Multilateral and Regional Trade Agreements: Options for Bangladesh

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Markus Lips, Andrzej Tabeau and Frank van Tongeren*[1]

Abstract

We analyze several trade liberalization scenarios for Bangladesh. Multilateral agreements in the framework of the WTO are compared with regional agreements in the framework of SAFTA. The paper argues that the imminent completion of the Agreement on Textile and Clothing (ATC) leads to a welfare loss for Bangladesh. Bangladesh's textile and wearing apparel industries have by now free access to the EU, its most important export market. A further multilateral trade liberalization of trade in these products erodes the Bangladeshi position vis-à-vis its competitors. A simulation of the WTO proposals tabled by the EU and the USA shows that there is little reason to expect that the Doha Round will mitigate the situation for the Bangladesh garment industry. However, in terms of prospects for the garment sector, the EU proposal compares favourably to the USA proposal because it entails zero tariffs from imports from LDCs and it allows Bangladesh to protect its own industry.
Due to unbalanced trade relations to its neighbour's countries also the regional trade liberalization of the South Asian Free Trade Association (SAFTA) is not favourable.
For the analysis we introduced economies of scale into the general equilibrium model of the Global Trade Analysis Project (GTAP).

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* Agricultural Economics Research Institute (LEI), Burgemeester Patijnlaan 19, PO box 29703, 2502 LS Den Haag, The Netherlands, markus.lips@wur.nl

1 Introduction

Like many other developing countries, Bangladesh is facing the issue whether to engage in bilateral trade agreements with industrialized countries, whether to engage in regional trade agreements with neighboring countries and what position develop in the WTO Doha round. This paper investigates the relative merits of regional and multilateral agreements. A special feature of Bangladesh's foreign trade is its heavy bias towards trade in wearing apparel. Around two third of Bangladesh's exports are generated in the trade of textile and wearing apparel. Bangladeshi exporters are confronted with export quotas, due to the Multifibre Agreement (MFA), and with considerable import tariffs in industrialized countries. An exception is the EU market, which provides tariff- and quota free access. A change in export quota or in tariffs will directly affect the Bangladesh economy. Export quotas are due to be phased out by December 31st, 2004 through the Agreement on Textiles and Clothing (ATC) of the World Trade Organization (WTO). A change of import tariffs might be a result of the implementation of the South Asian Free Trade Association (SAFTA) a regional trade agreement. Furthermore, tariffs are an important subject of the ongoing Doha Round of the WTO. Due to the worldwide export quotas it can be assumed that production capacities are not entirely used in the textile and wearing apparel sectors. It therefore seems likely that global economies of scale can be realized when trade liberalization would take place. In order to capture the possibility of exploiting hitherto unutilized economies of scale in the face of trade liberalization, this paper incorporates economies of scale into the GTAP model. The analysis is carried out with a modified version of the general equilibrium model of the Global Trade Analysis Project (GTAP, Hertel, 1997). The GTAP model has been used for several economic analyses for South Asian integration. Bandara and Yu (2001) provided an assessment of the SAFTA. Tennakoon (2000) and Siriwardana (2000) analyzed different trade liberalization scenarios for Sri Lanka. None of these earlier studies considers scale economies.

The paper is organized as follows: In section two the introduction of economies of scale into the GTAP model is presented. The used data aggregation and the definition of the scenarios are discussed in section three. The results can be found in section four. Since the implementation of economics of scale requires additional parameters

we assess their impact on model results in section five. The conclusions are drawn in the last section.

2 Introduction of Economies of Scale into the GTAP Model

The presence of economies of scale potentially leads to an expansion of industries at a faster rate than the expansion of inputs. The degree of scale economies is typically measured by the Cost Disadvantage Ratio (CDR):

$$CDR = \frac{AC}{MC}$$

Clearly, CDR > 1 if the firm is on the downward sloping part of the Average cost curve, AC. That is, average cost exceed marginal cost, MC. Following Francois (1998), we introduce (external) scale economies into the standard GTAP model by introducing a relation between the change in aggregate inputs, qva(i,r), and the scale of output, using a technology shifter in the production function, aoall(i,r):

$$aoall(i,r) = SCALE(i,r) * qva(i,r)$$

where:

$$SCALE = \frac{AC - MC}{MC}$$

The full derivation of this relation is provided in the appendix.

3 Data and Scenarios

We use the version 5.1 of the GTAP database, which refers to the year 1997 (Dimaranan and McDougall, 2002). For the analysis we employ an aggregation with 14 regions and 12 sectors. They are presented in the Tables 1 and 2 respectively.

Table 1: Regions

Region	Description
Bangladesh	
India	
Sri Lanka	
rSAFTA	Rest of South Asian Free Trade Association (Bhutan, Maldives, Nepal, Pakistan)
China	China and Hong Kong
hASIA	Japan, Korea, Singapore, Taiwan
oASIA	Indonesia, Malaysia, Philippines, Thailand, Vietnam
EU	EU-15
CEEC	Hungary, Poland, Rest of Central and Eastern European Countries
Turkey	
USA	
Canada	
cAMERIKA	Mexico, Central America and Caribbean
ROW	Rest of the World

Next to Bangladesh our aggregation includes India and Sri Lanka, two other countries of the SAFTA. All other member countries are in the region "rSAFTA". While China and Hong Kong build an own region the rest of the Asian countries are distinguished between high income countries "hASIA" and others "oASIA". The EU, the USA and Canada are important textile importers. The Central and Eastern European Countries ("CEEC") and Turkey are important due to the Eastern Enlargement of the EU respectively the preferential access to the EU.

Table 2: Sectors

Sector	Description
Rice	Paddy Rice and processed Rice
Grains	Non Rice Grains
Fibers	Plant-based Fibers
rAGR	Rest of Agriculture (Oil Seeds, Sugar Beet, Cattle, Pig and Poultry, Milk)
Food	Processed Food without processed Rice
Textiles	
Wearing Apparel	
Leather Products	
Extract	Fishing, Forestry, Coal, Oil, Gas, Minerals
LiMANF	Labor intensive Manufactures
CiMANF	Capital intensive Manufactures
Services	Services

For our analysis all textile related sectors like plant based fibers ("Fibres)", "Textiles", "Wearing apparel" and "Leather products" are crucial. The sector "Rice" includes the production of paddy rice as well as the rice processing. All non-rice grains are in the sector "Grains", while all other agricultural activities are included into the sector "rAGR". The sector "Food" covers the whole food processing without processed rice. Forestry, fishing and extraction activities are in the sector "Extract". The manufacturing is split into a labor intensive ("LiMANF") and capital intensive ("CiMANF") sector. The last sector includes all services.

As mentioned in the previous chapter we require the coefficient CDR. Francois et al. (2002) provide sector specific estimates of CDR coefficients. We take these estimates as a starting point, but we take half their value, assuming that the economies of scale are smaller in developing countries. The sector "services" is treated differently. Among the regions different values are assumed for this sector, reflecting the differences of the service sector in developed and developing countries. All CDR estimates are given in the appendix (Table 10). The sensitivity of results with respect to the CDR estimates is subjected to a Systematic Sensitivity Analysis in section five.

We define four scenarios (Table 3). Scenario 1 includes the implementation of the Agreement on Textiles and Clothing (ATC). The ATC was decided in the Uruguay Round and has replaced the Multi Fiber Agreement (MFA). It includes a complete phase out of quantitative restriction for textiles and wearing apparel. Although there are some doubts that the ATC will really go into place as planned (Reinert 2000, p.29) we assume that it will be the case. The quota rents, which result from the export quotas, are included as tariff equivalents in the GTAP 5 database (Francois and Spinanger, 2002). Eliminating export quotas in the simulation means that the tariff equivalents are completely dismissed. Export quota for Bangladeshi exports to the EU do not exist anymore since 1997, and imports into the EU face no import tariffs. For imports, we also assume that the rule of origin for textiles as well as the export licenses for textile and clothing products, which are falling under the surveillance system, have just an administrative nature and do not represent a barrier to exports.[2]

[2] The GTAP database does, in fact, include exports tariff equivalents for textiles and wearing apparel exported from Bangladesh into the EU. Similarly, tariffs are non-zero. This leads to the question of how to correctly model the liberalization. We opted for leaving the original values of quota rents and

Since the EU is the most important importer of Bangladeshi textile and wearing apparel both matters of fact have a huge impact on our analysis. The base scenario includes also three further issues. First, the WTO accession of China, which implies import tariff reduction for China in order to respect the Most Favorite Nation clause. Second, the enlargement of the European Union, which means complete tariff elimination between the regions EU und CEEC is considered. Third, a preferential trade agreement between the EU and Turkey for non-food goods is also implemented. The last two issues are important for our analysis, since the CEEC as well as Turkey exports get free access for their textile and wearing apparels export to the EU. The base scenario is included in all further scenarios.

Table 3: Scenarios

	Scenario
Base	Agreement on Textiles and Clothing (ATC) WTO Accession of China EU Eastern Enlargement (No Tariffs between EU and CEEC) Preferential Agreement EU -Turkey
SAFTA	Base Scenario + SAFTA (Regional free Trade)
WTO-EU	Base Scenario + Doha Round (EU Proposal)
WTO-USA	Base Scenario + Doha Round (USA Proposal)

In the second scenario we study the South Asian Free Trade Agreement (SAFTA) implying complete tariff elimination between the seven SAFTA member countries Bangladesh, Bhutan, India, Maldives, Nepal, Pakistan and Sri Lanka.

To evaluate a potential outcome of the Doha Round we analyze two proposals. The proposal of the EU (scenario 3) is similar to the Uruguay Round and includes a tariff reduction of 36% (bound tariff), a reduction of export subsidies of 45% and a reduction of the Aggregate Measurement of Support (AMS) of 55%. The developing countries receive Special and Differential Treatment, by granting them two exceptions. First, they do not have to reduce their own import tariffs. Second, industrial countries have to eliminate completely their tariffs on imported goods from developing countries.

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import tariffs in the database untouched in the simulation, hence avoiding an overestimation of price effects under the ATC and/or under a market access liberalization scenario.

The USA proposes a tariff reduction by Swiss Formula[3] such that the maximum applied tariff will be 25% (scenario 4)[4]. This treatment is applied for all countries, and no exceptions are made for developing countries. Furthermore, export subsidies are completely removed and the AMS is limited to 5% of the value of domestic production. A more detailed description of modeling the Doha Round is provided in van Tongeren and van Meijl (2003).

The scenarios enable us to conclude which type of agreement is most important for the Bangladesh economy: regional agreement (scenario 2) or worldwide agreement (scenarios 3 and 4).

4 Results

4.1 Worldwide Results

If a trade liberalization like the ATC is analyzed in the presence of economies of scale, a strong specialisation process take place. Accordingly, in the base scenario worldwide production of wearing apparel is reallocated. The largest effect shows India with an increase of 161% (Table 4). Like India, export quotas also heavily restrict China. The removal of them leads to an increase of 40% of the wearing apparel production. Due to free access to the EU, the CEEC and Turkey are also largely expanding their production. Decreases take place in importing regions (EU, USA, Canada). Central America faces also a strong reduction of its wearing apparel productions. The exports to its most important importer the USA are mostly replaced by Indian and Chinese wearing apparels. The effect on Bangladesh is similar (see next section).

A comparison with a similar application without economies of scale (Lips et al. 2003) shows that the specialisation process is much stronger in the presence of economies of

[3] In the Swiss Formula, the new tariff (t_1), is calculated with this formula: $t_1 = \frac{25 * t_0}{25 + t_0}$ where t_0 is the old tariff. Both tariffs (t_0 and t_1) are measured in percent.

[4] While the EU wants to reduce bound tariffs the USA claims a reduction of applied tariffs. The bounded tariffs can exceed the applied tariffs dramatically.

scale. Without them, the Indian and Chinese wearing apparel sectors are increasing less.

Looking at the results of the related sectors it turns out that the textiles and fibres production in most regions show a modest impacts of the ATC. There are two reasons for that. First, in most regions the textile sector is larger than the wearing apparel industry. Accordingly, a large increase of wearing apparels leads to just a small effect in the textile sector as it is the case for India. Second, in most regions the sector fibres is delivering an important part of its output to other users than the textile sector (for example rAGR and Food).

Table 4: Output Changes in Percent for the Base Scenario (all Regions)

	Bangla-desh	India	Sri Lanka	rSAFTA	China	hASIA	oASIA	EU	CEEC	Turkey	USA	Canada	cAMERIKA	ROW
Rice	0.1	-0.9	0.1	-0.2	-0.7	0.0	0.4	0.2	3.6	-2.1	1.2	0.6	0.1	0.3
Grains	3.2	-0.1	0.6	-0.3	0.8	-11.3	-0.3	0.4	-2.2	-1.6	-1.9	0.3	0.2	-0.2
Fibers	1.7	-0.7	0.7	0.8	9.8	1.2	0.2	-1.1	3.4	12.7	-1.5	-0.1	-6.6	-0.1
rAGR	0.9	-0.6	-0.2	0.1	-0.7	0.2	-0.1	0.2	-0.9	-1.5	0.6	-0.0	0.4	0.0
Food	1.6	-3.7	-1.0	-0.8	-1.4	0.4	-0.0	0.1	0.8	-1.2	0.2	0.1	0.3	-0.0
Textiles	-1.0	9.1	14.5	7.8	11.4	2.8	4.1	-4.8	7.9	29.3	-7.6	-12.4	-12.8	-2.6
Wearing Apparel	-20.0	161.4	-7.6	-5.9	39.9	-3.0	-1.0	-17.8	48.8	51.0	-22.3	-35.3	-35.5	-6.6
Leather Products	30.5	-30.7	12.7	-9.3	-7.3	1.6	1.8	3.2	16.5	1.7	2.2	0.9	2.7	0.8
Extract	0.1	-3.9	-0.2	-0.7	-1.3	0.1	-0.0	-0.0	-3.0	-2.5	0.2	0.2	0.9	0.2
LiMANF	4.4	-4.9	0.3	-0.8	-2.2	-0.0	-0.1	0.5	-4.6	-5.1	0.2	0.4	1.4	0.2
CiMANF	7.5	-7.4	5.0	-1.4	-4.3	0.0	-0.4	0.6	-5.5	-2.0	0.8	1.0	6.6	0.5
Svces	-0.1	-0.4	-0.7	-0.3	-0.4	-0.0	-0.0	0.0	0.2	-0.2	0.1	0.2	0.1	0.0

Source: model simulations

Table 5 includes the welfare changes for all regions measured by the Equivalent Variation. The ATC improves the worldwide welfare with about $ 14 billion. The EU and the USA, both net importers of textiles and wearing apparel, exhibit the largest welfare gains. Two effects are contributing. First, the removal of export quotas reduces the price of wearing apparel imports through a removal of quota rents. This is an improvement of the Terms of Trade. Second, reducing the domestic production of wearing apparel, the factors are allocated to more efficient industries, which results in a positive allocation effect. While India can benefit from the ATC, the free access to the EU market brings also a remarkable welfare improvement to the CEEC and Turkey.

The introduction of the SAFTA (scenario 2) has a rather modest impact on its member countries. The stimulation of the regional trade increases welfare in all SAFTA countries except Bangladesh. India benefits most of the agreement and faces an improvement of $ 319 million compared with the first scenario (Table 5). The welfare changes relative to the base scenario are minimal for all non-SAFTA regions. They are not affected. The output changes under the SAFTA scenario are found in Table 11 in the appendix.

Both Doha Round scenarios (3 and 4) illustrate very clearly, that a worldwide trade liberalization results in large welfare gains. While the US proposal (scenario 4) is more profitable for the industrialized countries (hASIA, EU, USA and Canada) the EU proposal (scenario 3) is more balanced. Corresponding output changes are given in the appendix (Tables 12 and 13).

Table 5: Equivalent Variation in Mill. $

		Differences to Base Scenario		
	Base	SAFTA	WTO-EU	WTO-USA
Bangladesh	-441	-13	332	83
India	1901	319	3666	581
Sri Lanka	-256	22	553	249
rSAFTA	-173	79	1290	151
China	-69	-4	1868	2538
hASIA	-209	-70	14372	17295
oASIA	-1116	-30	4742	1884
EU	6044	-102	3691	11826
CEEC	4083	0	586	713
Turkey	846	1	149	388
USA	6695	-89	-1113	3453
Canada	1072	-11	-93	1278
cAMERIKA	-1390	3	497	748
ROW	-3141	-94	6656	8949
World, total	13845	12	37197	50138

Source: model simulations

4.2 Results for Bangladesh

The Tables 6 to 8 look more closely at the changes in Bangladesh. The output changes of the Bangladeshi sectors are shown for all scenarios in Table 6. Scenarios 2 to 4 are reported as differences to the first scenario.

Table 6: Percentage Changes of Output for Bangladesh (All Scenarios)

		Differences to Base Scenario		
	Base	SAFTA	WTO-EU	WTO-USA
Rice	0.1	-0.4	0.7	0.2
Grains	3.2	-1.7	6.5	7.7
Fibers	1.7	4.2	-4.1	-2.4
rAGR	0.9	-0.1	1.5	1.3
Food	1.6	-1.9	10.5	1.5
Textiles	-1.0	1.3	-3.8	-8.4
Wearing Apparel	-20.0	4.1	1.2	20.8
Leather Products	30.5	-0.8	1.6	39.3
Extract	0.1	0.1	0.5	0.2
LiMANF	4.4	-0.3	-2.7	-3.5
CiMANF	7.5	-2.9	-7.7	-8.4
Services	-0.1	-0.1	-0.2	0.1

Source: model simulations

Table 7 includes the changes of the aggregated factor bundle, which consists of land, capital as well as skilled and unskilled labor. Furthermore, the value changes of imports and exports of Bangladesh are indicated.

Table 7: Percentage Changes of Factor Prices, Imports and Exports Values for Bangladesh

		Differences to Base Scenario		
	Base	SAFTA	WTO-EU	WTO-USA
Price Factor Bundle	-3.3	0.5	5.2	-2.7
Value Imports	-6.2	4.7	7.2	11.4
Value Exports	-6.4	5.5	8.4	16.6

Source: model simulations

Table 8 provides welfare decomposition for Bangladesh. The Equivalent Variation is split in the main sources of the welfare change, which are the allocation efficiency, the Terms of Trade and the technical progress as a result of the economies of scale.

Table 8: Decomposed Equivalent Variation for Bangladesh in Mill. $

		Differences to Base Scenario		
	Base	SAFTA	WTO-EU	WTO-USA
Allocation Efficiency	-109	22	122	314
Terms of Trade	-339	-35	224	-218
Economies of Scale	7	1	-13	-14
Total	-441	-13	332	83

Source: model simulations

4.2.1 Base Scenario (ATC and WTO Accession of China)

The elimination of the export quotas leads to a decrease of the Bangladeshi wearing apparel production of 20% (Table 4). The reason is that other wearing apparel exporters especially India and China are relatively more restricted by the ATC. They have larger quota rents to reduce and consequently larger price decreases in the importing countries. In addition, since Bangladesh has free access to the EU its exports become relatively more expensive compared to the imports from the CEEC and Turkey, which get also free access. Due to an increase of exports the sector leather products shows an output change of 30% (Table 6). Leather products are not affected by the ATC. The impact on the Bangladesh economy is modest since the sector leather production is rather small. Altogether, production and hence factor prices are decreasing (Table 7). The values of exports as well as imports decline. An import substitution process is going on. The decomposition of the Equivalent Variation shows that Bangladesh's welfare change is dominated by a negative Terms of Trade effect of $ 340 million (Table 8). A negative Terms of Trade effect can be caused by a decrease of export prices, or an increase of import prices. Both effects are present here. Through the elimination of export quota rents the Bangladeshi exports become cheaper. At the same time imports from India show an increase in prices.

4.2.2 Scenario SAFTA

The tariff elimination within the SAFTA stimulates trade between the member countries. Bangladesh imports more food and manufacturing goods from its neighbors. At the same time more Bangladeshi wearing apparels can be exported, which is partly neutralizing the output decrease from the ATC (Table 6). Both exports and imports are relatively increasing (Table 7). Nevertheless, it results a welfare loss

for Bangladesh, which is larger than those of the first scenario (Table 8). The reason is the unbalanced trade relation between Bangladesh and the others member countries of the SAFTA. The most extreme example is India, which has exported in 1997 roughly 20 times more (in value terms) to Bangladesh than the other way round. When Bangladesh reduces its tariffs, more imports from India, an increase of the Indian production and finally an increase of Indian factor prices result. Measured at the cost insurance freight (CIF) price level, the Bangladeshi imports from India become more expensive. Due to the unbalanced trade relation, the Terms of Trade are worsening (Table 8).

4.2.3 Scenarios WTO-EU and WTO-USA

The impact of the EU and the US proposal of the Doha Round are quite different on Bangladesh. In the EU proposal (scenario 3) all developed countries eliminate their import tariffs for developing countries. In contrast, the developing countries can keep their tariffs. Bangladesh can increase its exports especially processed food to the EU and the US. Compared to the first scenario the production is increasing with more than 10% (Table 6). The demand for factors is larger, a factor price raise of 5% results. Compared to the Base scenario, welfare is improving by more than $ 300 million (Table 8).

The US proposal suggests the same treatment for all countries. The tariff reduction enables more Bangladeshi exports of wearing apparel. The production of wearing apparel increases by nearly 21% compared with the first scenario (Table 6). There are two reasons, which explain the difference of the Bangladeshi wearing apparel sector in scenarios 3 and 4. First, the tariff cuts under the US proposal are deeper and this enables more exports to the US and Canada. Second, in the WTO-USA scenario factor prices are reduced and this leads to a decrease of production costs in all sectors. At the same time the textile sector reduces its output quantity by almost 8%. The Bangladeshi textile sector is protected by a remarkable import tariff. Unlike the EU proposal the US proposal schedule also tariff reductions for developing countries. Hence, in scenario 4 textile imports are increasing while domestic production is reduced. Since this sector is quite important for the whole economy a reduction of factor prices is the consequence (Table 7). Cheaper factor prices are reflected in all

output prices, which leads also to a price decrease of exports and finally a worsening of Terms of Trade of more than $ 220 million (Table 8). Since the allocation efficiency exceeds $ 300 million, the Equivalent Variation is about $ 83 million higher than in the first scenario. The reduction of import tax of the textile sector plays an important role and makes the Bangladesh economy vulnerable.[5] Compared to that, the remarkable increase of the sector leather products, which is driven by lower factor prices and economies of scale, has a minor influence (Table 6).

5 Systematic Sensitivity Analysis

In the Systematic Sensitivity Analysis (SSA) by Arndt and Pearson (1998) we use a value range instead of single values for the CDR coefficients. In view of the Bangladeshi export we focus on the three most important sectors: textile, wearing apparel and leather products. We assume that all their CDR coefficients are lying between 0 and twice the assumed value in the calculation of the previous chapter. The results are presented as means (μ) and standard deviations (σ). Both are reported as percentage changes. To get the 95 percent confidence interval, twice the standard deviation has to be added and subtracted from the mean.

Table 9 includes the means and standard deviations for the Equivalent Variation and the quantity changes for Bangladesh for all four scenarios. Since the SSA applies another calculation method, the means can differ from the results reported in the previous Tables[6].

The Equivalent Variation shows relatively small standard deviations, which means that the CDR coefficient have a rather modest influence on welfare change. Looking at the quantity changes of the three sectors (textile, wearing apparel and leather products), the SSA leads to different results. The sector textiles has small standard deviations indicating that economies of scale have a modest influence on its production. It is completely different for the other sectors (wearing apparel and leather products). The produced quantity depends heavily on the CDR coefficients. In

[5] A word of caution: many textile importers in Bangladesh enjoy duty exemptions if they produce export garments. The results reported here may therefore overstate the effects of reduced textile import tariffs. This issue is explored more in Lips et al. (2003).

[6] In the Systematic Sensitivity Analysis the model is run twice for every coefficient in consideration. In our application the model is run six times. The mean is the average of the six calculated model solutions.

the most extreme case, the leather production in scenario 4, the confidence interval reaches from 10 to 160%.

Table 9: Systematic Sensitivity Analysis for Bangladesh

		Base		SAFTA		WTO-EU		WTO-USA	
		μ	σ	μ	σ	μ	σ	μ	σ
	EV Bangladesh in Mill. $	-446.9	40.9	-455.8	21.4	-114.5	38.8	-353.9	26.3
Quantity Changes	Rice	0.1	0.0	-0.3	0.0	0.9	0.0	0.3	0.0
	Grains	3.2	0.5	1.5	0.3	9.7	0.7	10.7	0.6
	Fibers	1.5	0.5	5.8	0.3	-2.6	0.5	-1.1	1.2
	rAGR	1.0	0.4	0.9	0.2	2.6	0.4	2.5	0.7
	Food	1.6	0.3	-0.3	0.2	12.2	0.5	3.0	0.3
	Textiles	-1.4	0.8	0.2	0.5	-5.2	0.9	-9.9	1.3
	Wearing apparel	-21.2	4.6	-16.4	2.6	-20.1	4.6	-0.3	2.7
	Leather products	37.0	15.7	32.4	9.2	39.2	16.6	85.5	37.3
	Extract	0.2	0.1	0.2	0.0	0.6	0.1	0.3	0.0
	LiMANF	4.5	0.6	4.1	0.4	1.8	0.6	0.9	0.3
	CiMANF	7.7	1.1	4.6	0.6	0.0	1.0	-1.0	0.6
	Services	-0.1	0.0	-0.2	0.0	-0.3	0.0	0.0	0.0

Source: model simulations

6 Conclusions

In this paper we analyze several trade policy changes under presence of economies of scale. In all of them Bangladesh suffers a welfare decrease.

Multilateral agreements in the framework of the WTO are compared with regional agreements in the framework of SAFTA. The paper argues that the imminent completion of the Agreement on Textile and Clothing (ATC) leads to a welfare loss for Bangladesh. Bangladesh's textile and wearing apparel industries have by now free access to the EU, its most important export market. A further multilateral trade liberalization of trade in these products erodes the preferential position vis-à-vis its competitors. A simulation of the WTO proposals tabled by the EU and the USA shows that there is little reason to expect that the Doha round will mitigate the situation for the Bangladesh garment industry.

Nevertheless, it makes an important difference for Bangladesh whether the EU or the USA proposal is adopted in the Doha Round. The EU proposal is clearly more favorable.

The introduction of a regional free trade agreement (SAFTA) is neither a possibility for Bangladesh from an economic point of view, since also a welfare reduction results. The reason here is the unbalanced trade relations to the neighbor countries, especially India. While regional trade agreements unusually enable the smaller partners to gain access to a larger market, and hence experience gains from trade creation, which are larger than the losses from trade diversion, this is perhaps not the case in SAFTA. Bangladesh's exports are biased towards destinations outside the SATA region, and it depends heavily on imports from India.

Although we introduced economies of scale, in none of the analyzed scenarios a significant specialization of the Bangladesh economy takes place. Only one sector (leather products) shows a tremendous increase of production. The impact on the whole economy is negligible since this sector is very small.

The Systematic Sensitivity Analysis shows that the leather production and wearing apparel sector reacts quite sensitive on the size of the CDR coefficient. Latter is necessary for the introduction of economies of scale.

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Appendix 1

Introduction of Economies of Scale into the GTAP Model

Let's assume that $\boldsymbol{X}$ is the vector of inputs for the production of good *Y, Y=F(**X**)* is a production function and *T* a positive scalar. Let's also consider a function *Y(T)=F(T**X**),* which is differentiable and strictly increasing. The elasticity of scale *e(**X**,Y)* measures the increase in output due to a one percent increase in all inputs by *T* times (Varian, 1992, p.17 and 88; Chambers 1988, p. 22):

$$e(\boldsymbol{X},Y) = \frac{dF(T\boldsymbol{X})}{dT} * \frac{T}{F(T\boldsymbol{X})}\bigg|_{T=1} \tag{1}$$

For the implementation in the GTAP model we are interested in the specific case of a production function, the homothetic production function. This functions exhibits the property that proportional changes in all inputs $\boldsymbol{X}$ are accurately reflected by the same proportional change in the aggregate input $f^*(\boldsymbol{X})$[7] (Chambers 1988, p. 38), because $G(f(T\boldsymbol{X})) = G(Tf(\boldsymbol{X})) = F(T\boldsymbol{X})$. Latter can be expressed with two cost functions (Chambers 1988, p. 73):

$$H(Y) = \frac{C(Y,\boldsymbol{W})}{C(\boldsymbol{W})} \tag{2}$$

*C(Y,**W**)* is the cost function of output *Y* given a vector of input prices $\boldsymbol{W}$. The cost function *C(**W**)* only depends on input prices. Using *H(Y)* Chamber (1988, p. 74) shows that the elasticity of scale for homothetic production function is equal to:

$$e(\boldsymbol{X},Y) = \frac{\partial Y}{\partial H(Y)}\frac{H(Y)}{Y} \tag{3}$$

Replacing *H(Y)* in equation 3 by the definition of equation 2 yields:

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[7] If *F(**X**)* is a homothetic function, it can be represented as (Chambers 1988, 37-38):

$G(f^*(\boldsymbol{X})) = F(\boldsymbol{X})$

$f^*(\boldsymbol{X})$ can be regarded as aggregated input and hence, also be defined as function of the output *Y*:

$H(Y) = f^*(\boldsymbol{X})$

where $H(Y) = G^{-1}(Y)$.

$$e(\boldsymbol{X},Y)=\frac{1}{\frac{\partial\left(\frac{C(Y,\boldsymbol{W})}{C(\boldsymbol{W})}\right)}{\partial Y}}\frac{C(Y,\boldsymbol{W})}{Y*C(\boldsymbol{W})} \tag{4}$$

After some rearrangements we get:

$$e(\boldsymbol{X},Y)=\frac{C(\boldsymbol{W})}{\frac{\partial C(Y,\boldsymbol{W})}{\partial Y}}\frac{AC(Y,\boldsymbol{W})}{C(\boldsymbol{W})}$$

*AC(Y,**W**)* is the average cost of the produced output *Y*. After a further simplification the above equation becomes:

$$e(\boldsymbol{X},Y)=\frac{AC(Y,\boldsymbol{W})}{MC(Y,\boldsymbol{W})} \tag{5}$$

*MC(Y,**W**)* is the marginal cost of the produced output. We introduce now equation 5 in equation 3 and rearrange it:

$$\frac{dY}{Y}\frac{H(Y)}{dH(Y)}=\frac{AC(Y,\boldsymbol{W})}{MC(Y,\boldsymbol{W})} \tag{6}$$

We assume that $C(Y,\boldsymbol{W})=Y^{\theta}C(\boldsymbol{W})$ respectively $H(Y)=Y^{\theta}$ whereas 0 < θ < 1 (Francois 1998, p. 2). Accordingly, *AC(Y,**W**)/ MC(Y,**W**)* is constant[8]. Equation 6 can be formulated by using percentage changes $\hat{Y}$ and $\hat{H}$ (Francois 1998, p.3):

$$\hat{Y}=\frac{AC}{MC}\hat{H} \tag{7}$$

If e > 1 or equivalently AC > MC then output increase more than scale of input and the technology exhibit increasing returns to scale. To show the scale effect, it is useful to formulate equation 7 in the following way:

$$\hat{Y}=(SCALE+1)\hat{H} \tag{8}$$

Where

$$SCALE=\frac{AC-MC}{MC} \tag{9}$$

[8] The relation AC/ MC is constant since: $\frac{AC}{MC}=\frac{Y^{\theta-1}C(\boldsymbol{W})}{\frac{\partial(Y^{\theta}C(\boldsymbol{W}))}{\partial Y}}=\frac{1}{\theta}$

describes the additional output growth when inputs increase.

To calculate SCALE, Francois (1998, p.3) employs the **C**ost **D**isadvantage **R**atio (CDR)[9]:

$$SCALE = \frac{CDR}{1 - CDR} \tag{10}$$

Since the GTAP standard model assumes no economics of scale, Francois (1988) suggests to introduce them in the upper level nest (output nest) of the production tree in which the Leontief production function is applied. Following Francois (1998, p.3), we assume that the additional output change from the economies of scale is accommodated by the parameter of the technical progress of the whole production of sector i, that alter parameters of the Leontief production function in such a way that:

$$\hat{Y} = aoall + \hat{X}_i \tag{11}$$

and therefore

$$\hat{X}_j = \hat{X}_i = \hat{H} \qquad \text{for all i and j} \tag{12}$$

Equation (11) can be then rearranged as:

$$\hat{Y} = \left(1 + \frac{aoall}{\hat{H}}\right)\hat{X}_i \tag{13}$$

which is in fact equation (8) in a case of the Leontief production function with SCALE parameter equal to:

$$SCALE = \frac{aoall}{\hat{H}} \tag{14}$$

To represent the input change in equation (14) we use the variable qva(i,r), which indicates the quantity change of the factor bundle input in sector i of region r[10] and equation (14) in GTAP notation becomes:

$$aoall(i,r) = SCALE(i,r) * qva(i,r) \tag{15}$$

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[9] $CDR = \frac{AC - MC}{AC}$

[10] Since GTAP is a multi regional model we have to add the index r for region.

Equation (15) has to be added to the GTAP standard model. Normally, aoall(i,r) is an exogenous variable. Through the introduction of equation (15) aoall(i,r) becomes endogenous, which indicates a change of the model closure.

Since we assume external economies of scale we can maintain the assumption of perfect competition of the standard GTAP model (Krugman and Obstfeld, p.123).

CDR Coefficients and Output Changes

Table 10: CDR Coefficients

Sector	CDR
Rice	0
Grains	0
Fibers	0
rAGR	0
Food	0.055
Textiles	0.055
Wearing apparel	0.055
Leather products	0.055
Extract	0.075
LiMANF	0.085
CiMANF	0.085
Services	0.025 Bangladesh, Sri Lanka, rSAFTA, China, cAmerika, ROW 0.05 India, oAsia, CEEC, Turkey 0.105 hASIA, EU, USA, Canada

Source: Francois et al. (2002)

Table 11: Output Changes in Percent for the SAFTA Scenario (All Regions)

qo	Bangla-desh	India	Sri Lanka	rSAFTA	China	hASIA	oASIA	EU	CEEC	Turkey	USA	Canada	cAMERIKA	ROW
Rice	-0.3	-0.7	-5.3	0.1	-0.7	0.1	0.4	0.3	3.6	-2.1	1.2	0.7	0.1	0.3
Grains	1.5	-0.1	-0.2	-0.4	0.8	-11.3	-0.3	0.4	-2.2	-1.6	-1.9	0.3	0.2	-0.2
Fibers	5.9	-0.7	1.2	-0.3	9.8	1.2	0.2	-1.1	3.3	12.8	-1.5	-0.1	-6.5	-0.1
rAGR	0.8	-0.5	0.4	-0.1	-0.7	0.2	-0.2	0.2	-0.9	-1.5	0.6	-0.0	0.4	0.0
Food	-0.3	-2.9	-1.9	-1.7	-1.4	0.4	-0.1	0.1	0.8	-1.2	0.2	0.1	0.3	-0.0
Textiles	0.3	8.7	14.3	8.6	11.4	2.7	4.1	-4.8	8.0	29.4	-7.6	-12.3	-12.8	-2.6
Wearing apparel	-15.9	153.8	1.9	-7.8	40.1	-3.0	-0.8	-17.8	49.0	51.1	-22.2	-35.1	-35.4	-6.6
Leather products	29.7	-31.9	2.6	-9.7	-7.3	1.6	2.0	3.2	16.5	1.8	2.2	1.0	2.7	0.8
Extract	0.2	-3.9	-0.4	-0.8	-1.4	0.1	-0.0	-0.0	-3.0	-2.5	0.2	0.2	0.9	0.2
LiMANF	4.1	-4.6	-0.3	0.9	-2.2	-0.0	-0.1	0.4	-4.6	-5.1	0.2	0.4	1.4	0.2
CiMANF	4.6	-7.3	5.6	-1.8	-4.3	0.0	-0.4	0.6	-5.5	-2.0	0.8	1.0	6.6	0.5
Services	-0.2	-0.4	-0.9	-0.3	-0.4	-0.0	-0.0	0.0	0.2	-0.2	0.1	0.2	0.1	0.0

Source: model simulations

Table 12: Output Changes in Percent for the WTO-EU Scenario (All Regions)

qo	Bangla-desh	India	Sri Lanka	rSAFTA	China	hASIA	oASIA	EU	CEEC	Turkey	USA	Canada	cAMERIKA	ROW
Rice	0.8	1.0	7.5	1.2	-0.9	-3.7	0.5	-19.9	1.0	-6.8	6.3	6.0	-1.6	0.7
Grains	9.7	0.7	-8.0	-0.8	-1.9	-31.5	-1.8	-10.5	0.2	-1.0	-0.3	13.9	-0.8	0.6
Fibers	-2.4	-0.5	-11.4	-0.0	12.5	11.5	-1.8	-0.8	-4.5	10.0	-1.0	5.7	-8.6	0.7
rAGR	2.4	0.7	0.1	1.6	-1.2	-3.3	-0.7	0.1	-1.8	-0.9	1.3	-0.7	1.1	-0.2
Food	12.1	2.9	4.1	9.6	-2.6	-1.6	0.3	-1.1	-0.1	-1.8	0.8	-1.3	0.8	0.6
Textiles	-4.8	10.7	16.3	9.1	14.7	12.1	26.6	-6.6	1.1	23.6	-11.1	-19.3	-16.5	-5.3
Wearing apparel	-18.8	199.0	23.4	4.7	60.1	-6.0	41.8	-23.6	19.2	40.0	-30.4	-50.2	-43.3	-9.2
Leather products	32.1	-40.4	-24.9	-27.7	-0.3	5.0	95.8	-5.1	4.6	-0.4	-9.8	-25.9	-7.1	-5.5
Extract	0.6	-6.8	-3.8	-2.3	-2.3	-0.7	-2.7	-0.0	-2.5	-2.2	0.4	0.7	0.8	0.3
LiMANF	1.7	-7.7	-8.0	-6.6	-4.5	1.3	-6.7	0.7	-3.0	-4.4	0.3	-0.1	1.8	-0.4
CiMANF	-0.2	-12.7	-41.6	-6.8	-5.7	-0.0	-1.9	0.6	-2.4	-0.3	1.9	2.7	8.2	-0.3
Services	-0.3	-0.6	-1.2	-0.5	-0.3	-0.0	-0.6	0.2	0.7	-0.1	-0.0	0.3	0.1	0.3

Source: model simulations

Table 13: Output Changes in Percent for the WTO-US Scenario (All Regions)

qo	Bangla-desh	India	Sri Lanka	rSAFTA	China	hASIA	oASIA	EU	CEEC	Turkey	USA	Canada	cAMERIKA	ROW
Rice	0.3	-1.0	-2.4	0.1	-0.1	-16.9	1.2	-32.0	1.3	-8.9	53.1	10.2	0.2	3.6
Grains	10.9	-0.1	-10.8	0.2	4.5	-63.2	1.2	-23.9	2.1	0.5	-1.4	30.9	0.3	1.2
Fibers	-0.7	-1.0	-3.9	0.5	10.9	23.4	-0.7	1.8	-4.0	9.5	-2.8	12.8	-9.0	-0.5
rAGR	2.2	-0.6	-1.5	-0.7	-1.6	-4.3	-1.2	-0.9	-2.1	0.4	2.7	-2.0	1.8	-0.2
Food	3.1	-3.9	-9.4	-4.8	-2.6	-1.7	1.5	-2.3	-2.3	-3.3	1.7	-3.3	1.5	1.6
Textiles	-9.4	10.5	14.1	17.1	12.8	12.2	12.5	-5.5	2.1	23.9	-10.5	-17.8	-17.0	-5.8
Wearing apparel	0.8	202.7	47.6	30.4	55.0	-3.6	14.1	-21.5	23.9	44.7	-28.1	-47.4	-43.1	-10.1
Leather products	69.8	-33.5	-28.6	6.2	3.5	9.9	39.4	-2.1	3.4	0.8	-8.7	-20.2	-5.6	-5.2
Extract	0.3	-6.7	-5.2	-5.3	-2.2	-0.4	-1.1	-0.2	-2.5	-2.5	0.4	0.6	0.8	0.1
LiMANF	0.9	-8.2	-6.1	-19.7	-4.0	1.2	-4.1	1.0	-3.4	-4.7	-0.1	-0.3	1.5	-0.5
CiMANF	-0.9	-9.5	-21.6	-10.2	-5.5	0.2	0.3	0.3	-1.3	-0.3	1.1	1.9	7.5	0.3
Svces	-0.0	-0.1	-1.3	0.9	-0.4	0.0	-0.2	0.3	0.7	-0.3	0.0	0.3	0.0	0.2

Source: model simulations