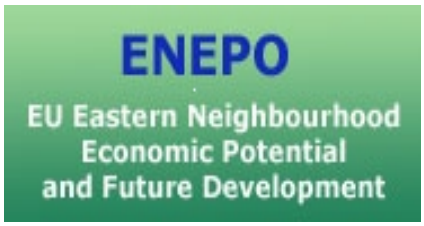

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ENEPO

EU Eastern Neighbourhood: Economic Potential and Future Development

Instrument: Specific Targeted Research Project

Thematic Priority: Priority 7 – Citizens and Governance in a Knowledge-based Society

A series of draft papers dealing with CGE-based simulations of WTO entry and different types of EU-CIS FTA for individual CIS countries

Due date of deliverable: 01/12/2007
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IfW - Kiel

Revision [version 1]

Economic Impact of a Potential Free Trade Agreement (FTA) Between the European Union and the Commonwealth of the Independent States

Study prepared by Joseph Francois[1] and Miriam Manchin[2]
as part of the project ENEPO- EU Eastern Neighbourhood: Economic Potential and Future Development funded by the Sixth Framework Programme of the European Union

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1 Introduction

One of the EU's most important trading partners is Russia from the CIS (Commonwealth of the Independent States)[3]. Russia has been the EU's third most important export and import partner with 10% of total EU imports originating from Russia and about 6% of EU exports going to Russia. Other CIS play a much less important role in the EU's trade relations with about 2.5% of total EU exports and imports originating from the other countries in the region.

With the 2004 and 2007 EU enlargements the physical border of the EU shifted towards East and several of the CIS became immediate neighbours of the EU. Currently Russia, Ukraine, Belarus and Moldova are immediate neighbours of the EU and in case of a Turkish enlargement, Armenia, Azerbaijan and Georgia would also become neighbouring countries. Although these countries have no serious prospect of acceding to the EU, political and economic relations with these countries are important. The European Commission proposed a 'differentiated, progressive, and benchmarked approach' to the new neighbours which was specified in the European Neighbourhood Policy (ENP) Strategy Paper.[4] On the basis of this strategy paper bilateral action plans were agreed with each participating country. The ENP aims, among other things, to create grounds for possible further trade liberalisation and for gradual participation in the Internal Market.

The ENP was not extended to Central Asian States, however, the European Commission adopted a Strategy for Central Asia in 2002. Furthermore Russia was also left out from the ENP and a bilateral, EU-Russian partnership was developed. One of the main pillars of this partnership is the creation of a Common Economic Space which implies the development of an open and integrated market between the EU and Russia.

[3] Throughout the study we will refer to the twelve successor countries of the former Soviet Union as CIS.

[4] It was approved by the Council in June 2004 in the Council of the European Union Presidency Conclusions 10679/2/04.

Energy plays also a central role in EU-CIS economic relations. The EU is significantly dependent on import of the CIS energy resources, mainly from Russia. About 60% of EU gas imports are expected to come from Russia by 2030.[5]

The purpose of this study is to evaluate the effects of potential measures to open trade between CIS and the EU. In so doing, we employ a computable general equilibrium model. The model follows recent development in trade theory in taking industry specific market structures and elasticities into account. Furthermore, we employ estimates on tariff equivalent for the service sector, which are obtained through econometric estimations.

As several CIS countries currently are negotiating WTO accession, the model's baseline has been modified to take these accessions into account.

The rest of the study is organized as follows, Chapter 2 offers a general background to the production and trade structure of the EU and the CIS, Chapter 3 describes the theoretical background of the model, the data used and the set up of the analysis. The discussion of results is presented in Chapter 4 of the study. Concluding comments can be found in Chapter 5.

2 Trade and Production structure of the EU and CIS

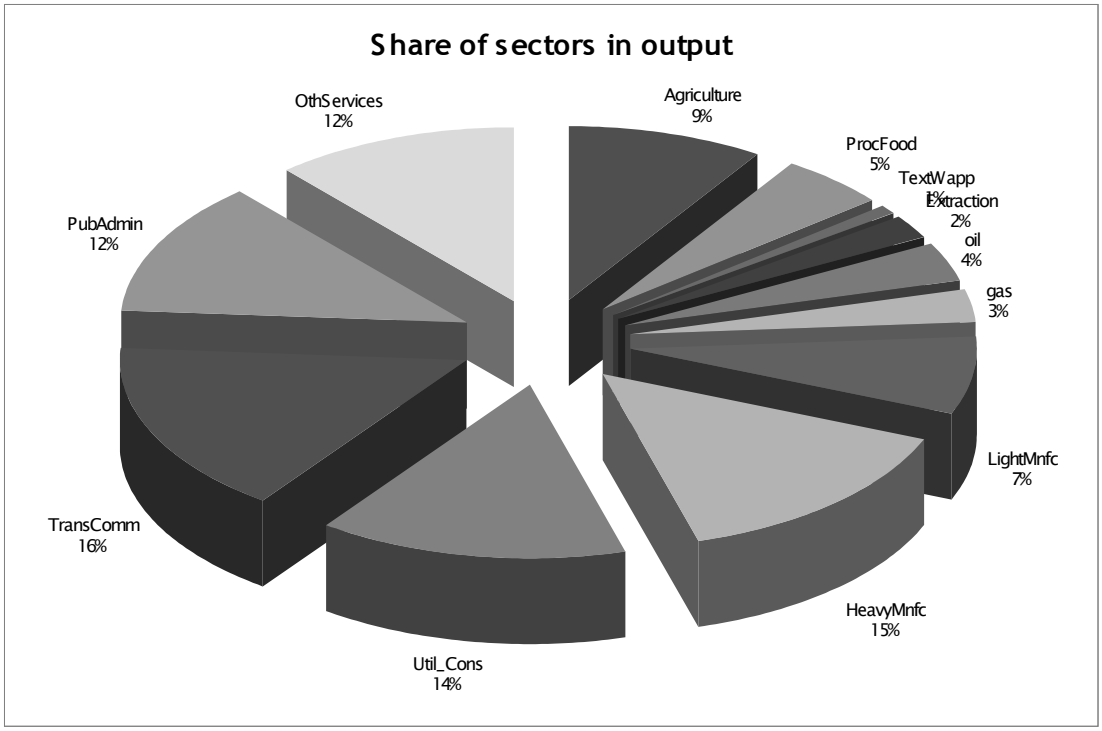
The aim of this chapter is to give an overview of the underlying patterns of production and trade structure of the EU and CIS, with special attention given to the nature of bilateral trade.

[5] Communication for the European Commission to the European Council and the European Parliament. An Energy Policy for Europe, Brussels, 10.1.2007 COM(2007)

2.1 Trade and Production structure of the CIS countries

About 54% of output in the CIS economies is concentrated in services. Oil, gas, and other mineral extractions all together represented about 9% of total output on average in the CIS in 2004 which is depicted in Figure 2-1. Heavy manufacturing (which includes petroleum, coal products, chemical, rubber, plastic prods, mineral products, ferrous metals, metals, electronic equipment, machinery and equipment, and manufactures nec) contributes 15% of output. Output in light manufacturing sectors is only about half of the output share of the heavy manufacturing sectors. The agricultural output together with output in the processed food sector represents about 14% of total output.

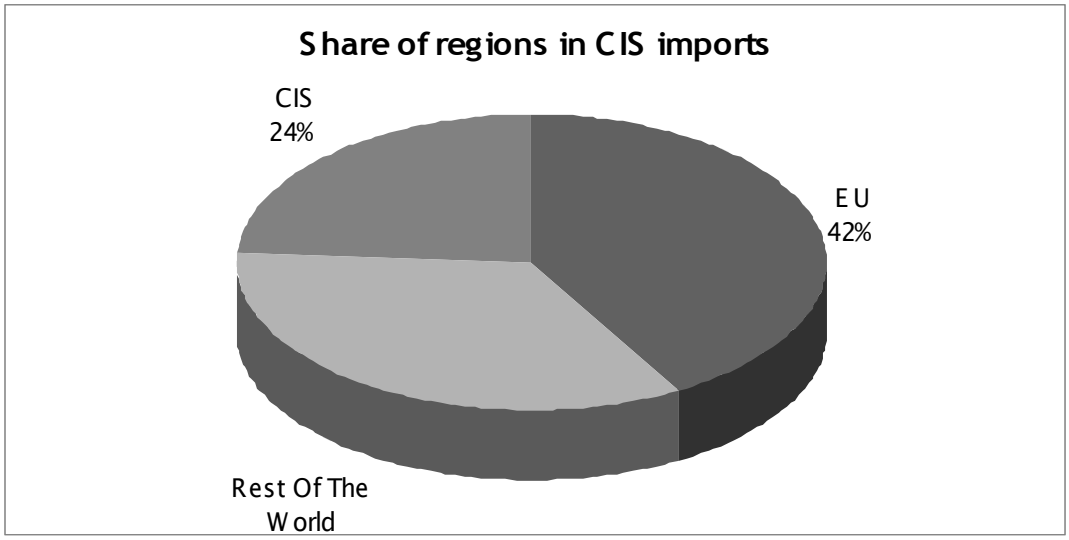
Figure 2-1 Share of sectors in the output of CIS countries in 2004



Source: own calculations, data come from GTAP database version 7

Figure 2-2 shows the share of three main regions in CIS's imports including intra-region imports. While about 24% of imports is coming from other countries in the region, imports from the EU countries are almost the double of those arriving from intra-regional origins. The magnitude of imports coming from the EU indicates that for many countries in the region the EU is a very important trading partner. Moreover, for the region as a whole the EU is a more important trading partner than intra-regional trade. Therefore preferential agreements with the EU could have more important effects on some of the CIS economies than agreements within the region.

Figure 2-2 Share of regions in CIS imports in 2004



Source: own calculations, data come from GTAP database version 7

The importance of different countries in CIS exports and imports for the year 2006 is presented in table 2-1. The EU is by far the most important export and import partner for the region with almost 40% of total imports originating from the EU and about half of total exports going to the EU. The second and the fourth most important trading partner for the CIS are within the region. Russia is the second most important export and import partner with 16.8% of imports originating from Russia and about 5.2% of exports going to Russia. The fourth most important trading partner is Ukraine. Other countries which play a relatively important role in the intra-CIS trade relations are Kazakhstan and Turkmenistan.

Table 2-1 CIS's major trading partners (merchandise) 2006

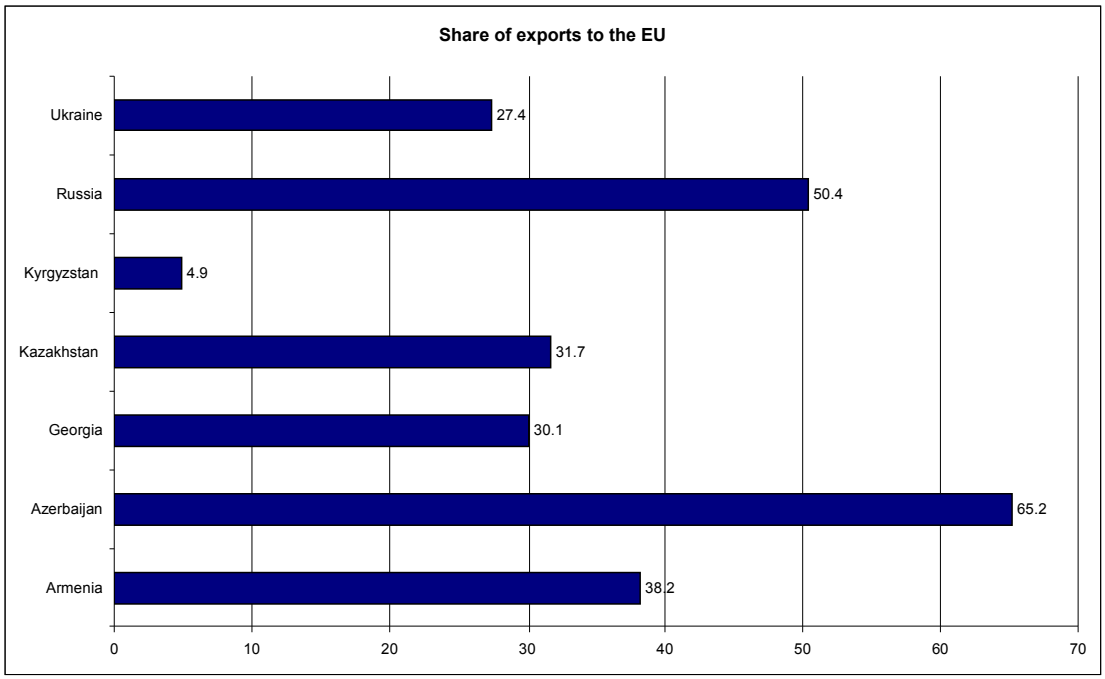
	Imports				Exports		
	Partner	Millions of Euro	% of total		Partner	Millions of Euro	% of total
	World	1,350,494	*100.0*		World	1,166,109	*100.0*
1	**EU**	**82,659**	***38.7***	1	**EU**	**169,341**	***52.6***
2	Russia	35,873	***16.8***	2	Russia	16,622	***5.2***
3	China	21,098	***9.9***	3	China	16,264	***5.1***
4	Ukraine	10,534	***4.9***	4	Ukraine	15,794	***4.9***
5	Japan	7,348	***3.4***	5	Turkey	15,333	***4.8***
6	USA	7,318	***3.4***	6	USA	10,319	***3.2***
7	Korea	7,063	***3.3***	7	Switzerland	10,141	***3.2***
8	Turkey	5,432	***2.5***	8	Kazakhstan	8,445	***2.6***
9	Kazakhstan	4,156	***1.9***	9	Romania	4,673	***1.5***
10	Turkmenistan	3,289	***1.5***	10	Japan	4,226	***1.3***
11	Belarus	3,070	***1.4***	11	Iran	4,136	***1.3***
12	Brazil	2,973	***1.4***	12	Belarus	3,655	***1.1***
13	Uzbekistan	1,873	***0.9***	13	Bulgaria	3,217	***1.0***
14	Switzerland	1,596	***0.7***	14	India	3,181	***1.0***
15	India	1,396	***0.7***	15	Korea	1,992	***0.6***
16	Norway	1,178	***0.6***	16	Azerbaidjan	1,879	***0.6***
17	Romania	1,092	***0.5***	17	Egypt	1,847	***0.6***
18	Malaysia	976	***0.5***	18	Israel	1,412	***0.4***
19	Canada	968	***0.5***	19	Uzbekistan	1,392	***0.4***

20	Azerbaidjan	900	***0.4***	**20**	Moldavia	1,331	***0.4***

Source: Eurostat, COMEXT database

The importance of the EU as export destination for different countries in the region is shown in Figure 2-3. While the EU is a very important export destination for the region as a whole there are important differences between countries. EU is the export destination for about two-thirds of Azerbaijan's exports and also about half of Russia's exports. On the other hand only about 5% of Kyrgyzstan's exports are going to the EU.

Figure 2-3 Share of exports to the EU in 2004[6]

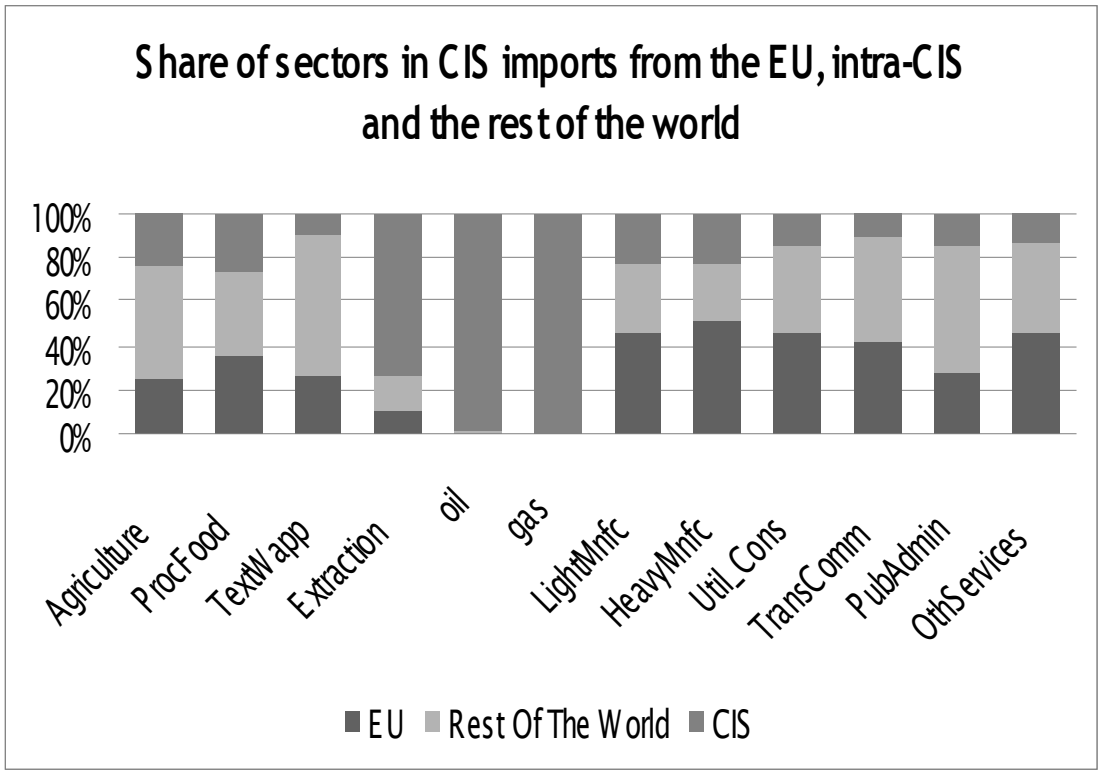


Source: UNCTAD

Figure 2-4 shows the share of different sectors in CIS imports originating from the EU, rest of the world and intra-regional sources. Oil and gas is imported almost only from intra-regional sources in the CIS countries. Similarly to oil and gas, the majority of other mineral extractions are originating from other CIS countries. Imports from the EU are most important in light and heavy manufacturing industries. In heavy manufacturing sectors about half of the imports originate from the EU. Furthermore, trade in some services sectors is important with the EU. Imports from countries other than CIS and EU countries are significant in agriculture products, processed food and most importantly in textiles and clothing products. In the latter sector more than half of the imports are coming from other countries than the EU or other CIS countries.

[6] For the rest of the analysis we will only have Ukraine, Russia, Kyrgyzstan, Kazakhstan, Georgia, Azerbaijan and Armenia as separate countries, the other CIS will be aggregated up as rest of CIS (XSU) give the unavailability of individual country data a the current version of the GTAP.

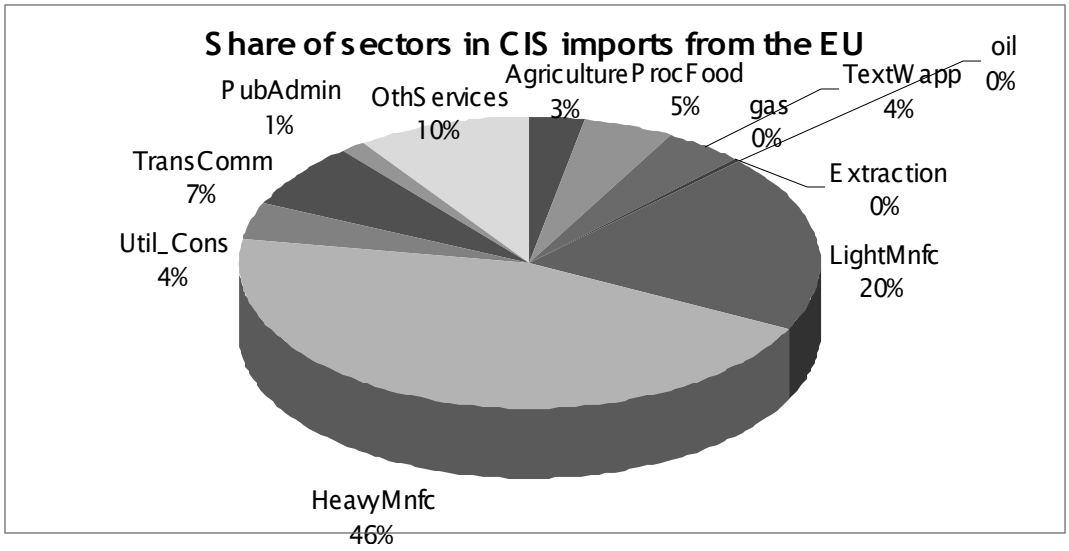
Figure 2-4 Share of sectors in CIS imports in 2004.



Source: own calculations, data come from GTAP database version 7

Figure 2-5 depicts the importance of different sectoral imports of CIS countries from the EU. An important part of imports originating from the EU is concentrated in heavy manufacturing products which presents 46% of total imports. Light manufacturing products are also important in imports from the EU. On the other hand agricultural and processed food products represent a smaller share. While agricultural products represent about 3% of total CIS imports from the EU, processed food products amount for a slightly higher share and represent 5% of total imports. CIS countries do not import oil, gas and other mineral extractions from the EU and imports in textiles and apparel also represent only around 4% of total imports.

Figure 2-5 Share of sectors in CIS imports from the EU in 2004.



Source: own calculations, data come from GTAP database version 7

The table below presents import tariffs in the CIS countries in different sectors. Although there are some important differences in the magnitude of the tariffs the tariff structure of the different countries in the region is relatively similar. The highest import protection occurs in most of the countries in processed food products followed by protection in textiles and clothing and agriculture. Import tariffs are also higher in light manufacturing products while tariffs are very low or zero in extractions, gas and oil. While the structure of tariffs is relatively similar between the countries in the region, Ukraine has the highest tariffs followed by Russia. For almost all the countries the processed food sector is the most protected, however the magnitude of tariffs are different ranging from 33% in Ukraine to 9% in Armenia.

Table 2-2 Import tariffs of CIS countries in 2004

	Russia	Ukraine	Kazakhstan	Kyrgyzstan	Armenia	Azerbaijan	Georgia
Agriculture	12.5%	23.0%	7.3%	4.1%	7.1%	15.8%	11.7%
ProcFood	15.4%	33.3%	12.5%	12.5%	9.0%	11.1%	12.0%
TextWapp	16.6%	5.9%	7.6%	13.1%	8.5%	16.9%	12.0%
Extraction	4.0%	1.0%	2.2%	4.5%	0.0%	3.3%	11.2%
oil	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
gas	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
LightMnfc	14.8%	8.2%	11.8%	9.0%	4.4%	10.2%	8.7%
HeavyMnfc	9.0%	7.7%	3.0%	5.5%	0.9%	5.5%	7.0%
Util_Cons	0.4%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
TransComm	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
PubAdmin	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
OthServices	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Total	6.1%	6.6%	3.7%	4.1%	2.5%	5.2%	5.2%

Source: own calculations, data come from GTAP database version 7

2.2 Trade and Production structure of the EU

Russia is one of the most important trading partners of the EU while other CIS countries play a rather small role in the EU's trade relations. As can be seen from Table 2.3, on the import side, Russia is the EU's third largest trading partner. Looking at exports, Russia is the destination for close to 6.2 % of the EU's exports, making it also the third largest export partner. On the other hand, only a small share of EU imports originates from the rest of the CIS region. Only about 2.5% of EU exports go to the rest of the CIS and about the same share originates from these countries.

Table 2-3 EU's major trading partners (merchandise) 2006

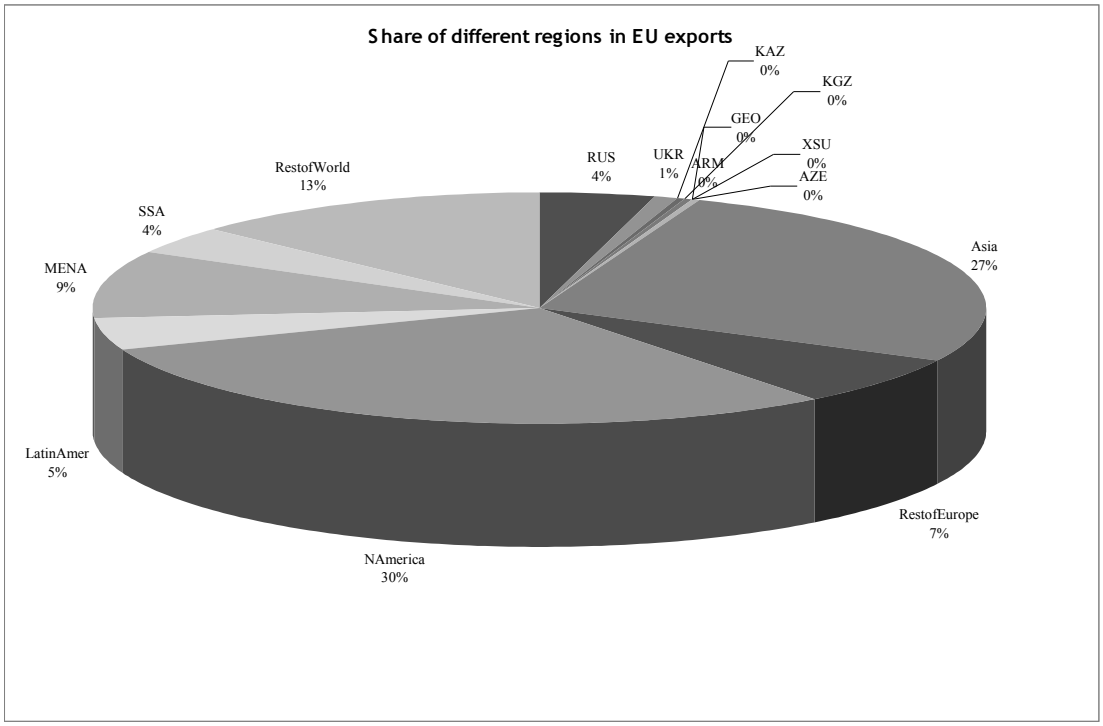
	Partner	Millions of Euro	% of total		Partner	Millions of Euro	% of total
	World	**1,350,494**	***100.0***		**World**	**1,166,109**	***100.0***
1	China	191,769	***14.2***	**1**	USA	267,895	***23.0***
2	USA	176,514	***13.1***	**2**	Switzerland	86,752	***7.4***
3	**Russia**	**137,022**	***10.1***	**3**	**Russia**	**71,944**	***6.2***
4	Norway	79,061	***5.9***	**4**	China	63,361	***5.4***
5	Japan	76,483	***5.7***	**5**	Turkey	46,457	***4.0***
6	Switzerland	70,898	***5.2***	**6**	Japan	44,656	***3.8***
7	Turkey	38,538	***2.9***	**7**	Norway	38,170	***3.3***
8	Korea	38,334	***2.8***	**8**	Romania	27,297	***2.3***
9	Brazil	26,280	***1.9***	**9**	Canada	26,521	***2.3***
10	Taiwan	26,127	***1.9***	**10**	United Arab Emir.	24,704	***2.1***
11	Libya	25,763	***1.9***	**11**	India	24,061	***2.1***
12	Algeria	23,970	***1.8***	**12**	Korea	22,780	***2.0***
13	Saudi Arabia	23,511	***1.7***	**13**	Hong Kong	21,576	***1.9***
14	India	22,361	***1.7***	**14**	Australia	21,298	***1.8***
15	Canada	19,565	***1.4***	**15**	South Africa	19,852	***1.7***

16 Singapore	19,398	***1.4***	**15** Singapore	19,459	***1.7***
17 South Africa	18,431	***1.4***	**16** Mexico	19,022	***1.6***
18 Malaysia	17,699	***1.3***	**17** Ukraine	17,834	***1.5***
19 Romania	17,639	***1.3***	**18** Brazil	17,682	***1.5***
20 WA_AO	16,581	***1.2***	**19** Saudi Arabia	17,434	***1.5***
CIS	**171,021**	***12.7***	**20** **CIS**	**104,230**	***8.9***

Source: Eurostat, COMEXT database

The share of different regions in EU exports for the year 2004 is presented in Figure 2-6. While Russia is the third most important trading partner of the EU regarding the value of trade, the CIS as a region represent a smaller part of export destination compared to other regions. The two most important export destinations for the EU are North-America and Asia. In 2004 a bit more than 5% of EU exports went to the CIS countries from which Russia received 4%, Ukraine 1% and the rest of the exports went to other countries in the region with each country receiving less than 1%. Exports towards the region and specially Russia increased from 2004 to 2006 which can be seen in the figures in Table 2-3.

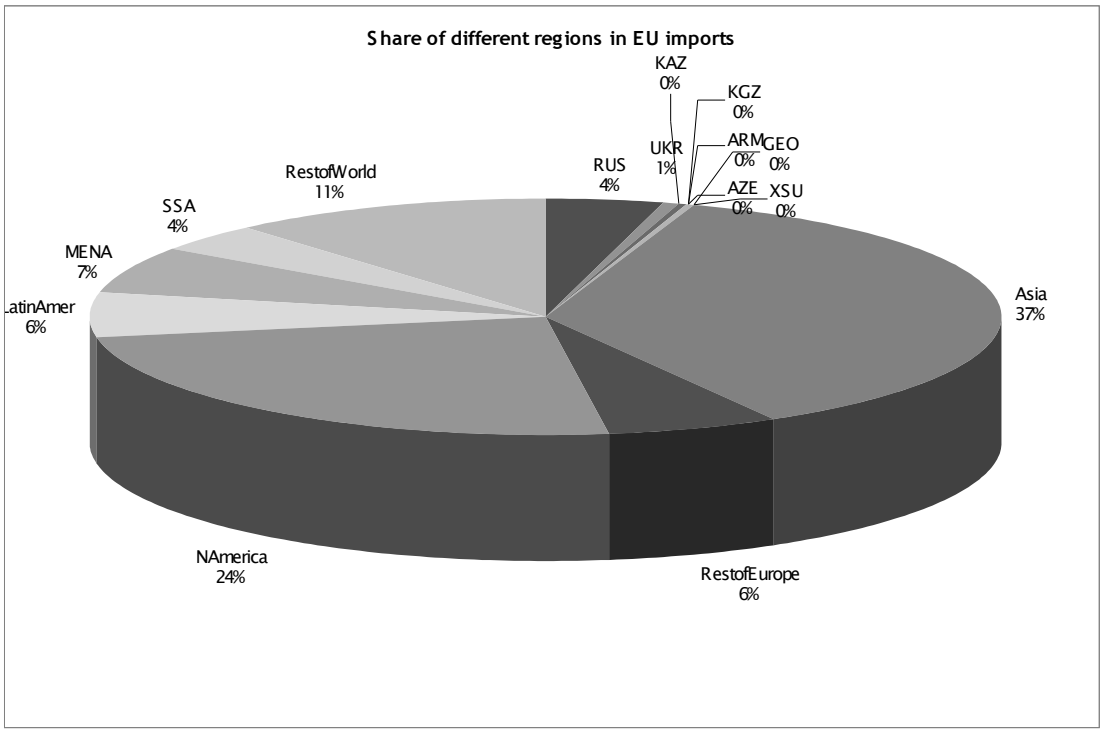
Figure 2-6 Share of different regions in EU exports



Source: own calculations, data come from GTAP database version 7

Similarly to exports, the CIS region as a whole provided a bit more than 5% of EU imports in 2004. The importance of the region as a trade partner is relatively small compared to some other regions. Nevertheless, Russia's importance when compared to other individual trading partners is very significant both as an import and as an export destination. The two most important import partners for the EU are North America and Asia. While North America is more important export partner than Asia, imports from Asia represent a higher share of total imports than imports from North America.

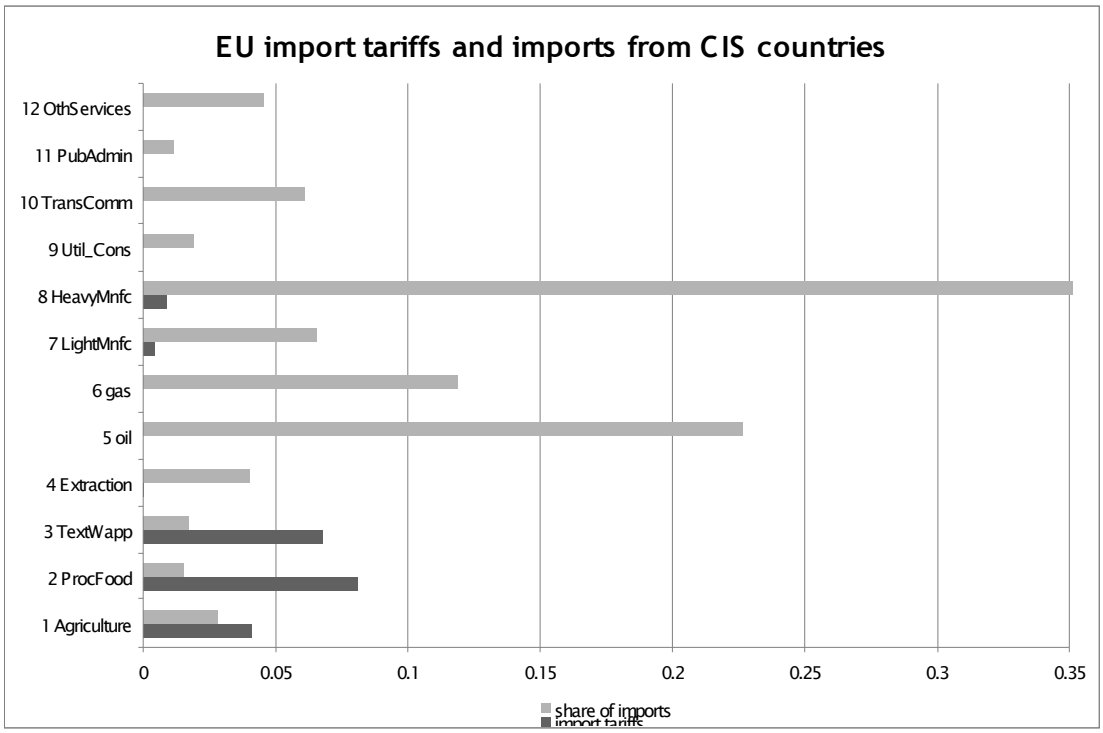
Figure 2-7 Share of different regions in EU imports



Source: own calculations, data come from GTAP database version 7

Figure 2-8 depicts the share of imports in different sectors from the CIS countries together with import tariffs in those sectors in percentages. The most protected sectors in the EU, similarly to CIS countries are processed food followed by textiles and apparel and agriculture. These sectors have the lowest share of imports in total imports from the CIS countries. The most important part of imports consists of heavy manufacturing products (representing about 35% of total imports), oil (23% of total imports) and gas (12% of total imports) where tariffs are close to zero. Based on these figures one would expect only very limited benefits of an FTA if it would be limited only to reduction of tariffs given the current trade structure of the CIS.

Figure 2-8 EU import tariffs and imports from CIS countries



Source: own calculations, data come from GTAP database version 7

3 The Model and the Data

In this chapter, we aim to describe the model and the data on which we base our analysis. Furthermore, we describe the general outline of the analysis defining underlying assumptions as well as the employed scenarios.

3.1 The CGE model

The methodology used in this study is comparable with recent policy analyses of the World Bank, the IMF and the OECD, incorporating a similar quantitative modeling framework. This section provides a brief overview of the global computable general equilibrium (CGE) model used in this study.

The CGE-model is based on an input-output structure (which stem from national input-output tables) which explicitly links industries through chain of value added in production, from primary goods, through stages of intermediate processing, to the

final assembling of goods and services for consumption. This inter-sectoral linkage works both through direct linkages, e.g. the use of steel in the production of transport equipment, and indirect, i.e. via intermediate use in other sectors. These linkages are captured in the model by the usage of firms' use of factors and intermediate inputs. An overview of the model is provided in Box 3.1 below, while a more detailed description is available in the Technical Annex.

Recent developments in international trade and economic geography focuses on the importance of scale economies (e.g. starting from Krugman (1979), (1980), Helpman and Krugman (1989) and onwards) and imperfect competition in determining the patterns of production and trade. In order to incorporate this development into the analysis, our model is expanded to take differences in underlying market structures across sectors into account.

Furthermore, in order to further increase the quality of the analysis, we employ estimates on elasticities as reported in the recent paper by Antweiler and Trefler (2002).

Impediments to trade in services are not as clearly visible as is the case with tariffs for trade in merchandise. Rather, trade barriers in the service sector often entail prohibitions, quantitative restrictions and government regulations, which are designed to limit the market access of foreign suppliers. These are not easy to quantify. In order to remedy this lack of data, we follow Francois (2003) in estimating tariff equivalents for the service sector through the use of a gravity type equation. These estimates are then incorporated into the analysis. Further information about these estimates is available in the Technical Annex.

Box 3.1: Overview of the model

The model employed in this study is a global, multi-regional, multi-sectoral general equilibrium model. In each region, there is a single representative household, which allocates its expenditures over personal consumption today and savings (future consumption). The representative household owns all production factors and receives income by selling them to firms. It also receives income from tariff revenues. Part of the income is distributed as subsidy payments to some sectors.

On the production side, firms use domestic production factors (capital, labour and land) and intermediate inputs from domestic and foreign sources to produce outputs in the most cost-efficient way that technology allows. Factor markets are competitive, and labour and capital are mobile between sectors but not between regions.

Perfect competition is assumed in 16 of our 36 sectors. In these sectors, products from different regions are assumed to be imperfect substitutes in accordance with the so-called 'Armington' assumption. In the remaining sectors, we assume imperfect competition. The approach followed involves monopolistic competition. Monopolistic competition entails scale economies that are internal to each firm, depending on its own production level. In particular, based on estimates of price-cost mark-ups, we model the sector as being characterized by Chamberlinian large-group monopolistic competition. An important property of the monopolistic competition model is that increased specialization at intermediate stages of production yields returns due to specialization, where the sector as a whole becomes more productive the broader the range of specialized inputs. These gains spill over through two-way trade in specialized intermediate goods. With these spill-over effects, trade liberalization can lead to global scale effects related to specialization. With international scale economies, regional welfare effects depend on a mix of efficiency effects, global scale effects, and terms-of-trade effects. Similar gains follow from consumer goods specialization.

Prices on goods and factors adjust until all markets are simultaneously in (general) equilibrium. This means that we solve for an equilibrium in which all markets clear. While we model changes in gross trade flows, we do not model changes in net international capital flows. Rather our capital market closure involves fixed net capital inflows and outflows.

A full description of the model is provided in the technical appendix.

3.2 Model data

The GTAP database, version 7, provides the majority of the data for the empirical implementation of the model. The database is the best and most updated source for internally consistent data on production, consumption and international trade by country and sector. For more information, please refer to Dimaranan and McDougall (2006).

The GTAP version 7 dataset is benchmarked to 2004, and includes detailed information on input-output, trade and final demand structures for the whole world this year. However, there are some important changes to the trade policy environment that have happened since then, that we wish to include in the basic dataset. Therefore, before conducting any policy experiments, we first run a 'pre-experiment', where we include the ATC (Agreement on Textile and Clothing) (include full name here please) phase-out and EU enlargement. Moreover, several of the CIS countries are currently in the process of joining the WTO. The EU would most probably only negotiate FTAs if the given partner country would already be a WTO member. Therefore, we implement the result from WTO accessions of all non-WTO members of CIS as well in our baseline.

For the purpose of this study, the GTAP database has been aggregated into 16 regions and 12 sectors. The list of sectors and regions is shown in .

Table 3-4: Sectors in the model

Sectors	Regions
Agricultural products, food	Russia
Processed Food	Ukraine
Textiles and Clothing	Kazakhstan
Coals and other minerals	Kyrgyztan
Oil	Armenia
Gas	Azerbaijan
Light Manufacturing	Georgia
Heavy Manufacturing	Rest of Former Soviet Union
Utilities and Construction	East, Southeast and South Asia
Transport and Communication	Rest of Europe
PubAdmin/Defence/Health/Educat	North America
Other Services	Latin America

	European Union 25
	Middle East and North Africa
	Sub-Saharan Africa
	Rest of World

3.3 Setting up the analysis; baselines and trade liberalization scenarios

All results are compared to the baseline, which takes into account the effects of a successful WTO accession, the EU enlargement and the phase-out of the ATC. The baseline scenario is discussed in greater detail in the Annex I.

The core of our analysis is structured around a set of scenarios. We simulate these three scenarios assuming that all CIS countries have the same FTAs with the EU. These scenarios are based on alternative liberalization approaches for agriculture, manufactured goods and services trade, as well as measures to facilitate trade. Trade facilitation measures aim to reduce less transparent trade barriers, such as customs procedures, product standards and conformance certifications, licensing requirements, and related administrative sources of trading costs. The scenarios which we use as basis for our analysis are summarized in the table below.

Table 3-5: Scenarios

		Assumptions			
Nr	**Description**	**Food**	**Non-food**	**Services**	**Trade facilitation**
1	Partial 1 trade agreement	No tariff reductions	Full bilateral tariff reductions	no reduction	None
2	Partial 2 trade agreement	Full bilateral tariff reductions	Full bilateral tariff reductions	no reduction	None
3	Full FTA	Full bilateral tariff reductions	Full bilateral tariff reductions	Full services liberalisation[7]	2% of value of trade

The partial trade agreements imply more realistic outcomes of the trade negotiations than the Full FTA scenario described above. With regards to the outcome of the bilateral trade agreements on non-food, the assumption is the same as in the full FTA, namely full bilateral tariff reduction. The second partial trade agreement scenario

[7] We assume an average trade restriction reduction (TCE or trade cost equivalent) for producer services of 23.7 percent in the CIS and 18.4 percent in the EU27 based on the findings of Francois and CE (2007). See further details in the Technical Annex.

offers a deeper liberalisation between the regions implying full bilateral reduction in not only manufacturing goods but also in the food sector. No trade facilitation is assumed to take place in the partial scenarios.

The Full FTA agreement implies full bilateral tariff reductions for manufacturing goods, full bilateral tariff reductions in the agriculture and processed food sectors, full liberalization of trade in services and trade facilitation measures corresponding to 2 percent of value of trade. From a policy point of view, this scenario can be seen as quite radical in its assumptions. Nonetheless it is very useful in providing an upper benchmark for the effect of potential measures to liberalize trade.

4 Results

4.1 Real Income Effects

Trade liberalization has a small positive net income effect on the EU amounting to 0.2% increase under the full FTA scenario which is shown in Table 4-6. On the other hand the CIS on average would experience a negative income effect under the first two scenarios and a positive effect under the third scenario. The gains form liberalization for the EU is the highest under the full FTA scenario and very similar in magnitude under the first two scenarios. The CIS countries would experience a higher decrease in real income in case of the second scenario which would involve not only liberalization in manufacturing but also agricultural sectors. This latter scenario would mean a 0.83% decrease in real income on average in the CIS countries. These negative income effects are mainly due to the important negative terms of trade effects taking place in Russia and Ukraine. On the other hand, full liberalization would imply a 0.62% increase in real incomes in the CIS on average. This increase in real incomes will be about three times higher than the increase which would take place in the EU under this third scenario.

Table 4-6. Real Income Effects (percentage change from baseline)

Scenario	Partial 1 trade agreement	Partial 2 trade agreement	Full FTA
EU	0.14	0.13	0.21
CIS	-0.53	-0.83	0.62

Source: Model simulations. Note: All results are reported as percentage change compared to baseline.

4.2 Effects on Sectoral Outputs

Our analyses of the expected changes in sectoral output as a result of different forms of trade liberalisation show that while the effects for the EU would be very small, important changes would occur in the sectoral output of CIS countries. More precisely, a small increase in textiles and apparel, light manufacturing, processed food and agriculture output would take place combined with a small reduction in other sectors. On the other hand, CIS countries on average would experience an important drop in light manufacturing sectors and increase in heavy manufacturing and textiles and apparel output. The next section discusses the changes in sectoral output in more details.

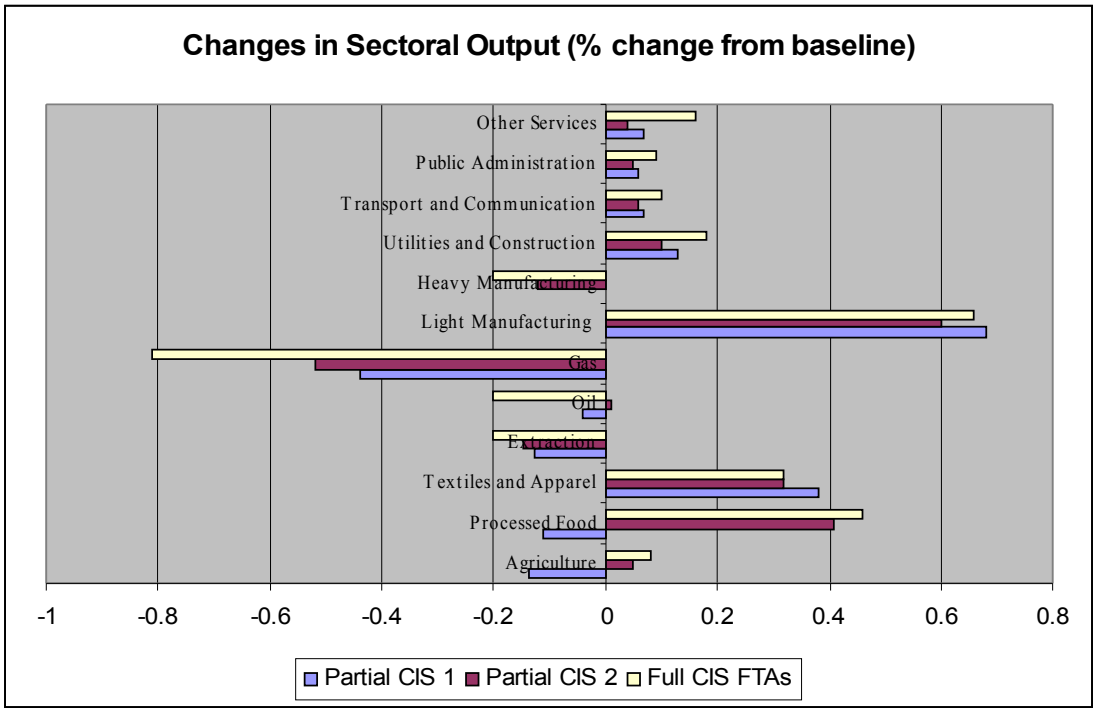
4.2.1 Changes in sectoral output in the EU

The figure below shows changes in sectoral output for the EU under the three different scenarios. The results below depict changes compared to the baseline scenario which assumed that CIS countries joined the WTO, the ATC and the EU enlargement took place. These results would occur if the EU would have FTAs with all CIS countries. As can be seen from the figure below, which depicts percentage changes, the effects of different FTAs on EU's output structure would be rather limited.

The most important increase in sectoral output would occur in the light manufacturing sectors with an increase of about 0.6-7%. Moreover, textiles and apparel production would also increase somewhat. Finally, there would be an increase in agricultural and processed food sectors if the trade agreements would incorporate more than just liberalisation in manufactured goods.

Some of the sectors would experience small reductions in output. The most important reduction in sectoral output would happen in the gas sector, with a decrease of about 0.8% in case of full CIS free trade agreements. Some very small reductions would take place in heavy manufacturing, oil and other extraction outputs.

Figure 4-9



Source: Model simulations. Note: All results are reported as percentage change compared to baseline.

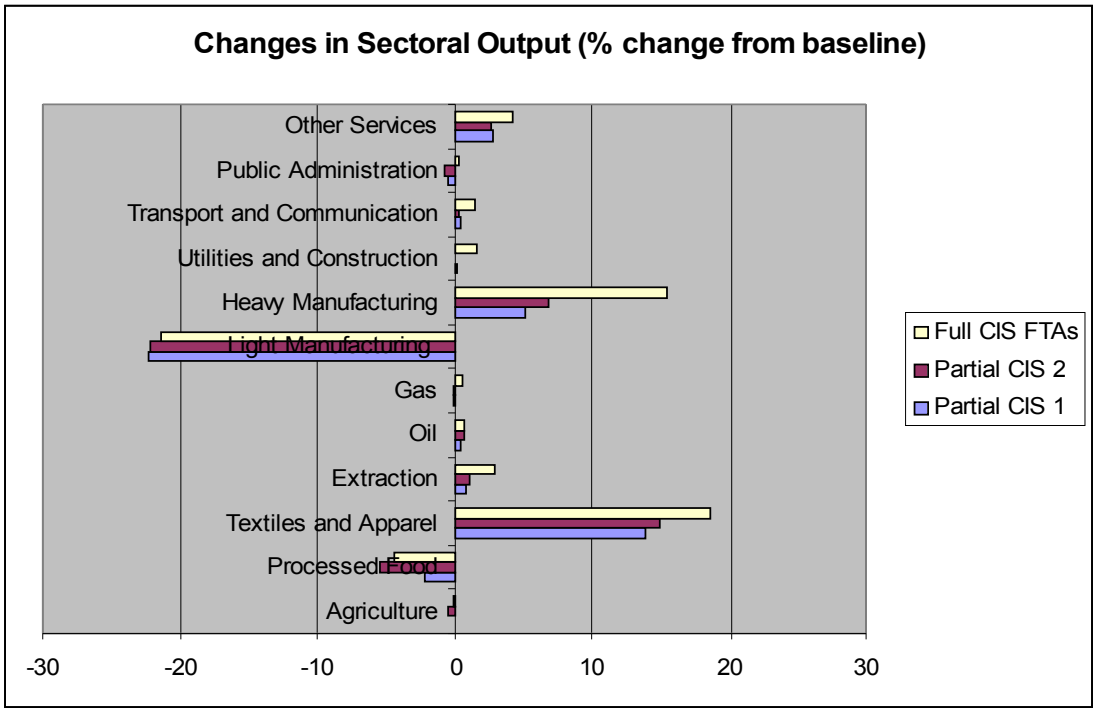
4.2.2 Changes in sectoral output in the CIS

The changes which would occur after trade liberalization between the CIS and EU would be much more pronounced for the CIS countries than for the EU. Average changes in the CIS after the three different FTAs would take place are shown in Figure 4-2.

The most pronounced decrease would take place in the light manufacturing sectors with the drop in the production being slightly less pronounced in case of full liberalization. The decrease of production would be around 22%. The other sector where reduction of sectoral output would occur is the processed food sector. However, in this sector the output drop would be smaller, in the magnitude of 2-6% depending on the form of trade agreements.

The sectors where important increases in sectoral output would take place are the heavy manufacturing sectors and textiles and apparel. For both sectors the biggest increases would occur in case of full FTAs. While output in textiles and apparel would increase by about 18%, heavy manufacturing output would increase by about 15% under the deepest form of FTA. The increase in heavy manufacturing production would be less than half in case of the partial FTA scenarios.

Figure 4-10



Source: Model simulations. Note: All results are reported as percentage change compared to baseline.

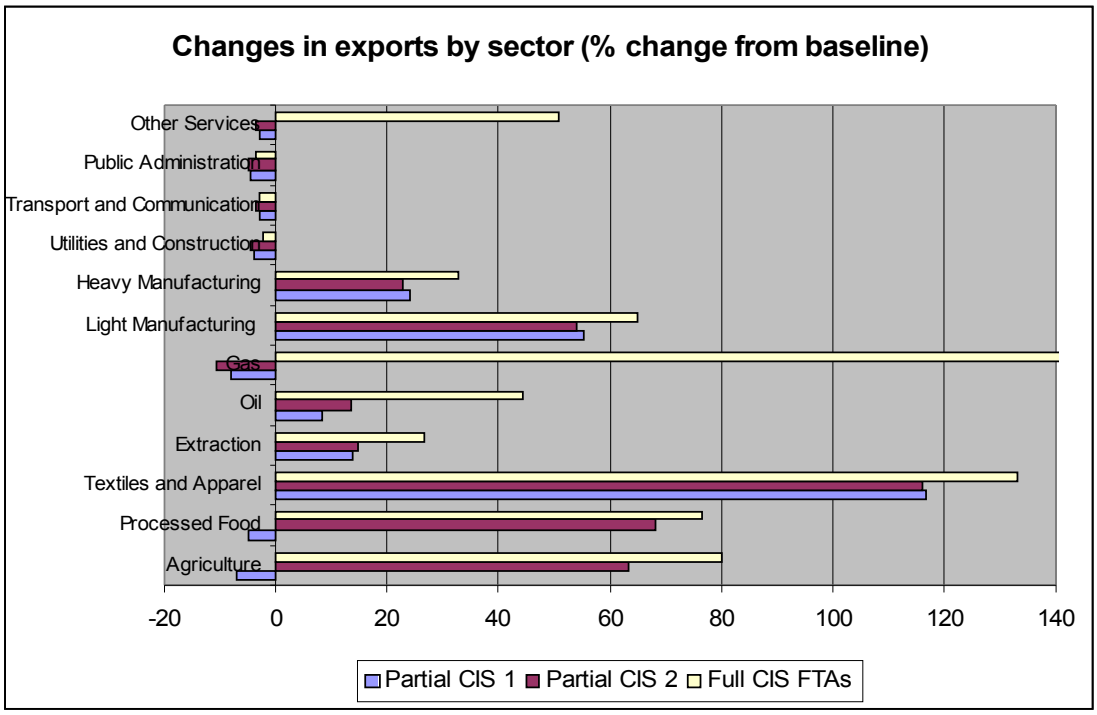
4.3 Effects on bilateral trade flows

In this section we provide detailed results on trade impacts in the three scenarios, and we present the changes in trade flows by sector.

The figure below depicts changes in EU exports towards CIS countries after the three different FTA scenarios. The services sectors experience a small reduction in the first two scenarios. Under the third scenario, trade in services sectors belonging to 'other services' is liberalised. As a consequence of this there would be an important, about 50% increase in EU exports in other services sectors towards the CIS countries. Important increase would occur in exports of textiles and apparel under all scenarios, the biggest increase occurring under the third scenario. The exports in these sectors would more than double towards the CIS countries. Light manufacturing exports would also increase about 50-60% depending on the scenarios. When trade liberalisation would occur also in agriculture and processed food sectors, these sectors would also experience an important increase in their exports towards the region. There would be an increase in gas exports, which according to the graph is important

in terms of percentage change compared to the baseline scenario. The table below shows the percentage changes compared to the baseline together with the share of exports in each sector. The share of gas and oil sector's exports is close to zero, thus the increase shown in the graph in the exports of gas towards the CIS countries in terms of levels is minimal.

Figure 4-11



Source: Model simulations. Note: All results are reported as percentage change compared to baseline.

Table 4-7 Percentage changes in sectoral exports and the share of sectors in total exports in the baseline of the EU

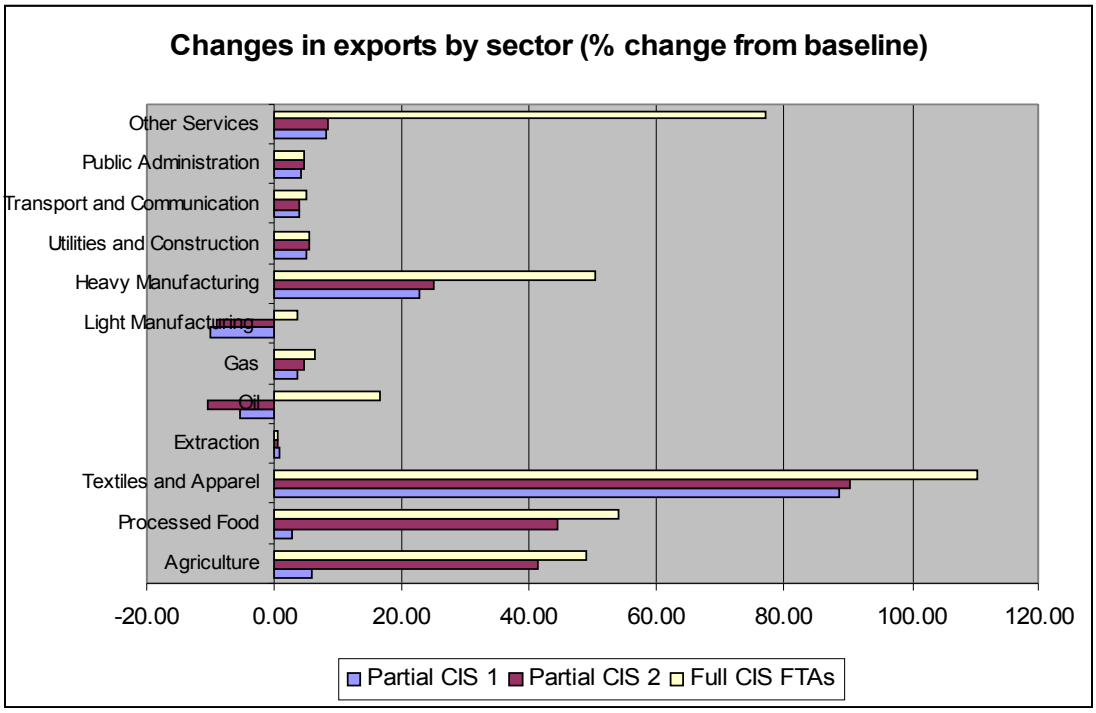
	Partial CIS 1	Partial CIS 2	Full CIS FTAs	share in total exports
Agriculture	-7.08	63.46	80.01	2.96%
Processed Food	-5.07	68.19	76.54	5.12%
Textiles and Apparel	116.70	116.23	133.38	4.15%
Extraction	13.93	14.88	26.72	0.35%
Oil	8.21	13.51	44.27	0.00%
Gas	-8.10	-10.70	262.78	0.00%
Light Manufacturing	55.42	54.14	65.05	19.38%
Heavy Manufacturing	23.95	22.93	32.74	45.12%
Utilities and Construction	-4.05	-4.59	-2.41	4.02%
Transport and Communication	-3.28	-3.62	-3.03	6.85%
Public Administration	-4.41	-5.17	-3.71	1.25%
Other Services	-3.36	-3.59	50.95	10.80%

Source: Model simulations. Note: All results are reported as percentage change compared to baseline.

Figure 4-4 shows percentage changes in exports of CIS by each sector towards the EU. Similarly to the case of EU exports in services, an important increase would occur in other services exports if trade would be liberalised between the EU and the CIS in these sectors.

While some reduction in exports would occur in light manufacturing sectors, exports in heavy manufacturing would increase by 23-25% under the two first scenarios and by 50% in case of full liberalisation. Increase in exports of processed food and agricultural products would take place under all three scenarios, the effect being small in case of no liberalisation in agriculture and becoming important once liberalisation in the agriculture and food sectors would also take place. The most pronounced increase would occur in the textiles and apparel sectors. Under the first and second scenarios, the increase would be around 88-90% and it would be around 110% in case of full liberalisation.

Figure 4-12



Source: Model simulations. Note: All results are reported as percentage change compared to baseline.

Table 4-4 shows the percentage changes in sectoral exports together with the share of each sector in total exports towards the EU in the baseline. Although the most important increase would occur in the textiles and apparel sector with exports to the EU increasing by 90-110% depending on the scenario, this sector only represents a small share of exports in total exports. Less than 2% of exports occur in these sectors. The second most important increase would occur in processed food followed by the increase in exports of agricultural products. Again, these sectors represent only a very small share of total exports therefore the change after the different FTAs in level would be only very small.

Table 4-8 Percentage changes in sectoral exports and the share of sectors in total exports towards the EU in the baseline

	Partial CIS 1	Partial CIS 2	Full CIS FTAs	share in total exports
Agriculture	6.06	41.38	49.03	2.80%
Processed Food	2.85	44.65	54.11	1.54%
Textiles and Apparel	88.60	90.31	110.50	1.92%
Extraction	0.95	0.66	0.60	3.68%
Oil	-5.46	-10.39	16.60	21.11%
Gas	3.56	4.44	6.21	11.57%
Light Manufacturing	-10.13	-9.20	3.79	6.56%
Heavy Manufacturing	22.73	25.19	50.29	36.62%

Utilities and Construction	5.04	5.37	5.25	1.94%
Transport and Communication	3.86	4.06	5.16	6.19%
Public Administration	4.18	4.65	4.51	1.18%
Other Services	8.31	8.37	77.06	4.90%

Source: Model simulations. Note: All results are reported as percentage change compared to baseline.

4.4 Other Macroeconomic Results

In this section other macroeconomic results, such us changes in wages and GDP are discussed. These results are summarized in Table 4-9 and 4.5 below. Overall, these variables follow the general pattern previously pointed out; the impact of a trade agreement is higher for CIS than for the EU for all variables. The change in GDP indicates a much higher gain for the CIS than for the EU in case of full FTA however a decrease in case of the first two scenarios. These negative effects under the first two scenarios are mainly due to the important negative terms of trade effects taking place in Russia and Ukraine. The effects on worker wages are larger for the CIS in case of full FTA and rather small and similar in magnitude to those in the EU in case of the first two forms of FTAs implying less deep form of liberalization.

Table 4-9 below shows the resulting changes in some selected macroeconomic variables from a full FTA. There would be a rather small increase in GDP in the EU after a full FTA, amounting to 0.18%. On the other hand, the increase in the CIS would be more pronounced, the corresponding increase in the CIS is 1.2%.

The increase in wages is also larger in the CIS than in the EU. The change in wages for skilled and unskilled workers is similar in magnitude in both regions. While the EU would experience a very marginal, 0.2% change in wages, the increase in CIS wages would be around 1.5% for both skilled and unskilled workers.

Table 4-9: Macroeconomic results from Full FTA (in %)

	EU	CIS
Change in GDP	0.18	1.195
Unskilled worker wage	0.26	1.56
Skilled worker wage	0.24	1.47

Source: Model simulations. Note: All results are reported as percentage change compared to baseline.

The results with regards to the effect on other macroeconomic variables of the more realistic scenarios of trade agreements are summarized in Table 4-10 below. These results are different not only in magnitudes but also the sign of change is reversed for

the GDP of the CIS. While the full FTA would result in an increase in GDP, the first two scenarios with lower level of trade liberalisation would imply a reduction in GDP for the CIS. On the other hand, the change for the EU would be positive, although rather small. The negative effect on GDP is higher in case of the second scenario which would involve also agriculture liberalisation while being relatively small in the first case for the CIS countries.

The increase in wages is significantly smaller for the CIS under the first two scenarios than in the full FTA case, with the increase being much smaller for unskilled workers than for skilled workers. The increase in unskilled worker's wage in the CIS under the first two scenarios is rather small and close to those in the EU being around 0.16-0.22%.

Table 4-10: Macroeconomic results from Partial 1 & 2 trade agreement

	Partial 1 trade agreement		Partial 2 trade agreement	
	EU	CIS	EU	CIS
Change in GDP	0.12	-0.13	0.10	-0.35
Unskilled worker wage	0.18	0.22	0.18	0.16
Skilled worker wage	0.16	0.32	0.15	0.36

Source: Model simulations
Note: All results are reported as percentage change compared to baseline.

4.5 Terms of Trade Effects

The table below shows terms of trade effects in the case of full free trade agreement with liberalization in not only agriculture and manufacturing products but also services trade and reduction in technical barriers. While the EU would have a small terms of trade improvement amounting to about 0.11%, the CIS on average would experience a 0.83% deterioration.

Table 4-11: Terms of trade results from Full FTA (in %)

	EU	CIS
Terms of trade effects	0.11	-0.83

Source: Model simulations. Note: All results are reported as percentage change compared to baseline.

The terms of trade effects for the two regions under the two other forms of trade liberalisation are presented in the table 4.8 below. The terms of trade gains for the EU would be slightly lower under the second partial trade agreement and the lowest under the first form of FTA. On the under hand the terms of trade deterioration would be the smallest for the CIS under the first scenario and slightly higher under the second, amount to a 0.76% decrease.

Table 4-12: Terms of trade results from Partial 1 & 2 trade agreement

	Partial 1 trade agreement		Partial 2 trade agreement	
	EU	CIS	EU	CIS
Terms of trade effects	0.09	-0.63	0.10	-0.76

Source: Model simulations. Note: All results are reported as percentage change compared to baseline

5 Conclusions

In this study we explore the economic effects of potential measures to liberalize trade between the European Union and the CIS. In so doing, we have a Computable General Equilibrium Model, CGE Model, based on the most recent version of the GTAP data base, i.e. GTAP 7, which is benchmarked to data from 2004. Our CGE model follows recent research in trade theory in taking different in underlying industry specific market structures and elasticities into account. Furthermore, the model incorporates estimated non-tariff trade barriers to trade in services, stemming from industry-specific gravity equation, which enhances the analysis of the service sector. The results are compared to a baseline which incorporates recent developments in the trade policy environment, i.e. the phase out of ATC, enlargement of the EU and CIS accessions to the WTO. The analysis takes agricultural liberalization, liberalization in industrial tariffs, and liberalization in services trade as well as trade facilitation measures into account.

The EU is a very important trading partner for the CIS. On the other hand, the CIS as a region represents only a relatively small share of EU trade. EU's imports from the region are concentrated around a few sectors, mainly gas, oil and extractions. As a consequence of this asymmetric relationship the effects of an FTA between the EU and the CIS would have asymmetric effects on the two regions. The impact of an FTA would be more pronounced for the CIS and rather marginal for the EU.

Only a rather limited income effect would occur in the EU as a consequence of the FTAs while the income effect in the CIS would be higher in magnitude. The CIS would experience a negative income effect if the FTA would be limited only to trade in goods. These negative effects under the first two scenarios are mainly due to the important negative terms of trade effects taking place in Russia and Ukraine. This implies that the CIS would most likely to benefit from an FTA with the EU if it would

incorporate deeper form of integration not being limited to liberalisation of tariffs in goods.

The change in GDP in the two regions after the different FTAs also highlight that the CIS would only benefit from a full FTA and would experience a reduction in GDP in case of the first two, less coherent forms of FTAs. On the other hand, the effects on the EU would be always positive although small. Moreover, liberalisation limited to only industrial goods results in smaller drop in GDP and smaller decrease in real incomes in the CIS than when the FTA also incorporates liberalisation of agricultural and processed food products due the higher negative terms of trade effects. The effect of an FTA on CIS's GDP would be positive only if the FTA would involve more than just removal of tariffs on industrial goods and agriculture.

6 Annex I Baseline scenario

The detailed results presented in the paper for the three different FTA scenarios are compared to the baseline scenario which takes into account the effects of a successful WTO accession, the EU enlargement and the phase-out of the ATC. This Annex presents a few tables with basic results of this baseline scenario.

The baseline scenario assumes that the WTO accession would imply a 2% reduction of technical barriers to trade. We do not assume that further tariff reductions would take place given that for most of the countries the currently negotiated binding tariffs are equal or higher to the current tariffs. For the EU enlargement we assumed elimination of tariffs between old and new member countries.

Table 6-1 below shows the real income effects of a WTO accession, EU enlaregement and ATC phase-out. The effects are positive for most of the CIS countries and often higher than what an FTA with the EU would imply. Russia and Ukraine would experience the largest increases in real income amounting to 0.75% increase in the case of Russia and 1.23% for Ukraine.

Table 6-13 Real income effects (percentage changes)

RUS	0.75
UKR	1.23
KAZ	0.64
KGZ	-0.11
ARM	-0.01
AZE	0.64
GEO	-0.06
XSU	2.18
EU_25	0.17

Terms of trade effects are shown in table 6-2. While Russia, Kazakhstan, and Azerbaijan would experience a terms of trade improvement other countries would have a small terms of trade deterioration. The terms of trade effects for the EU would be rather small, but positive.

Table 6-14 Tems of trade effect

RUS	0.5
UKR	-0.16
KAZ	0.41

KGZ	-0.32
ARM	-0.04
AZE	0.59
GEO	-0.12
XSU	0.21
EU_25	0.05

The resulting changes in GDP are presented in Table 6-3. These results are in line with the real income effects shown in Table 6-1. The changes in GDP are positive for all CIS. The highest increase would occur for the 'rest of CIS' (which consists of Belarus, Moldova, Tajikistan, Turkmenistan, and Uzbekistan). The increase in GDP would be the second most pronounced for Ukraine amounting to a 1.37% increase followed by Russia.

Table 6-15 Change in GDP

RUS	0.63
UKR	1.37
KAZ	0.48
KGZ	0.09
ARM	0.06
AZE	0.38
GEO	0.03
XSU	2.19
EU_25	0.15

7 **Annex II Technical Annex**: An Overview of the Computational Model

1 Introduction

This annex provides an overview of the basic structure of the global CGE model employed for our assessment of WTO accession and various FTAs linked to the European Union and various former Soviet Republics and client states. The policy experiments themselves are explained with the country reports in the main body of the text.

The model is based on Francois, van Meijl, and van Tongeren (2005) and is implemented in GEMPACK -- a software package designed for solving large applied general equilibrium models. The reader can download and replicate our results, but will need access to GEMPACK to make modifications to the code or data. The model is solved as an explicit non-linear system of equations, through techniques described by Harrison and Pearson (1994). More information can be obtained at the following URL -- http://www.monash.edu.au/policy/gempack.htm. The reader is referred to Hertel (1996) for a detailed discussion of the basic algebraic model structure represented by the GEMPACK code. While this appendix provides a broad overview of the model, detailed discussion of mathematical structure is limited to added features, beyond the standard GTAP structure covered in that document.

The model is a standard multi-region computable general equilibrium (CGE) model, with important features related to the structure of competition (as described by Francois and Roland-Holst 1997). Imperfect competition features are described in detail in Francois (1998). Social accounting data are based on the most recent Version 7 (pre-release) of the GTAP dataset (www.gtap.org), which is benchmarked to 2004.

2 General structure

The general conceptual structure of a regional economy in the model is as follows. Within each region, firms produce output, employing land, labour, capital, and natural resources and combining these with intermediate inputs. Firm output is purchased by consumers, government, the investment sector, and by other firms. Firm output can also be sold for export. Land is only employed in the agricultural sectors, while capital and labour (both skilled and unskilled) are mobile between all production sectors. Capital is fully mobile within regions.

All demand sources combine imports with domestic goods to produce a composite good. In constant returns sectors, these are Armington composites. In increasing returns sectors, these are composites of firm-differentiated goods. Relevant substitution and trade elasticities are presented in Appendix Table 1.

3 Taxes and policy variables

Taxes are included in the theory of the model at several levels. Production taxes are placed on intermediate or primary inputs, or on output. Some trade taxes are modeled at the border. Additional internal taxes can be placed on domestic or imported intermediate inputs, and may be applied at differential rates that discriminate against imports. Where relevant, taxes are also placed on exports, and on primary factor income. Finally, where relevant (as indicated by social accounting data) taxes are placed on final consumption, and can be applied differentially to consumption of domestic and imported goods.

Trade policy instruments are represented as import or export taxes/subsidies. This includes applied most-favored nation (mfn) tariffs, antidumping duties, countervailing duties, price undertakings, export quotas, and other trade restrictions. The major exception is service-sector trading costs, which are discussed in the next section. The full set of tariff vectors are based on WTO tariff schedules augmented with data on trade preferences. The set of services trade barrier estimates is described below.

4 Trade and transportation costs and services barriers

International trade is modeled as a process that explicitly involves trading costs, which include both trade and transportation services. These trading costs reflect the transaction costs involved in international trade, as well as the physical activity of transportation itself. Those trading costs related to international movement of goods and related logistic services are met by composite services purchased from a global trade services sector, where the composite "international trade services" activity is produced as a Cobb-Douglas composite of regional exports of trade and transport service exports. Trade-cost margins are based on reconciled f.o.b. and c.i.f. trade data, as reported in version 6.2 of the GTAP dataset.

A second form of trade costs is known in the literature as frictional trading costs. These are implemented in the service sector. They represent real resource costs associated with producing a service for sale in an export market instead of the domestic market. Conceptually, we have implemented a linear transformation technology between domestic and export services. This technology is represented in Annex Figure 1. The straight line AB indicates, given the resources necessary to produce a unit of services for the domestic market, the feasible amount that can instead be produced for export using those same resources. If there are not frictional barriers to trade in services, this line has slope -1. This free-trade case is represented by the line AC. As we reduce trading costs, the linear transformation line converges on the free trade line, as indicated in the figure. In the model, this is modeled as a reduction in the cost of producing tradable goods and/or services, measured in units of the good/service itself.

We utilize service barrier estimates reported by Francois and CE (2007). These yield an average trade restriction (TCE or trade cost equivalent) for producer services of 23.7 percent in the FSU and 18.4 percent in the EU27. The basic methodology for estimation of services barriers involves the estimation of an equation where import

demand is a function of the size of the economy (GDP) and its income level (per-capita income). The Francois and CE approach is an improvement on the apporoach in Francois, ven Meijl and van Tongeren (2005) as under the latter approach a pooling strategy is employed so that there are several points for estimation of each national restriction index (the ℓ_j coefficient). Adjusted by the import substitution elasticity, estimated national coefficients provide an estimate of the trade-cost equivalent of existing barriers in services, as an average across service sectors. While the estimates are based on a cross-section of countries, Francois, Hoekman, and Woerz (2008) offer a panel-based set of estimates applying a similar method and interpreting country effect variables in the panel as measures of average openness. While their estimates do not cover the countries of interest here, for countries with overlap with the two samples the results are consistent.

5 The composite household and final demand structure

Final demand is determined by an upper-tier Cobb-Douglas preference function, which allocates income in fixed shares to current consumption, investment, and government services. This yields a fixed savings rate. Government services are produced by a Leontief technology, with household/government transfers being endogenous. The lower-tier nest for current consumption is also specified as a Cobb-Douglas. The regional capital markets adjust so that changes in savings match changes in regional investment expenditures. (Note that the Cobb-Douglas demand function is a special case of the CDE demand function employed in the standard GTAP model code. It is implemented through GEMPACK parameter files.)

6 Market Structure

6.1 Demand for imports: Armington sectors

The basic structure of demand in constant returns sectors is Armington preferences. In Armington sectors, goods are differentiated by country of origin, and the similarity of goods from different regions is measured by the elasticity of substitution. Formally, within a particular region, we assume that demand goods from different regions are aggregated into a composite import according to the following CES function:

(3) $$q^{M}_{j,r} = \left[\sum_{i=1}^{R} \alpha_{j,i,r} M^{\rho_j}_{j,i,r} \right]^{1/\rho_j}$$

In equation (3), $M_{j,i,r}$ is the quantity of M_j from region i consumed in region r. The elasticity of substitution between varieties from different regions is then equal to σ^{M}_{j}, where $\sigma^{M}_{j}=1/(1-\rho_j)$. Composite imports are combined with the domestic good q^D in a second CES nest, yielding the Armington composite q.

(4) $$q_{j,r} = \left[\Omega_{j,M,r} \left(q^{M}_{j,r} \right)^{\beta_j} + \Omega_{j,D,r} \left(q^{D}_{j,r} \right)^{\beta_j} \right]^{1/\beta_j}$$

The elasticity of substitution between the domestic good and composite imports is then equal to σ^D_j, where $\sigma^D_j=1/(1-\beta_j)$. At the same time, from the first order conditions, the demand for import $M_{j,i,r}$ can then be shown to equal

$$(5) \qquad M_{j,i,r} = \left[\frac{\alpha_{j,i,r}}{P_{j,i,r}}\right]^{\sigma^M_j} \left[\sum_{i=1}^{R} \alpha^{\sigma^M_j}_{j,i,r} P^{1-\sigma^M_j}_{j,i,r}\right]^{-1} E^M_{j,r}$$

$$= \left[\frac{\alpha_{j,i,r}}{P_{j,i,r}}\right]^{\sigma^M_j} \left(P^M_{j,r}\right)^{\sigma^M_j - 1} E^M_{j,r}$$

where $E^M_{j,r}$ represents expenditures on imports in region r on the sector j Armington composite. In practice, the two nests can be collapsed, so that imports compete directly with each other and with the corresponding domestic product. This implies that the substitution elasticities in equations (3) and (4) are equal. (These elasticities are reported in Annex Table 1).

6.2 Imperfect competition

As indicated in Annex Table 1, we model manufacturing sectors and service sectors as being imperfectly competitive. The approach we follow has been used in the Michigan and the WTO assessment of the Uruguay Round. Recent model testing work indicates that this approach works "best" vis-à-vis Armington models, when tracked against actual trade patterns. (See Fox 1999, who uses the U.S.-Canada FTA as a natural experiment for model testing).

Formally, within a region r, we assume that demand for differentiated intermediate products belonging to sector j can be derived from the following CES function, which is now indexed over firms or varieties instead of over regions. We have

$$(6) \qquad q_{j,r} = \left[\sum_{i=1}^{n} \gamma_{j,i,r} X^{\Gamma_j}_{j,i,r}\right]^{1/\Gamma_j}$$

where $\gamma_{j,i,r}$ is the demand share preference parameter, $X_{j,i,r}$ is demand for variety i of product j in region r, and $\sigma_j = 1/(1-\Gamma_j)$ is the elasticity of substitution between any two varieties of the good. Note that we can interpret q as the output of a constant returns assembly process, where the resulting composite product enters consumption and/or production. Equation (6) could therefore be interpreted as representing an assembly function embedded in the production technology of firms that use intermediates in production of final goods, and alternatively as representing a CES aggregator implicit in consumer utility functions. In the literature, and in our model, both cases are specified with the same functional form. While we have technically dropped the Armington assumption by allowing firms to differentiate products, the vector of γ parameters still provides a partial geographic anchor for production. (Francois and Roland-Holst 1997, Francois 1998).

Globally, firms in different regions compete directly. These firms are assumed to exhibit monopolistically competitive behaviour. This means that individual firms produce unique varieties of good or service j, and hence are monopolists within their chosen market niche. Given the demand for variety, reflected in equation (6), the

demand for each variety is less than perfectly elastic. However, while firms are thus able to price as monopolists, free entry (at least in the long-run) drives their economic profits to zero, so that pricing is at average cost. The joint assumptions of average cost pricing and monopoly pricing, under Bertrand behaviour, imply the following conditions for each firm f_i in region i:

$$\zeta_{j,f_i} = \sum_{r=1}^{R} \frac{X_{j,f_i,r}}{X_{j,f_i}} \left(\sum_{k=1}^{n} \left(\frac{\alpha_{j,k,r}}{\alpha_{j,f_i,r}} \right)^{\sigma_j} \left(\frac{P_{j,k,r}}{P_{j,f,r}} \right)^{1-\sigma_j} \right)^{-1} \tag{7}$$

$$P_{f,i} = AC_{f,i} \tag{8}$$

The elasticity of demand for each firm f_i will be defined by the following conditions.

$$\varepsilon_{j,f,i} = \sigma_j + (1 - \sigma_j)\zeta_{j,f,i} \tag{9}$$

$$\frac{P_{f,i} MC_{f,i}}{P_{f,i}} = \frac{1}{\varepsilon_{f,i}} \tag{10}$$

In a fully symmetric equilibrium, we would have $\zeta = n^{-1}$. However, the calibrated model includes CES weights γ, in each regional CES aggregation function, that will vary for firms from different regions. Under these conditions, ζ is a quantity weighted measure of market share. To close the system for regional production, we index total resource costs for sector j in region i by the resource index Z. Full employment of resources hired by firms in the sector j in region i then implies the following condition.

$$Z_{j,i} = \sum_{f=1}^{n_i} TC_{j,i,f} \tag{11}$$

Cost functions for individual firms are defined as follows:

$$C(x_{j,i}) = (a_{j,i} + b_{j,i}\, x_{j,i})\, P_{Z_{j,i}} \tag{12}$$

This specification of monopolistic competition is implemented under the “large group” assumption, which means that firms treat the variable n as "large", so that the perceived elasticity of demand equals the elasticity of substitution. The relevant set of equations then collapses to the following:

$$q_{j,r} = \left[\sum_{i=1}^{R} \bar{\gamma}_{j,i,r}\, \bar{x}_{j,i,r}^{\Gamma_j} \right]^{\frac{1}{\Gamma_j}}$$

$$\bar{\gamma}_{j,i,r} = \alpha_{j,i,r}\, n_{j,i\,0}^{1-\Gamma_j} \tag{13}$$

$$\bar{x}_{j,i,r} = \left(\frac{n_{j,i}}{n_{j,i\,0}} \right)^{(1-\Gamma_j)/\Gamma_j} X_{j,i,r}$$

(14) $$\bar{x}_{j,i} = \left(\frac{Z_{j,i\,1}}{Z_{j,i\,0}} \right)^{(1-\rho_j)/\rho_j} X_{j,i}$$

In equation (14), n_0 denotes the number of firms in the benchmark. Through calibration, the initial CES weights in equation (14) include the valuation of variety. As a result, the reduced form exhibits external scale effects, determined by changes in variety based on firm entry and exit, and determined by the substitution and scale elasticities.

6.3 Markups

Scale elasticities, based on our average markup estimates, are reported in the Annex Table 1. The starting point for these is recent estimated price-cost markups from the OECD (Martins, Scarpetta, and Pilat 1996). These provide estimates of markups, based on methods pioneered by Hall (1988) and Roeger (1995). The Martins et al paper provides an overview of the recent empirical literature. We have supplemented these with price-cost markups estimated, given our theoretical structure, from the set of GTAP Armington elasticities, and also from estimates reported in Antweiler and Trefler (2002).

1. Investment

We model changes in the capital stock as being linked to changes in levels of savings and investment. This follows Francois and McDonald (1996). Under this approach, there is a basic proportionality when comparing long-run equilibriums. In particular, given a policy shock, the long-run change in capital stock should be proportional to the long-run change in investment levels:

(15) $$K_t = K_0 \left(I_1 / I_0 \right)$$

Where investment is determined by changes in savings rates and the price of capital goods, and where savings rates are taken as fixed. More detail is provided in Francois and McDonald (1996).

2. Aggegation scheme

The basic aggregation scheme for the model is presented in Annex Tables 1 and 4.

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Annex Table 1

	Elasticity of Substiution in valued added	Trade substitution elasticity	Market structure	Variety-scale elasticity
Agricultural products, food	0.33	5.5	CRTS	0.000
Processed Food	1.12	4.4	MC	0.294
Textiles and Clothing	1.26	7.5	CRTS	0.000
coals, and other minterals	0.2	2.6	CRTS	0.000
oil	0.20	10.4	CRTS	0.000
gas	0.20	34.4	CRTS	0.000
Light Manufacturing	1.26	6.6	MC	0.179
Heavy Manufacturing	1.26	7.5	MC	0.154
Utilities and Construction	1.37	4.5	CRTS	0.000
Transport and Communication	1.63	3.8	CRTS	0.000
PubAdmin/Defence/Health/Education	1.26	3.8	CRTS	0.000
Other Services	1.26	3.8	MC	0.357

CRTS: constant returns to scale
MC: monopolistic competition

Annex Table 2
Model Aggregation Scheme

Model Regions	Model Sectors
Russia	Agricultural products, food
Ukraine	Processed Food
Kazakhstan	Textiles and Clothing
Kyrgyztan	coals, and other minterals
Armenia	oil
Azerbaijan	gas
Georgia	Light Manufacturing
Rest of Former Soviet Union	Heavy Manufacturing
East, Southeast and South Asia	Utilities and Construction
Rest of Europe	Transport and Communication
North America	PubAdmin/Defence/Health/Education
Latin America	Other Services
European Union	
Middle East and North Africa	
Sub-Saharan Africa	
Rest of World	

Annex Figure 1
Trading Costs in the Service Sector