as a result of increased demand for labor in developing countries. From this feature, it is argued that in developing countries employment might be generated by agricultural trade liberalization in OECD countries. These employment generations might be higher for un-skilled labor as the simulation results reflect a higher increase in wage rate in un-skilled labor.

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WTO Website: <http://www.wto.org/>

## Notes

Note 1. Cotton is the single-most important export from Chad, Mali, Benin and Burkina Faso where its share in total non-fuel commodity exports varies from just about 80 to 95 percent. Guinea Bissau similarly depends on cashew nut exports where its share in non-fuel commodity export is 98 percent.

Note 2. Supports that are considered as trade distorting are included in the Amber Box. Subsidies that are provided to farmers to limit production are included in the Blue Box and subsidies that are considered not to distort trade are included in the Green Box.

Note 3. The Swiss Formula and Harbinson approach are two mathematical formula designed to cut and harmonize tariff rates in international trade. Several countries are pushing for their use in WTO trade negotiations.

Note 4. See Hertel & Tsigas (1997) and Brockmeier (2001) for detail.

Table 1. Reduction in agricultural support and protection agreed in AoA.

	Developed Countries 6 Years (1995-2000)	Developing Countries 10 Years (1995-2004)
<b>Tariff</b>		
i) Average cut for all agricultural products	36%	24%
ii) Minimum cut per product	15%	10%
<b>Domestic Support</b>		
i) Cut of total support (AMS) for sector	20%	13%
ii) De minimis level	5%	10%
<b>Exports</b>		
i) Value of Subsidies	36%	24%
ii) Subsidized quantities	21%	14%

Source: WTO Website.

Table 2. Regional and Commodity Aggregation in GTAP Model

<b>Regional Aggregation</b>	
<b>New Region</b>	<b>Comprising old regions</b>
OECD Countries	Australia; New Zealand; Japan; Korea; Canada; United States of America; Mexico; Chile; Austria; Belgium; Czech Republic; Denmark; Estonia; Finland; Germany; Greece; Hungary; Ireland; Italy; Luxembourg; Netherlands; Poland; Portugal; Slovakia; Slovenia; Spain; Sweden; United Kingdom; Switzerland; Norway; Turkey.
East and South East Asia (ESEA)	China; Rest of East Asia; Cambodia; Indonesia; Lao People's Democratic Republic; Myanmar; Malaysia; Philippines; Thailand; Viet Nam; Rest of Southeast Asia.
South Asia (SA)	Bangladesh; India; Pakistan; Sri Lanka; Rest of South Asia.
Latin America and Caribbean (LAC)	Argentina; Bolivia; Brazil; Colombia; Ecuador; Paraguay; Peru; Uruguay; Venezuela; Rest of South America; Costa Rica; Guatemala; Nicaragua; Panama; Rest of Central America; Caribbean.
Middle-East and North Africa (MENA)	Rest of Western Asia; Egypt; Morocco; Tunisia; Rest of North Africa.
Sub-Saharan Africa (SSA)	Nigeria; Senegal; Rest of Western Africa; Central Africa; South Central Africa; Ethiopia; Madagascar; Malawi; Mauritius; Mozambique; Tanzania; Uganda; Zambia; Zimbabwe; Rest of Eastern Africa; Botswana; South Africa; Rest of South African Customs .
Rest of the World	Rest of Oceania; Hong Kong; Taiwan; Singapore; Rest of North America; Cyprus; France; Latvia; Lithuania; Malta; Rest of EFTA; Albania; Bulgaria; Belarus; Croatia; Romania; Russian Federation; Ukraine; Rest of Eastern Europe; Rest of Europe; Kazakhstan; Kyrgyztan; Rest of Former Soviet Union; Armenia; Azerbaijan; Georgia; Iran Islamic Republic of.
<b>Commodity Aggregation</b>	
<b>New Sector</b>	<b>Comprising old Commodities</b>
Agriculture	Paddy rice; Wheat; Cereal grains nec; Vegetables, fruit, nuts; Oil seeds; Sugar cane, sugar beet; Plant-based fibers; Crops nec; Cattle, sheep, goats, horses; Animal products nec; Raw milk; Wool, silk-worm cocoons; Meat: cattle, sheep, goats, horse; Meat products nec; Vegetable oils and fats; Dairy products; Processed rice; Sugar; Food products nec; Beverages and tobacco products.
Manufacturing	Forestry; Fishing; Coal; Oil; Gas; Minerals nec; Textiles; Wearing apparel; Leather products; Wood products; Paper products, publishing; Petroleum, coal products; Chemical, rubber, plastic prods; Mineral products nec; Ferrous metals; Metals nec; Metal products; Motor vehicles and parts; Transport equipment nec; Electronic equipment; Machinery and equipment nec; Manufactures nec.
Services	Electricity; Gas manufacture, distribution; Water; Construction; Trade; Transport nec; Sea transport; Air transport; Communication; Financial services nec; Insurance; Business services nec; Recreation and other services; PubAdmin/Defence/Health/Educat; Dwellings.

Source: GTAP Database

Table 3. GTAP Simulation Scenarios

	<b>Simulation 1:</b>	<b>Simulation 2</b>	<b>Simulation 3</b>	<b>Simulation 4</b>
Import tariff removed	100%	50%	100%	0%
Export subsidies removed	100%	50%	0%	0%
Output subsidies removed	100%	50%	0%	0%
Input subsidies removed	100%	50%	100%	100%
Land subsidies removed	100%	50%	0%	0%
Capital subsidies removed	100%	50%	0%	0%

Table 4. Decomposition of Welfare Changes (US\$ million)

<b>Region</b>	<b>Simulation 1</b>				<b>Simulation 2:</b>			
	<b>Allocative Efficiency</b>	<b>TOT Effect</b>	<b>I-S Effect</b>	<b>Total</b>	<b>Allocative Efficiency</b>	<b>TOT Effect</b>	<b>I-S Effect</b>	<b>Total</b>
ESEA	-529	3362	-430	2404	-234	1312	-167	912
SA	-170	74	31	-64	-75	39	13	-23
LAC	201	2744	-14	2931	77	1173	-8	1242
MENA	-416	-560	36	-941	-206	-285	15	-475
SSA	-86	307	1	222	-44	135	0	91

Table 4 (Continued)

Region	Simulation 3				Simulation 4			
	Allocative Efficiency	TOT Effect	I-S Effect	Total	Allocative Efficiency	TOT Effect	I-S Effect	Total
ESEA	-349	3480	-530	2601	-24	-26	12	-37
SA	-133	47	27	-59	-5	1	0	-5
LAC	234	2521	-17	2738	-1	28	0	27
MENA	23	147	30	200	-13	-26	1	-38
SSA	65	456	1	522	-3	4	0	1

Source: GTAP Simulation Results

Table 5. Macroeconomic Impact of Agricultural Trade Liberalization

	Changes in	ESEA	SA	LAC	MENA	SSA
Simulation 1	Real GDP (%)	0.98	0.49	2.11	0.29	0.97
	Balance of Trade (US\$ million)	4377.74	20.84	-1307.83	-248.91	-158.36
	Price of Agricultural Import (%)	1.46	1.39	2.35	3.28	3.21
	Agricultural Export (%)	45.2	11.67	26.98	9.37	17.16
	Agricultural Import (%)	3.42	-1.17	3.34	-4.44	-3.28
	Agricultural Output (%)	4.30	0.58	5.97	1.69	3.52
	Un-Skilled wage rate (%)	1.14	0.5	2.13	0.46	1.37
	Skilled wage rate (%)	0.18	0.3	1.86	0.22	0.69
Simulation 2	Real GDP (%)	0.43	0.26	0.94	0.16	0.48
	Balance of Trade (US\$ million)	1849.07	10.68	-564.12	-112.77	-71.49
	Price of Agricultural Import (%)	0.71	0.66	1.11	1.63	1.59
	Agricultural Export (%)	18.93	5.64	12.07	4.65	8.16
	Agricultural Import (%)	1.26	-0.52	1.37	-2.21	-1.68
	Agricultural Output (%)	1.81	0.28	2.68	0.84	1.69
	Un-Skilled wage rate (%)	0.5	0.26	0.95	0.25	0.67
	Skilled wage rate (%)	0.1	0.17	0.83	0.13	0.35
Simulation 3	Real GDP (%)	0.74	0.19	1.71	0.03	0.62
	Balance of Trade (US\$ million)	3870.85	53.93	-1026.52	-112.22	-100.97
	Price of Agricultural Import (%)	0.21	0.59	0.94	0.03	0.17
	Agricultural Export (%)	42.11	7.73	24.4	5.45	14.68
	Agricultural Import (%)	5.34	-0.16	5.06	0.1	1.87
	Agricultural Output (%)	3.85	0.37	5.25	0.35	2.41
	Un-Skilled wage rate (%)	0.89	0.2	1.73	0.07	0.87
	Skilled wage rate (%)	0.03	0.07	1.5	0.03	0.43
Simulation 4	Real GDP (%)	0.01	0.01	0.03	0	0.02
	Balance of Trade (US\$ million)	16.02	-5.55	-34.21	-15.4	-6.97
	Price of Agricultural Import (%)	0.09	0.06	0.08	0.09	0.08
	Agricultural Export (%)	0.44	0.39	0.37	0.43	0.45
	Agricultural Import (%)	-0.14	-0.1	-0.04	-0.13	-0.1
	Agricultural Output (%)	0.05	0.02	0.09	0.06	0.09
	Un-Skilled wage rate (%)	0.01	0.01	0.03	0.01	0.03
	Skilled wage rate (%)	0	0.01	0.02	0	0.01

Source: GTAP Simulation Results