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An application of a Computable General Equilibrium Model for the Estimation of Effects of the new wave of the European Union Enlargement on the Russian Economy

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В данном исследовании изучаются последствия расширения Европейского Союза для экономики России. Проблемы оценивания последствий расширения Европейского Союза на уровень благосостояния, внешнюю торговлю и общеэкономическое состояние России относятся к важным и актуальным задачам. Данная работа предлагает количественные оценки данных эффектов. В качестве инструмента исследования выбрана модель общего равновесия. Модель включает 15 отраслей и 4 региона, такие как, Россия, Европейский Союз, страны-кандидаты и «остальной мир». Модель была разработана в пакете GAMS, и полученные с помощью данной теоретической модели результаты представляют, также, и практический интерес. В работе показывается, что расширение Европейского Союза приводит к изменению торговых потоков между Россией, Европейским союзом и странами кандидатами, и к увеличению диверсификации российского производства. Существенно то, что, модель предсказывает увеличение российского импорта во всех отраслях, без исключения, а также небольшое уменьшение российского экспорта нефти и газа. Кроме того, в работе утверждается, что условия торговли для России будут ухудшаться. Проведенный в работе анализ показывает, что результаты модели устойчивы по отношению к изменениям эластичностей Армингтона.

Ключевые слова: модель общего равновесия, расширение европейского союза, Россия.

This study explores the economic impact of the European Union enlargement on the Russian economy. The problem of the estimation of the welfare effects, trade effects, and overall economic effects of the European Union enlargement on Russia are important and relevant. The proposed study seeks to find quantitative evaluation of the importance of such effects. A Computable General Equilibrium Model is chosen as a tool for the purposes of the study. The model incorporates 15 industries and 4 regions such as Russia, the European Union, Countries-Candidates and "the Rest of the World". The model has been worked out in GAMS package and the results obtained in the model appear to be interesting from a practical point of view. According to the predictions of the model, the enlargement of the European Union causes changes in the trade flows between Russia, the European Union and Countries-candidates and increases the diversification of the Russian industries. Other significant results are the overall increase of imports to Russia in all industries incorporated into the model and a slight drop of the Russian exports of oil and gas. In addition, it is argued that Russia is expected to suffer from a decline in its terms of trade. Sensitivity analysis shows that our results are robust to the changes in Armington elasticities.

Key words: computable general equilibrium models, European Union enlargement, Russia.

Contents

1. **Introduction.**

After successfully growing from 6 to 15 members, the European Union is now preparing for its biggest enlargement, 10 countries have applied for a membership: Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Malta, the Slovak Republic, and Slovenia. The accession of the new members, especially Baltic countries, is going to have the noticeable consequences for the Russian economy. The main issues of the European Union (EU) enlargement, which can affect the Russian economy, are the trade diversion and trade creation, which will follow the accession of the new members. Abolishment of trade barriers between the EU and the Central and Eastern European Countries (CEECs) can lead to more efficient production within the Union and, therefore, with respect to Russia it may cause a trade diversion. The number of antidumping cases against the CEECs is going to fall dramatically and as a result that will promote the trade creation between the EU and the CEECs. Since those changes in the patterns of trade of the EU and the CEECs will influence the Russian foreign trade, the problem of estimation of the effects of the European Union enlargement on the Russian economy represents an important and relevant question.

In our research we explore economic impact of the European Union enlargement on the Russian economy. The method of the study is predetermined by the necessity for the estimation of possible effects of the process of the EU enlargement not on a single industry, but on the entire economy. The most common approach to the simultaneous estimation of trade effects, changes in macroeconomic parameters, and changes in production in different industries is the use of a Computable General Equilibrium (CGE) model. In contrast to an econometric approach and partial equilibrium models, CGE modeling provides a full picture of the economic changes and gives an opportunity to explore the final effects of the European integration on the Russian economy. We can make a distinction between the primary and secondary effects of a trade shock on the economy. The primary effect is observed when changes in industries related to the international trade provoke changes in the other industries, which are not directly involved in the international trade. At the same time we can speak about the secondary effect in the situations when changes in not trade-oriented industries, initially caused by the primary shock, have the feedback effect on the industries directly involved in the international trade. The CGE model captures the final effects in all industries, no matter, to what extent the industries are related to international trade, at the same time taking into account all intersectional effects. Therefore, a CGE model is the most appropriate tool for the targets of our research.

Applied general equilibrium modeling is a straightforward implication of the Walrasian general equilibrium framework. This approach uses the real data on production, consumption, and trade for each of the economies under consideration. The Arrow-Debreu equilibrium is implied in the modeling. In a CGE model every market clears in equilibrium and those equilibrium conditions allow calibrating the model and using obtained equations for the policy evaluation. In such model producers maximize profits, and production functions are usually presented by either constant returns to scale or non-increasing returns to scale technologies. Consumers' utility maximizing conditions result in the demand functions for each commodity. The conditions that the supply is equal to demand in each market determine the level of prices

and level of production in each industry. Therefore, using this approach, the model is calibrated for the existing structure of the economies and world trade. Then, to evaluate some policy, those functions are implied to the data rearranged in the way that reflects that new policy, for example, tariffs are equated to zero. Comparing the existing and future equilibriums, projections of the policy's effects are obtained.

This paper is one of the first attempts to apply CGE modeling to the problem of the estimation of the impact of the EU enlargement on the Russian economy. We present the evaluation of the effect of the EU enlargement for 15 industries of the Russian economy and seek to explain the effects of the enlargement and produce quantitative results of these changes. Nevertheless, some other papers have already investigated possible outcomes of the EU enlargement with the help of an applied general equilibrium analysis.

For instance, Lejour [7] basing on GTAP model[1] tried to evaluate the enlargement. Two distinguishing features of this paper are that, first, it focused mostly on the effects on the Candidates and existing members of the European Union, and the other is that the model employed did not incorporate Russia as a separate region. Russia was included into the region that consists of the countries-members of the Former Soviet Union. So the results of this model with respect to Russia should be interpreted carefully. But what is important for our research is that both models GTAP and ours included the candidates and members of the European Union, therefore, our results could be somehow compared to the results of GTAP model according to figures obtained for the candidates and EU. Lejour argues that the volume of GDP in the candidates countries increases by 2.5% and our research shows 1.82% increase, what if we take into account the differences in the data (this version of GTAP utilized data for 1997 year, whereas, our model used 2000 as the base year) are mostly the same figures. As far as the terms of trade are concerned, the results differ, namely, Lejour suggests 0.3% deterioration in terms of trade for the candidates, while our results stand for 0.15% improvement. For the existing members of the European Union, the results are mainly the same. But it should me mentioned that in our analysis we make strong assumptions about the market structure of the economy - all the markets are modeled as perfectly competitive in our model.

The other two papers, which have examined the enlargement using the GTAP model, mainly focus on the outcomes of the EU enlargement for Russia. The first one [10] is written by Pekka Sulamaa from the Research Institute of Finnish Economy, and the second one [12] – by Xavier Greffe from RECEP. Although those papers focus on Russia, the model that they use, still, does not distinguish Russia from the other countries of the Former Soviet Union. With respect to Russia (the FSU in these papers) those studies suggest 0.09% deterioration of the terms of trade that is quite close to the figure that we obtained in our research (0.087% deterioration of the terms of trade for Russia). On the other hand, the main distinction between our research and those papers is the fact that we have managed to build a model that includes Russia as a separate region and to get results on possible outcomes of the enlargement not for the FSU (Former Soviet Union), but for Russia itself.

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[1] The GTAP model is a multiregional, multisector, computable general equilibrium model, with perfect competition and constant returns to scale. Bilateral trade is handled via the Armington assumption. The model also gives a wide range of closure options, including a selection of partial equilibrium closures, which facilitate comparison of results to studies based on partial equilibrium assumptions.

The analysis that we have made suggests a slight deterioration of the Russian terms of trade. In such export-orientated industries as Oil and Gas, Nonferrous Metallurgy the Russian exports are expected to fall by approximately 0.09% and 0.04% respectively that corresponds to almost 64 mln. euro in nominal terms.

Diversification of the Russian production is a significant result of the EU enlargement. It is shown that the production increases in such sectors as Ferrous metallurgy, Food-processing Industry, Agriculture, services in Agriculture and Forestry, and Construction. On the other hand, the level of production falls in Oil and Gas, Nonferrous metallurgy, Chemical industry and oil refinery, Electricity and heat.

In addition, in the paper we present the results of the sensitivity analysis which has been carried out with respect to the values of elasticities. The analysis implies that the results of our model are robust to rather large changes in the Armington elasticities. It is shown that production, exports and imports do not change much with the changes in the Armington elasticities. As far as the elasticities of substitution among different products within Russia are concerned, in the model we have used the econometric estimates obtained by C. Ballard [4] and R. Faini [6].

The structure of the paper is as follows. The first section provides the overview of the history of the European integration and the main stylized facts on the merchandise trade among Russia, the European Union and countries candidates. The second and the third sections present the description of the model and the results of the research[2]. In the fourth section we show the results of the sensitivity analysis with respect to changes in the Armington elasticities of substitution among regions. Finally, conclusions are given.

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[2] We are very thankful to John Whalley (universities of Warwick and Western Ontario) for providing us the core model.

2. <u>History and background of the subject.</u>

2.1 <u>What are the European Union and candidates.</u>

The European union with its 15 members accounts for only 6 percent of the world's population and for about one fifth of the overall imports and exports in the world. Therefore, the European Union is one of the biggest world's trade union. Trade was one of the first areas in which EU countries agreed to transfer to the European Commission the responsibility for handling trade issues, including negotiations of international trade agreements. This means that the EU's 15 Member States negotiate as one, both with their trading partners and at the WTO, thus maximising their influence on the international scene.

There are different European institutions that are involved in decision making on the structure of international trade. Ministers with other representatives of the governments from one hand and European parliament with European commission on the other.

According to the figures presented on the site of European commission, the European Union now can be characterised by the following figures, the EU is:

- the world's leading exporter of goods: over 973 billion euro in 2001, almost a fifth of the world total;
- the world's leading exporter of services: 291 billion in euro 2000, 23.9 % of the world total;
- the world's leading source of foreign direct investment (362 billion euro in 2000) and the second largest home for foreign investment (176.2 billion euro in 2000) after the United States (304.9 billion euro)
- the main export market for some 130 countries around the globe;
- a relatively open economy: international trade accounted for over 14 % of its gross domestic product in 2000, compared with 12 % for the United States and 11 % for Japan

Although the European Union has already experienced four enlargements, in 1973, 1981, 1986, and 1995, the new one with ten newcomers: *Hungary, The Czech Republic, Estonia, Latvia, Lithuania, Poland, Malta, Cyprus, The Slovak Republic, Slovenia* is the largest and the most promising.

Before a country can be considered as a possible EU member it should satisfy several criteria:

- existence of democracy and stable institutions,
- this country should be a market economy that could stand the competition from existent EU members,
- ability to take on economic, political, and financial obligations.

New prospective EU members differ much. The levels of economies and living standards vary from approximately 68% in Slovenia to 23% in Bulgaria.

3   GDP per head (PPS), 1999

Index, EU26 = 100
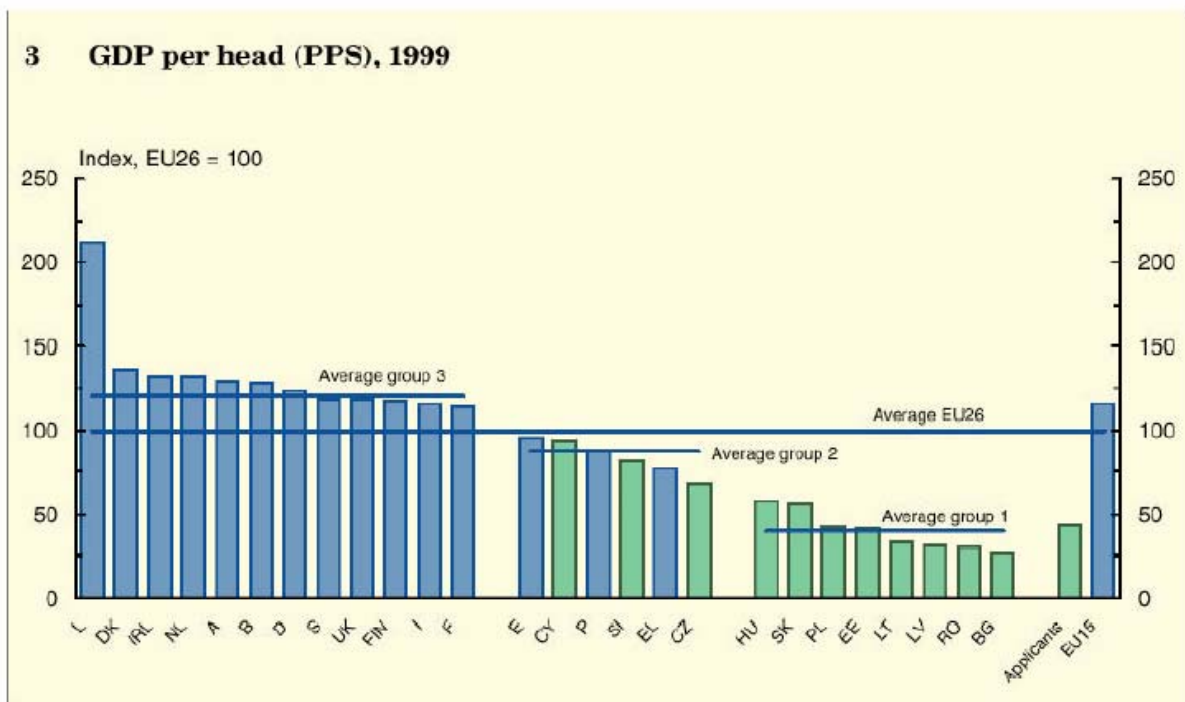
After the accession, as it is argued in literature, living standards, level of GDP per capita in the countries-candidates are going to increase and in the long run approach that of present EU members.

Opening up markets means removing trade barriers between countries. This was the basic target of the Union from the earliest days. In the 1960s, a 'customs union' between its member countries was created. Any EU country could trade any quantity of goods with any other EU country without having to pay customs duties and tariffs.

A 'single external tariff' was also introduced: non-EU countries exporting products to the EU were charged the same tariff regardless of which EU country was importing the goods. This is the main point that effect Russia's terms of trade and change the stricture of the Russian trade.

But although the tariff barriers were removed, many 'non-tariff' barriers to trade still remained. For example, different EU countries had different administrative requirements and different rules on things like packaging and labelling — all of which hindered trade between them. That is why, in 1992, the EU launched its 'single market', removing non-tariff barriers to trade in goods, and also opening up trade in services within the Union.

2.2 Main figures of merchandise trade between Russia, European Union and candidates.

2.2.1 Exports.

Chart1*: Russia's exports to EU(mln euro) and it's share in the overall Russian exports (1999 year).*
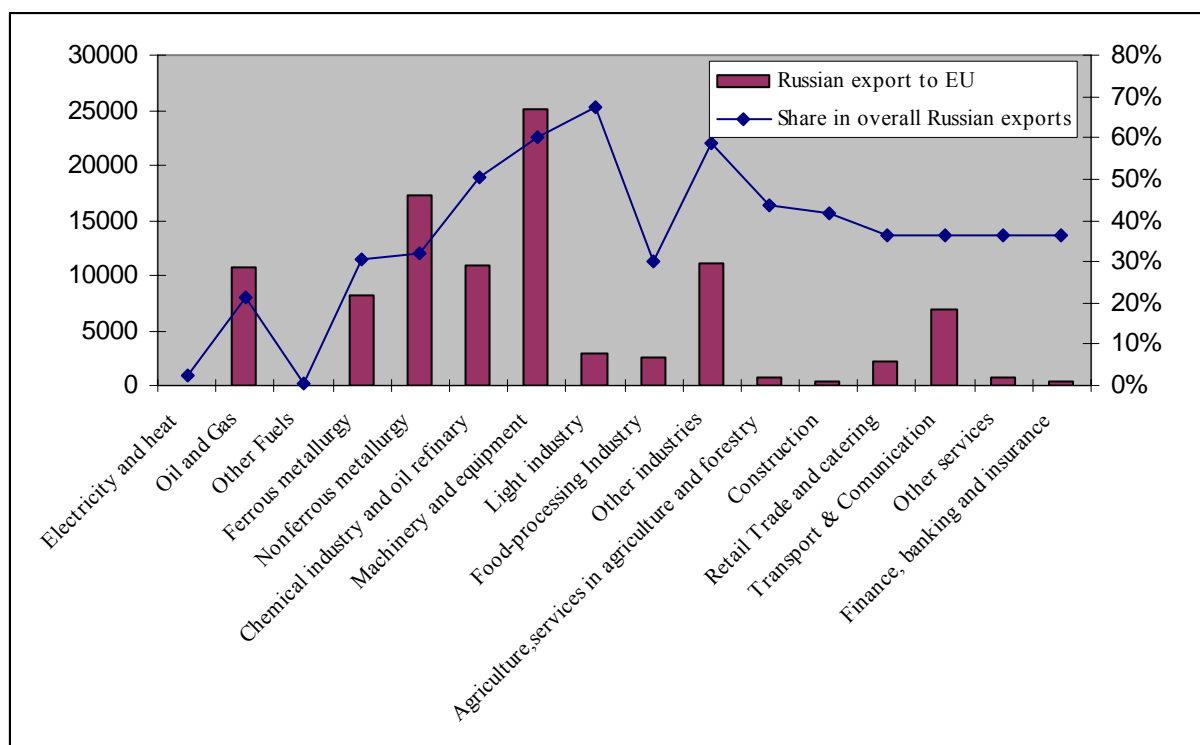
Except for such sectors as Electricity and Gas, Light Industry, Food-processing industry and services where Russia is not a sizable exporter, in all the others – the share of exports to the European union accounts for from 20 up to 70 percent of the overall Russian exports. Hence, the European Union is one of the biggest Russian trade partner.

The Russian exports to countries-candidates are lower then that of to EU in times. In almost all sectors the share of the exports to CEECs is not higher then 10 percent. Although even ten percent is a huge number for such sector as Oil and Gas. Another noticeable characteristic of trade between Russia and CEECs is that in contrast with the trade patterns between Russia and EU, the Russian exports of services are rather high.

Chart2: *Russia's exports to CEECs(mln euro) and it's share in the overall Russian exports (1999 year).*
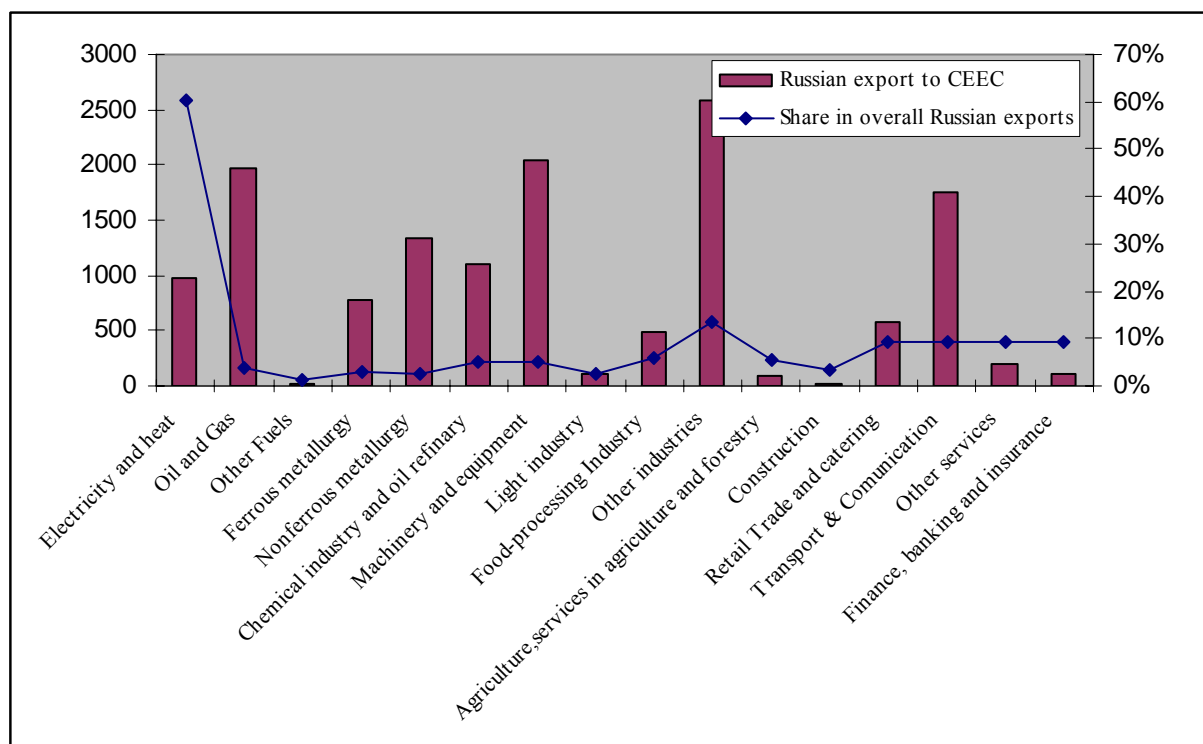
2.2.2 Imports.

The Russian imports from countries-candidates and the EU have a specific structure, namely, it is concentrated in four industries – Light Industry, Machinery and Equipment, Food-processing industry, and Chemical industry and oil refinery (data on trade in services from CEECs and the EU was not obtained for all the lines of 8-digit classification, therefore, imports of services in our data are skewed towards zero, but this fact do not influence our results much as we explore the effects of the enlargement with respect to Russia).

Imports in Light industry are to a certain extant characterized by huge amounts of imports of clothing, Machinery and equipment in CEECs case– cars from *The Czech Republic (Shkoda),* food – processing industry – a variety of food products that are very competitive on the domestic Russian market.

Chart3: *Russia's imports from EU(mln euro) and their shares in the overall Russian imports(1999 year).*
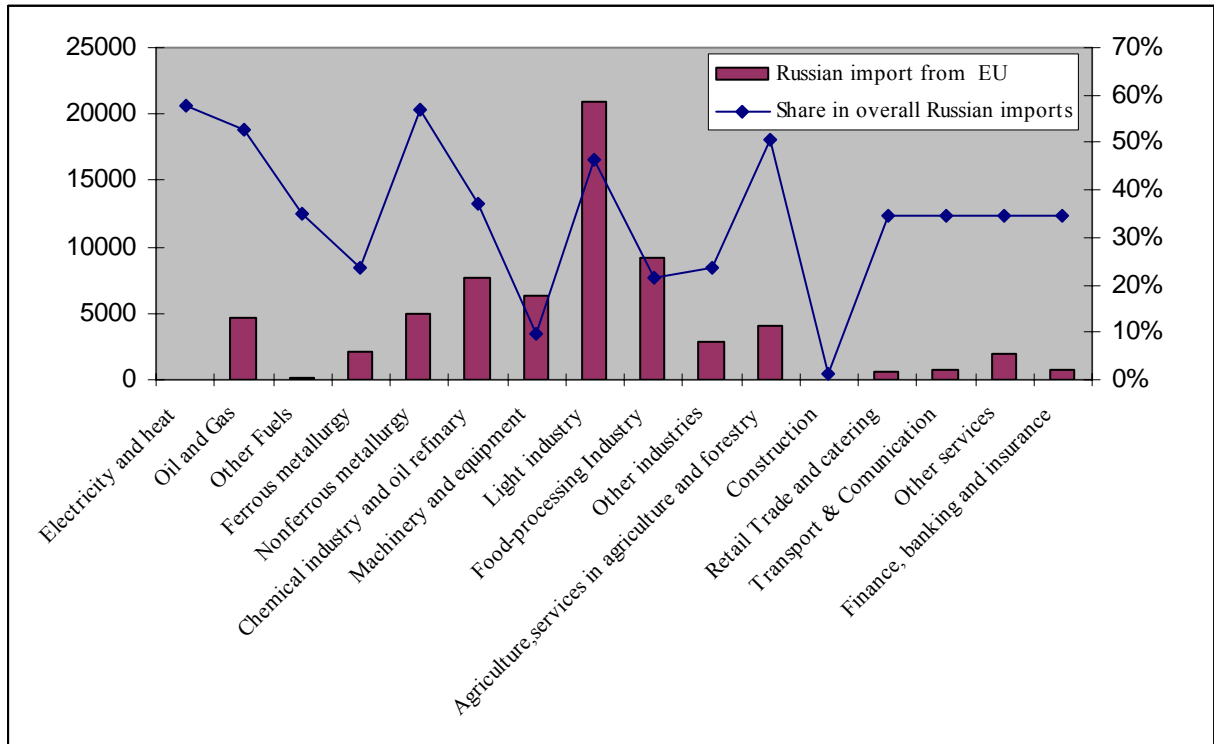
Chart4: *Russia's imports from CEECs(mln euro) and their shares in the overall Russian imports(1999 year).*
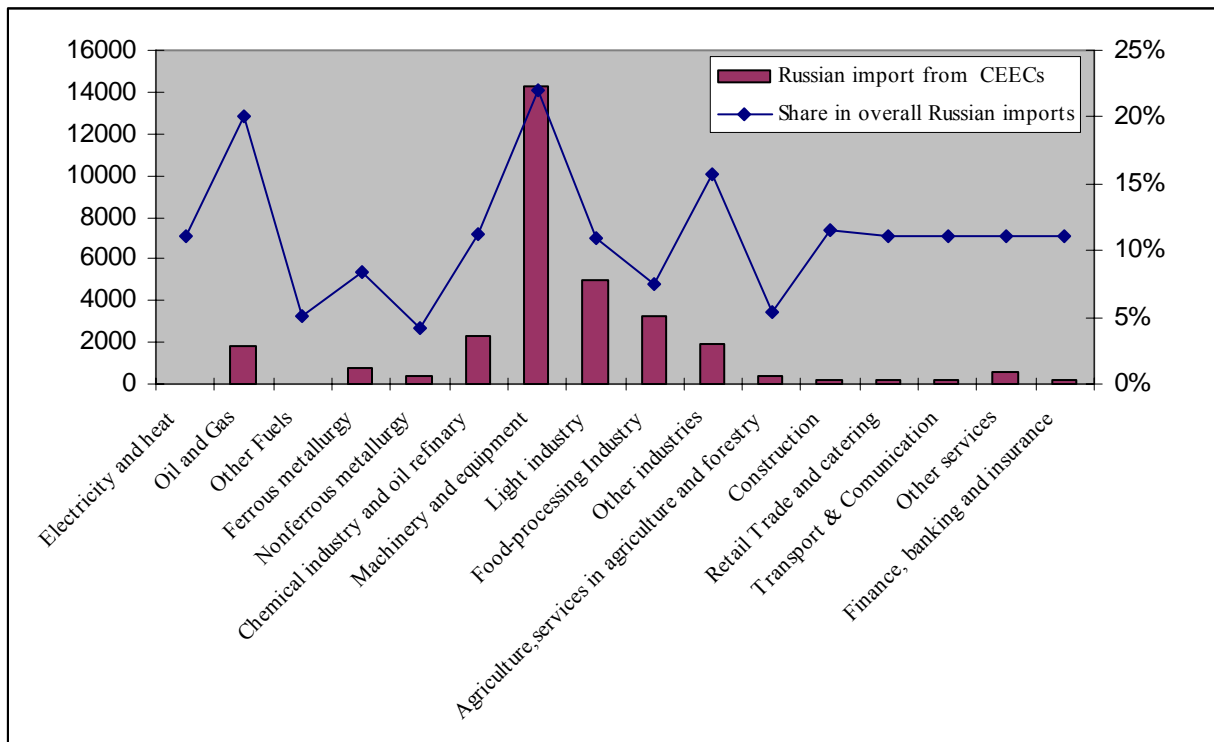
3. **Model and functional forms**

In this section the model, functional form and main variables are described[3]. The model is a comparative static CGE model that incorporates 4 regions and 15 sectors.

Regions:

- Russia

- The European Union

- Central and Eastern European Countries (CEECs)

- Rest of the World

Sectors:

Electricity and heat	Food-processing Industry
Oil and Gas	Other industries
Other Fuels	Agriculture, services and forestry
Ferrous metallurgy	Construction
Nonferrous metallurgy	Transport & Communication
Chemical industry and oil refinery	Other services
Machinery and equipment	Finance, banking and insurance
Light industry	

A comparative static (CS) model compares the economy at two distinct points in time, without modeling any explicit time periods or time path. Typically, the two states compared are the state of the economy with a given policy change and the state of the economy without the policy change. Consequently, this method of analysis does not provide any details of the adjustment path of the economy between the two points in time.

All markets in this model are perfectly competitive. The economies of all the regions are modeled as large economies. That is, changes in relative prices within the region can effect and do effect relative prices on the same goods produced in the other regions.

Since this is a multiregional model aimed at the quantitative evaluation of trade policies, Armington assumption is applied in the modeling. This means that similar goods produced in different regions are considered as different goods. In consumer's preferences these goods are aggregated into a composite commodity by means of corresponding elasticities of substitution (Armington elasticities). These elasticities were taken at the level equal to 0.9, nonetheless, a sensitivity analysis with respect to these elasticities was made and it showed that the results did not change much as Armington elasticities varied.

In each region the model introduce a representative consumer and production capacities belongs to this representative consumer. There is a government that collects tariffs and taxes and transfer all the revenues to the consumer. Government's revenues are tariff revenue from foreign trade, and tax revenue collected from domestic producers.

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[3] Detailed description of the data is presented in appendix 1.

Producers.

On the production side, we use a constant elasticity of transformation production function:

$$Y_j = \left[\sum_{i=1}^{15} \beta_{ij} \, S_{ij}^{\sigma_j^P} \right]^{\frac{1}{\sigma_j^P}}$$

(1)

where indices i and j represent products and regions respectively.

Y_j is an overall production in region i (GDP).

S_{ij} – production of good i in region j.

β_{ij} - share parameters that are calibrated in the model, $\sum_{i=1}^{15} \beta_{ij} = 1$

σ_j^P is the region j elasticity of transformation.

Consumers.

Consumers are presented by a 2 level nested CES function. The structure of consumer's demand, for example, in Russia can be represented by the following figure.

Figure 1: Consumer's demand.
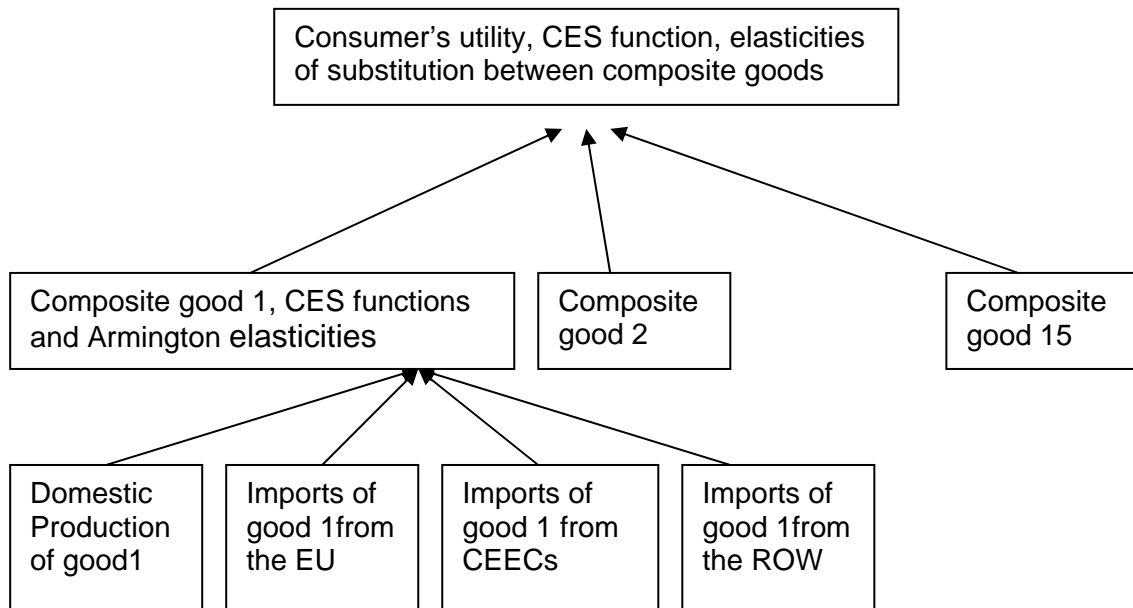
More specifically, consumer's utility is represented by the following functions.

$$U_j = \left[\sum_{i=1}^{15} \gamma_{ij} \, C_{ij}^{\frac{1}{\sigma_{ij}^P}} \right]^{\sigma_{ij}^P}$$

$(j = 1.....4)$

(2)

where

U_j - utility in region j,

γ_{ij} - the share parameter, I and j are still products and regions respectively.

C_{ij} - is the composite of type i in region j

σ_{ij}^p - is the elasticity of substitution among composites in region j.

Each composite, C_{ij}, is, in turn, given by a CES function

$$C_{ij} = \left[\sum_{k=1}^{4} \gamma_{ijk} \left(C_{ij}^k \right)^{\frac{1}{\sigma_{ij}^L}} \right]^{\sigma_{ij}^L} \qquad \begin{array}{l} (i = 1....15) \\ (j = 1.....4) \end{array} \qquad (3)$$

where

C_{ij} is the composite of type i consumed in region j,

γ_{ijk} are the share parameters for function (i, j) across the k sources of supply ($\sum_{k=1}^{4} \gamma_{ijk} = 1$),

C_{ij}^k is the consumption of good of type i in region j supplied by region k

σ_{ij}^L - lower level substitution elasticities for the function (i, j).

4. <u>Results</u>

This section analyses results of the modeling of the European Union enlargement on Russia and other regions. Equivalent and compensated variations, changes in production, redistribution of trade flows and changes in consumption for all four regions are presented.

The structure of this section is as follows. Firstly, in subsections 4.1 and 4.2 we describe the scenario and explore changes in GDPs and terms of trade, then in subsection 4.3 – changes in production in Russia an the other regions. Subsection 4.4 tries to examine the Russian exports, subsection 4.5 – imports. Finally in subsection 4.6 we present results for changes in trade flows between the European Union and the candidates.

4.1 <u>Scenario</u>

We tested the accession into the union of 10 countries candidates:
- *Malta*
- *The Czech Republic*
- *Estonia*
- *Latvia*
- *Lithuania*
- *Poland*
- *Cyprus*
- *Hungary*
- *Slovenia*
- *The Slovak Republic*

The following policy measures modeled the accession:
1. Tariffs between EU and CEECs are abolished.
2. CEECs tariffs for goods exported from Russia and ROW are to be equal to EU tariffs for Russia and ROW.

It should be mentioned a drawback of our model – nontariff barriers are not incorporated into the model. This fact may be one of the most important reasons why the results of our model are comparatively small. Therefore, in light of this reasoning our scenario can be treated as not an abolishment of tariffs between the EU and CEECs and equalization of tariffs between the countries candidates and Russia with that of EU, but as an abolishment and equalization of corresponding tariffs except for nontariff barriers. With regards to Russia, nontariffs barriers do play role in the Russian foreign trade policy, therefore, our results are to some extend skewered, namely underestimated.

4.2 Effects on GDPs and terms of trade.

Chart5: *Changes in GDPs by regions.*
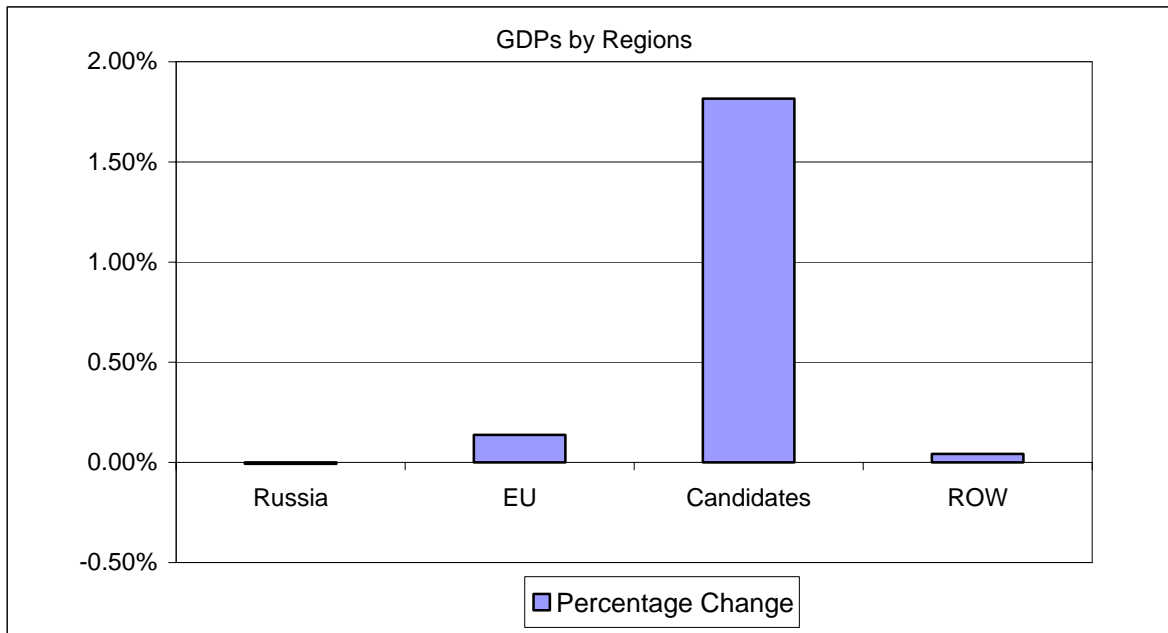
The first remarkable result of the enlargement is that changes in GDPs are small in all the regions except the Candidates. With respect to Russia this is a 0.01% fall that lays within the bounds of the measurement error in the initial data, therefore, it is approximately zero.

The sizable change in the Candidates GDP can be expected and explained by the fact that the European Union is the main trade partner of the countries-candidates, accounted for approximately 60% of an overall exports, therefore, the abolishment of trade barriers enhanced trade between these regions and, besides, improved trade patterns in terms of more efficient reallocation of the production in order to meet demands of the trade partner, decreasing distortions that were due to previous non-zero tariffs.

Table 1: Terms of trade by regions.

		Benchmark	Enlargement	Percentage Change
RUS	price of export	1.177	1.175	-0.17%
	price of import	1.172	1.169	-0.26%
	Terms of Trade	**1.004**	**1.005**	**0.09%**
EU	price of export	1.189	1.185	-0.34%
	price of import	1.170	1.167	-0.26%
	Terms of Trade	**1.016**	**1.015**	**-0.08%**
CEECs	price of export	1.167	1.138	-2.49%
	price of import	1.178	1.147	-2.63%
	Terms of Trade	**0.991**	**0.992**	**0.15%**
ROW	price of export	1.173	1.172	-0.09%
	price of import	1.192	1.191	-0.08%
	Terms of Trade	**0.984**	**0.984**	**0.00%**

Russia experiences slight gains in terms of trade, that is Russian exports become more expensive when it is compared to Russian imports. The picture for the Union is symmetric, terms of trade worsen for the members of the European Union. As regards candidates, both their exports and imports become cheaper

and this fact could be explained by relatively high initial barriers between them and existing members of the Union, while tariffs that the European Union imposes on imports from candidates are rather low, and, since, these changes in prices are not so sizable for the Union. Nonetheless, the candidates face gains in terms of trade.

4.3 Production

4.3.1 Russia

The most remarkable result of the model is that after the enlargement diversification of the Russian production is going to increase. Production in the largest Russian sector –Oil and Gas that does not include in our model oil refinery, but includes oil products is going to decrease. On the other hand, Russia's production in such industries as food-processing, agriculture, services in agriculture and forestry rises. These are the direct effects that show diversification of the production in Russia.

Chart6: Changes in the Russian production by sectors:
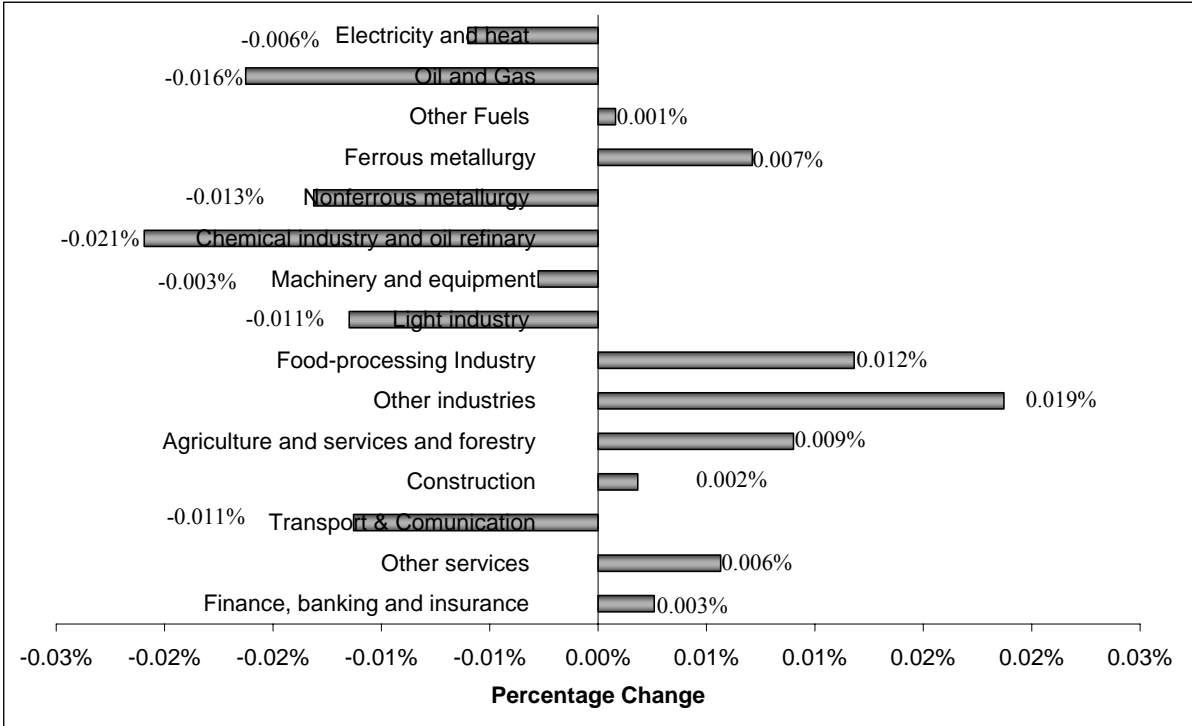
To see the reasons of such changes a more detailed and deep investigation of trade patterns is needed. We will focus on one sector, for example, Nonferrous metallurgy to see the origins of these changes.

The model uses data in nominal values, namely, millions of Euro. Therefore, in the benchmark equilibrium relative prices (with respect to the price on the first good, in our case – electricity) are all equal to one. In the new equilibrium changes in the relative producer prices show how this or that region face new conditions and how terms of trade change. If the price for a certain good in one region becomes lower that that of in the other, then we can expect that this region will export and probably produce more of this good,

and the other regions will consume more of the good produced in this favorable region (this kind of reasoning holds if other prices are hold equal, otherwise there may exist some sector where terms of trade are even better for this favorable region, and this region can switch to the second product instead of the first). Regarding Nonferrous metallurgy, the prices are as follows:

	Benchmark Equilibrium	New Equilibrium	Change
RUSSIA	1	0.999921	-0.0079%
EU	1	0.998735	-0.1265%
CEECs	1	0.985903	-1.4097%
ROW	1	0.999528	-0.0472%

The price for products of Nonferrous metallurgy is going to be the lowest in countries-candidates and the highest in Russia. Hence, Russia will import more products of this sector from abroad and produce less domestically. Figures on production, imports and exports, presented in Charts 6, 9 and 11 shows that teh production of Nonferrous metallurgy in Russia lowers together with its exports, while the Russian imports of Nonferrous metallurgy increases. Candidates trade changes in the opposite direction, see charts 8, 13, 15. Candidates production of Nonferrous Metallurgy increases, exports from CEECs increases, while imports fall.

The size of the production of Ferrous metallurgy is going to fall after the enlargement, while production of Nonferrous metallurgy , Oil and Gas decreases. These results coincide with the possible effects of the enlargement, suggested in literature. Namely, in paper by Vincent Aussilloux and Michael Pajot [3] the authors argue that Russia and the former USSR countries USSR account for 6.01% of the CEECs competition on the EU markets. It is claimed in the paper that the advantages of CEECs due to the accession will allow them to capture market shares from neighboring, non-EU countries. In such sectors as energy, ores & unprocessed minerals, iron and steel, and nonferrous metals CEECs face about 18% of competition from the former USSR countries. In these industries Russia can expect the highest losses in balance of trade.

Different sectors of services change in the opposite direction. This is explained mostly by different import tariffs that the European union and countries candidates impose on services in these sectors. More closely, differences in tariffs rates on transport and communication, retail trade and catering between candidates an the European union are much huger then differences in tariffs rates between these regions in finance banking and insurance, and other services. Therefore, after the accession, when these differences are removed Russia loses in sectors where the union and candidates experience gain in terms of trade (see table 3.3, appendix 3 for relative producer prices).

4.3.2   The EU and the candidates

Chart7: Changes in the production within the European Union by sectors:
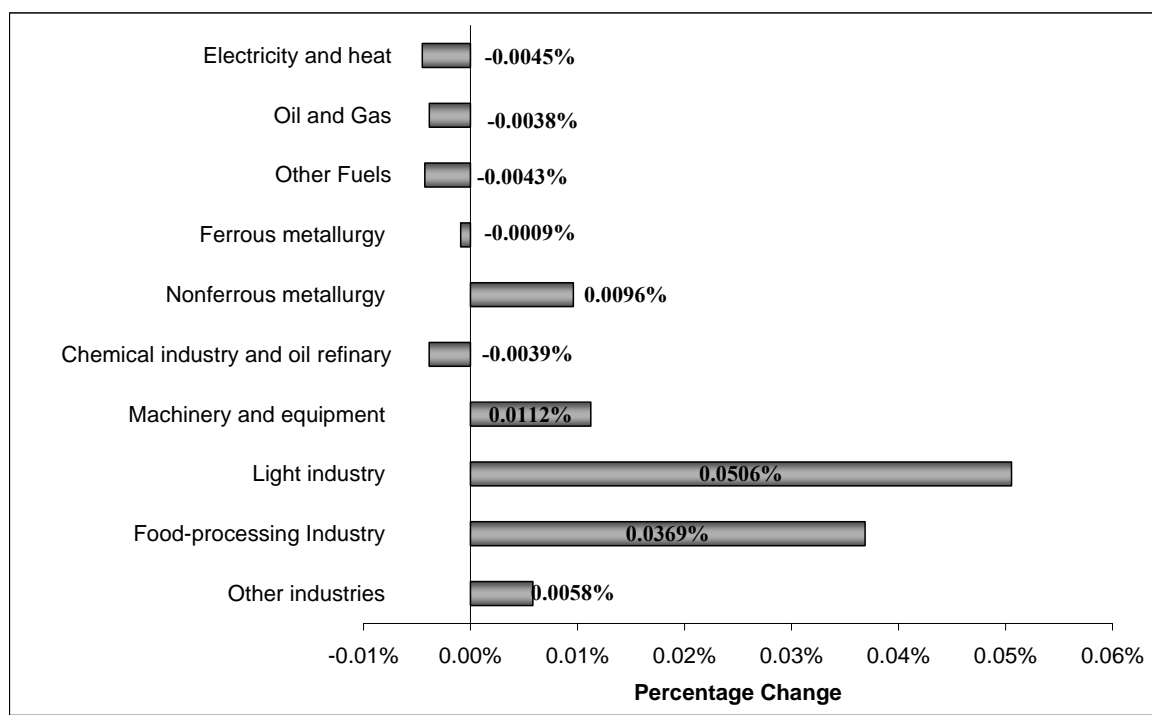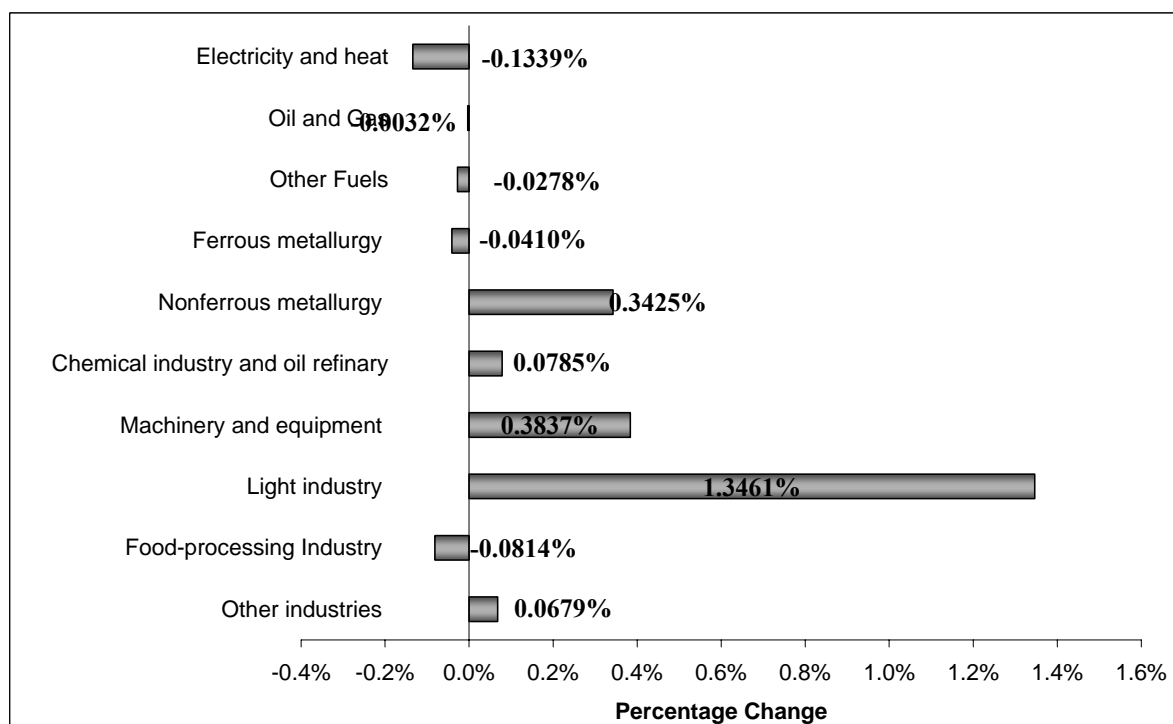

Chart8: Changes in countries-candidates production by sectors:

As we did not have data on trade in services for any region except Russia, we could not measure services sectors in the European Union and countries candidates.

Chart 7 reveals that the enlargement leads to a slight rise of production in the European union in such sector as Light industry.. Light industry in candidates rises by even 1.3%. This is mostly because these industries are export-orientated (see chart 12). The share of exports in the domestic production of products of Light industry accounts for almost 47% in the European Union, and 79% - in candidates countries.

These figures go absolutely in line with the results presented in the paper by A.M.Lejour, R.A. de Mooij, and R. Nahuis [7] which bases on the CGE analysis with the help of a perfectly worked over model that use a lot of advanced techniques and a very diverse and complete data[4]. The model used in the papers of these authors are much more advanced then ours, but, as it was already mentioned, does not incorporate Russia as a separate region, therefore, could not be used for estimation of the results of the enlargement on Russia . Nevertheless, this paper is very useful for us since it allows to check the validity of our results, comparing effects of the enlargement for the European Union and Candidates obtained in this paper with ours. Thus, such analysis can indirectly insure us that the figures for Russia are also correct.

The paper by A.M.Lejour, R.A. de Mooij, and R. Nahuis [7] suggests a huge rise in production by candidates in such sectors as Food Processing, Textiles and leather, transport equipment, electronic equipment, trade services, and Non-metallic minerals, machinery and equipment, on the other hand – drop in transport and communication, row materials. Chart 8 shows that our results are mostly the same.

4.4 Russian exports

On the trade side, Russia mainly suffers. The sum of all Russia's exports falls by 0.03% from 276499 mln euro in the benchmark equilibrium to 276414 mln euro in the new equilibrium.

This result follows from the drop in the exports of oil, gas and oil products, which are also incorporated into sector Oil and Gas. The Russian exports are mostly concentrated in such industries as Oil and Gas, nonferrous metallurgy (see charts 1 and 2), therefore, even a slight drop in these sectors result in the huge loss in nominal values.

Exports of the products of electricity and heat also fall by almost 0.7 percents. Nevertheless, the Russian exports of electricity and heat account for only 0.6% of the overall Russian exports, therefore, this

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[4] This model uses GTAP database of year 2001, version 5. In contrast with the Michigan Model this model divides EU into six regions: Germany, France, UK, Netherlands, South EU (Italy, Spain, Portugal, Greece), and Rest EU (Austria, Belgium, Luxembourg, Ireland, Denmark, Sweden, Finland). Th accession countries are divided into: Poland, Hungary, and CEEC5 (Czech Republic, Slovak Republic, Slovenia, Bulgaria, and Romania), the model does not distinguish Baltic countries from the "Rest of the World".

As regards the model equations, the production function is a nested CES function. At the lower nesting two composite goods (inputs) are produced. The first one - value added is produced by low-skilled labor, high-skilled labor, capital, and fixed factor (e.g. land), and it is modeled with the help of Cobb-Douglas function. The second is a composite input, composed by 16 intermediate inputs. At the highest nesting value added and the composite good are combined to obtain output, with the help of a CES function. One of the noteworthy features of the model is imperfect capital mobility. Namely, the model incorporates a mechanism, which distributes the investment among the regions on the bases of the value of the return to capital in the particular region.

change is to some extent negligible. Since electricity is characterized by relatively high costs of transportation of electricity (huge loses of power while transmitting by wires) it could by exported to only close neighbors, and, hence, exports and imports of electricity are small.

Chart9: Changes in the Russian exports by industries:
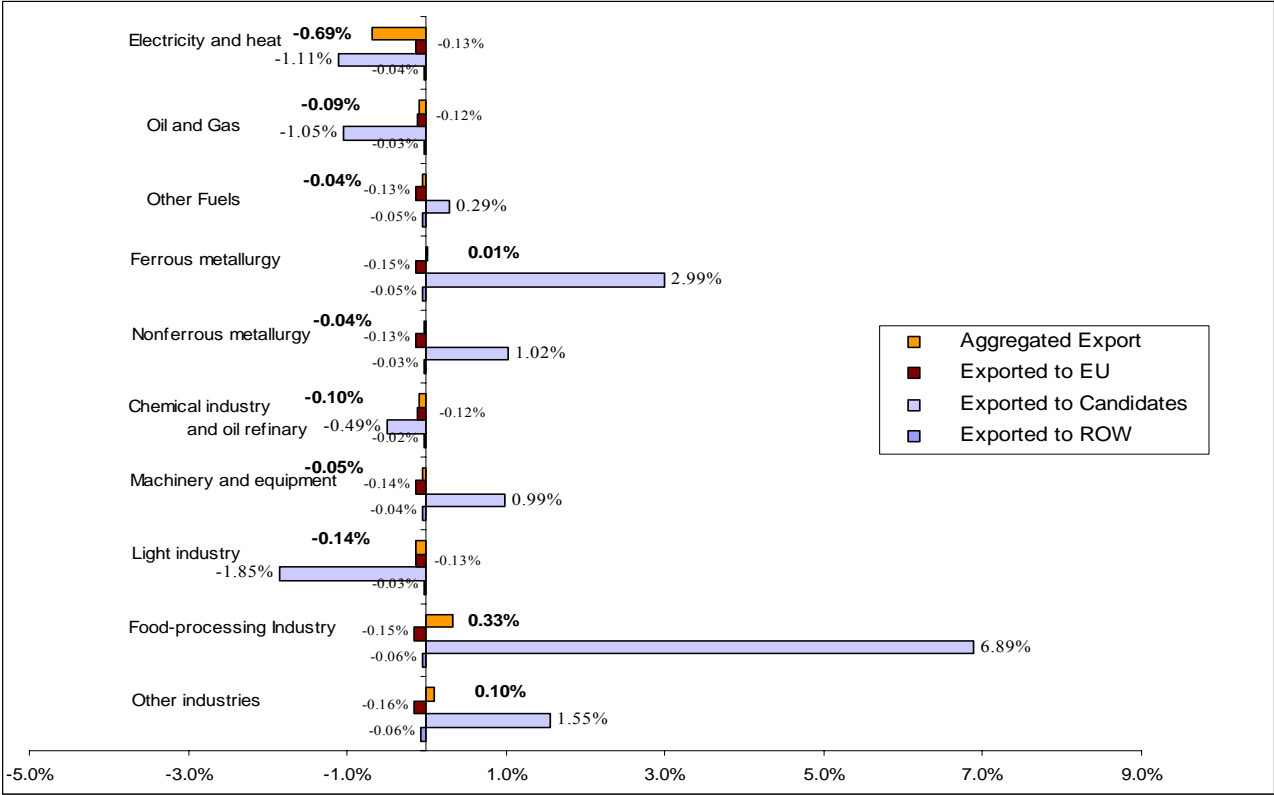
Chart10: Changes in the Russian exports in services sectors:
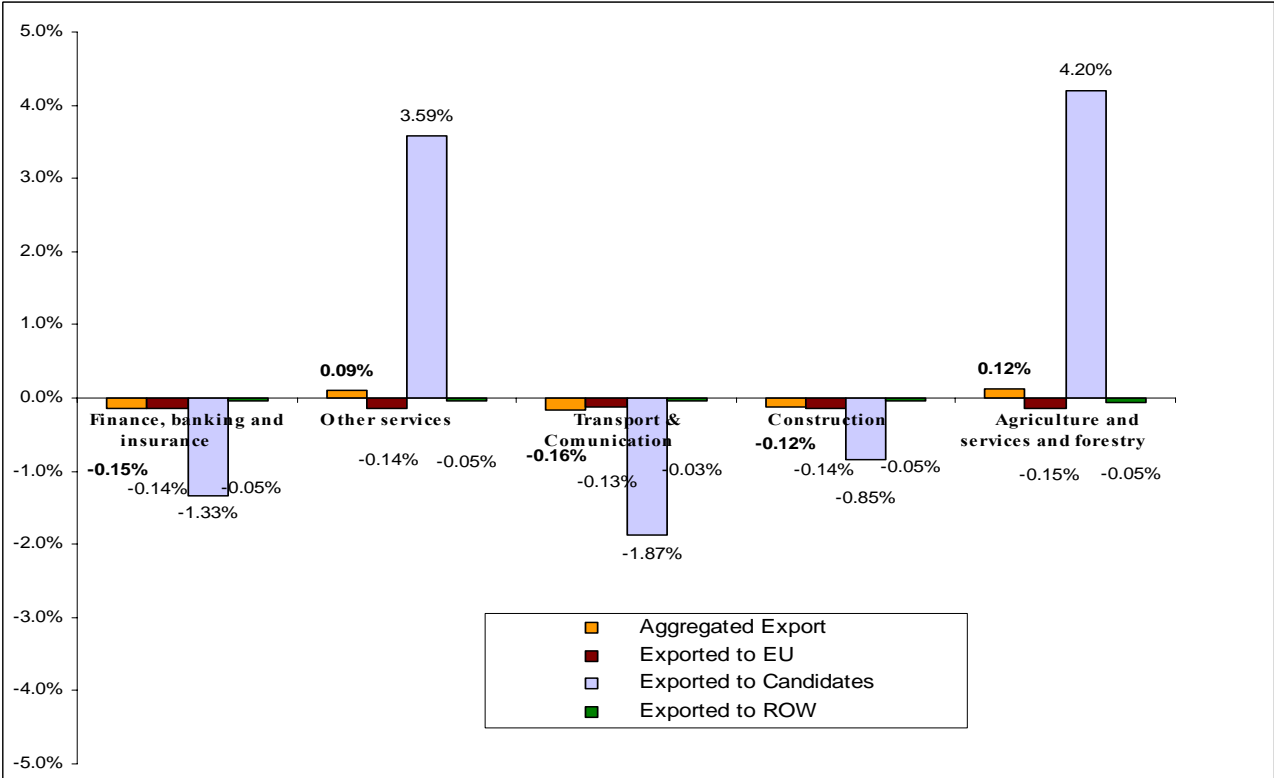
In the services sectors, we observe a slight diversification of exports. However, in terms of the overall exports the value of these sectors shrinks. The main reason is that after the enlargement the Russian exports of services face higher competition from the services produced in the European Union and countries candidates, therefore, in aggregated figures exports of services fall. But with respect to intersectional changes among services, we see that exports of agriculture, services in agriculture and forestry together with other services are going to rise, while exports of all the other services are going to fall. A remarkable feature of all these sectors is a low level of exports, therefore, all these changes result mostly from changes in domestic production and relative profitability of these sectors compared to manufacturing and power sectors.

4.5 Russian imports

The sum of all Russia's imports rises by 0.2% from 234304 mln euro in the benchmark equilibrium to 234807 mln euro in the new equilibrium.

Chart11: Changes in the Russian imports by sectors:
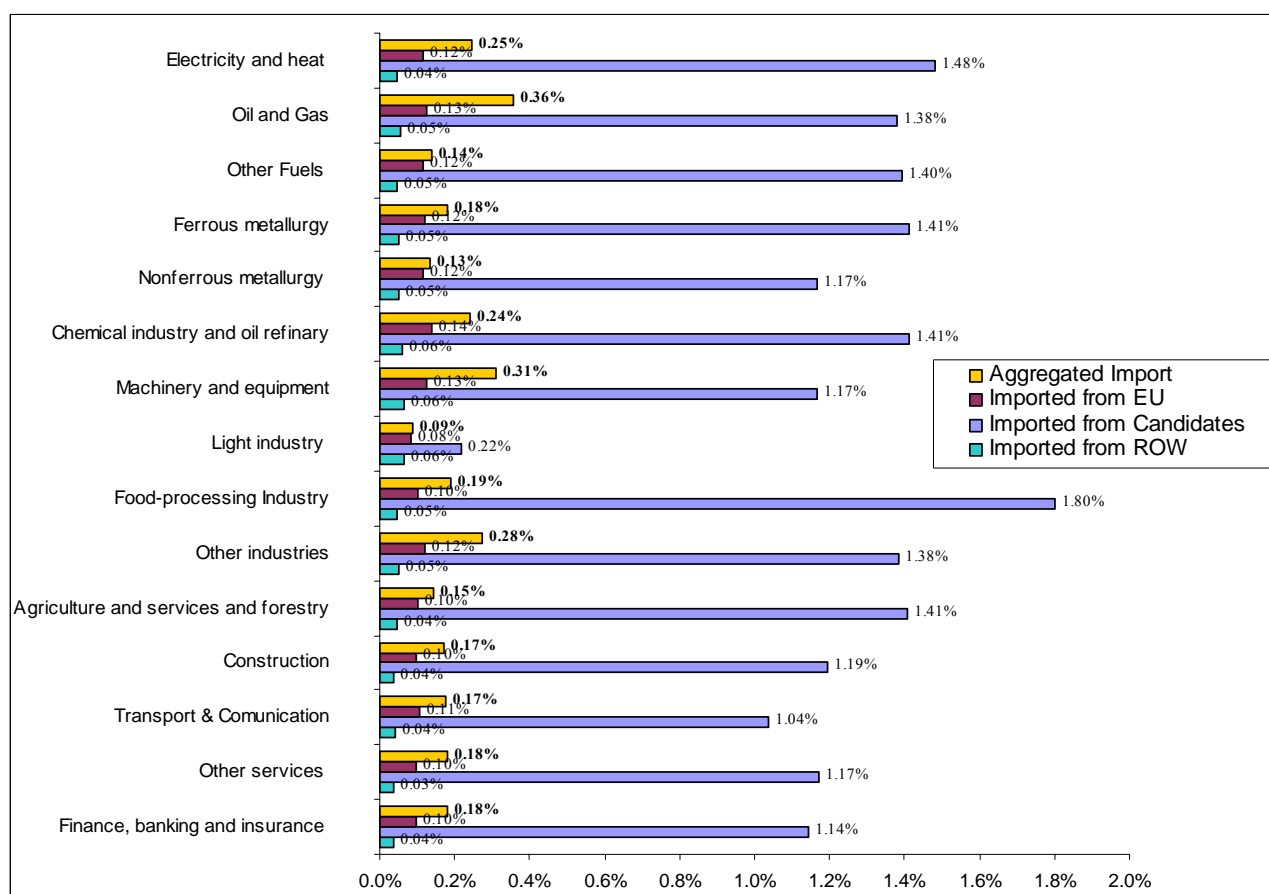
The Russian imports increase in all the sectors of the economy and this fact go strictly in line with the theory of international trade. As result of the abolishment of the trade barriers between countries candidates and the European Union relative consumer price of the goods produced in the union and candidates become lower then that of the good produced domestically in Russia, therefore, it becomes more profitable to import product from abroad, that is, in our model from candidates and the union. The amount of imported good increases up to the point when profitability of importation and domestic production of these goods are equated (the markets are perfectly competitive in the model).

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4.6   Exports and imports of the EU and the candidates

Chart12: Changes in the EU exports by industries:
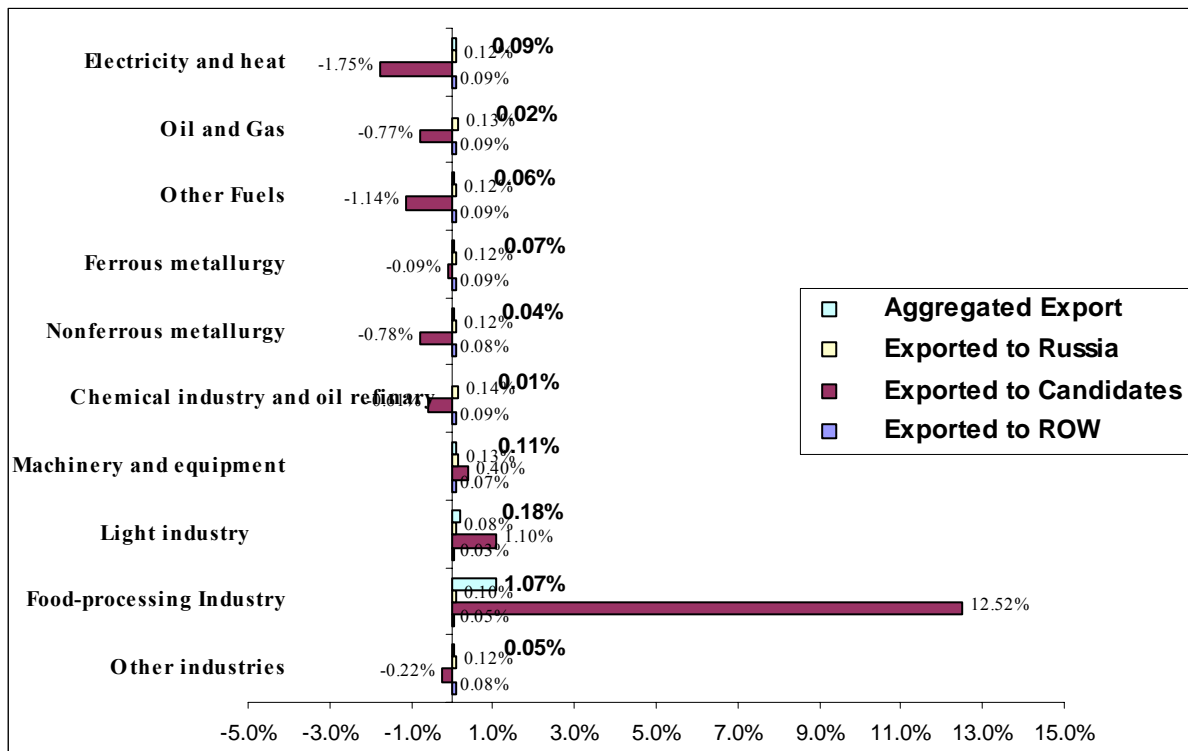
Chart13: Changes in teh candidates' exports by industries:
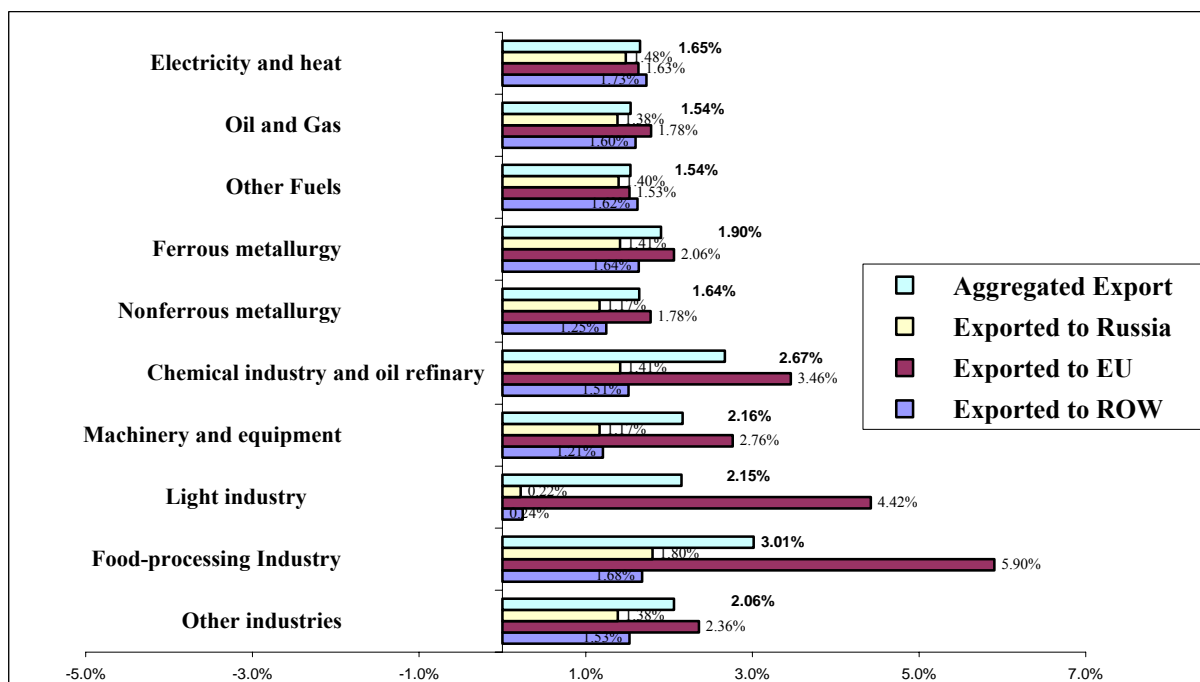
Analysis that was made shows that exports from the European Union and countries-candidates change in the absolutely opposite manner. Exports from candidates increase in all the sectors and this rise is quite sizable, while exports from the European Union do not change except for the food processing industry. To see the sources of these effects relative producer prices need to be examined. Producer prices on goods produced in the candidates fall by approximately 2% what results in more competitive characteristics of candidates

exports, hence, the exports from candidates rise. On the other hand, producer prices on goods produced in the union fall on average by only 0.1 percent (see table 3.2 appendix 3), that affects prices of exports and imports and, therefore, deteriorates terms of trade with respect to imports from candidates.

In the literature it is usually argued that candidates are going to lose in their competitiveness characteristics after the accession. For example, in the paper by Vincent Aussilloux and Michael Pajot [3] it is argued that candidates, firstly, will meet stronger competition from the side of the union, secondly, the authors state that there is relatively poor fit between demand in the EU and supply from candidates. But this fact does not contradict our results since our model explore a long run equilibrium, and therefore, in the long run the supply of candidates' exports will change in the way to fit the demand of the union.Another authors such as Martin Banse [5], Carmela Martin and Jaime Turrion [9] also argue that candidates are not going to gain more then present members of the European union, even because of the fact that candidates depend on their imports from the union, while candidates account for a small share in the European Union's imports. But still all these papers examine short run effects of the enlargement. Another argument for the validity of our results is that in the literature there is no agreement yet on the size and sign of the effects of the enlargement on the candidates. See, for example, paper by Urmas Varblane and Kristina Toming [11] on the trade impact of the enlargement on the Estonian economy. Nonetheless, even in nominal values these changes are huge and the overall rise in exports from the candidates predicted by our model is 3366 mln euro.

Effects of the enlargement on the imports to the European union and Candidates are the opposite to that of the exports. Imports to the European union increases in all the sectors, while imports to the candidates mainly fall. The reasons of such changes are absolutely the same as for the changes in the structure of exports.

Chart14: Changes in the EU imports by sectors:

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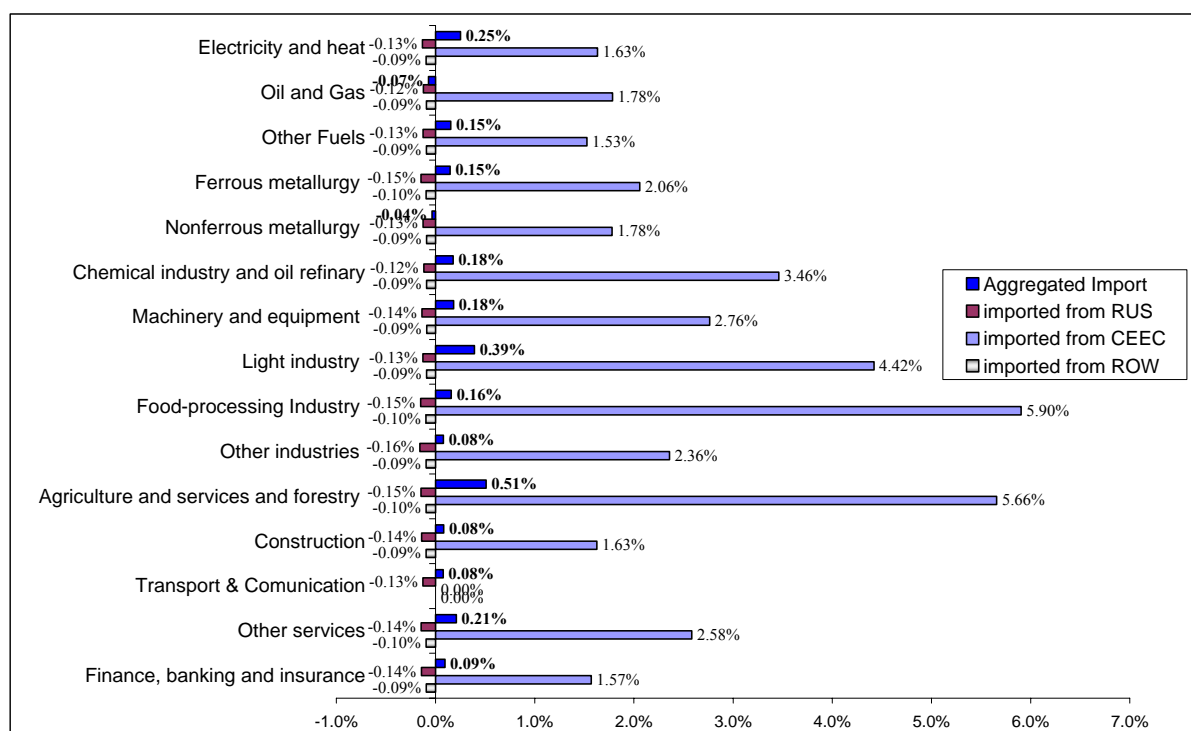
Chart15: Changes in the CEEC's imports by industries:
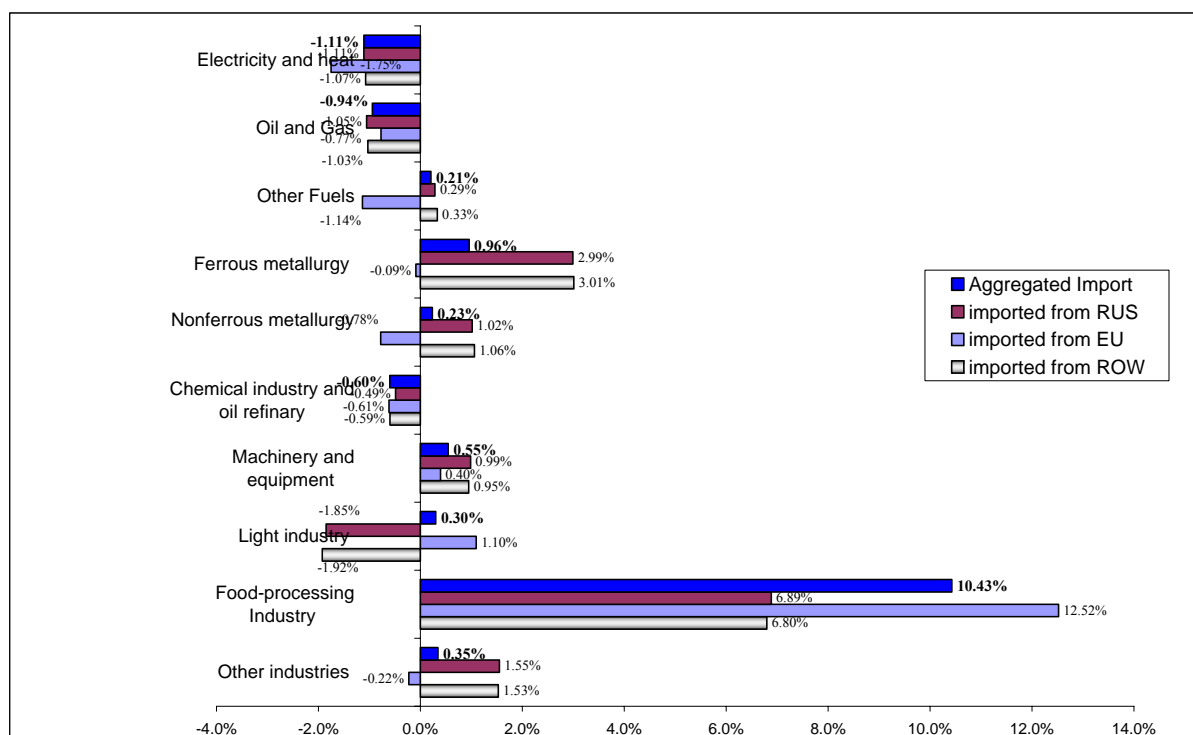
5   Sensitivity analysis

This section performs sensitivity analysis of the results of the previous sections. In particular we question the values of Armington elasticities of substitution between identical goods produced in different region. In our analysis we used an estimate of 0.9 as the Armington elasticity for all the sectors. Furthermore, by varying Armington elasticities we check this assumption and results for robustness and validity. Elasticities of substitution between sectors within the economy were fixed on the level econometrically estimated in the literature.

Table 2: elasticities of substitution among sectors:

Sector	Elasticity
Electricity and heat	0,75
Oil and Gas	0,75
Other Fuels	0,75
Ferrous metallurgy	0,806
Nonferrous metallurgy	0,806
Chemical industry and oil refinary	0,827

Machinery and equipment	0,587
Light industry	0,94
Food-processing Industry	0,789
Other industries	0,8
Agriculture and services and forestry	0,607
Construction	0,6
Retail Trade and catering	0,6
Transport & Comunication	0,6
Other services	0,6
Finance, banking and insurance	0,59

Source: : C. Ballard [4] , R. Faini [6], A.Zemtisky [1]:

The analysis made in the paper by Christine A. Mcdaniel and Edward J. Balisteri [8] was taken as a theoretical base of how these elasticities can vary. The authors run simulations and check general equilibrium models for sensitivity to the values of Armington elasticities. It is argued in the paper that Armington elasticities can vary up to rather high values. Therefore, we took elasticities from 0.5 up to 2 with step 0.2 and examined the behavior if our results.

Chart16: Production, Imports and Exports in Russia as functions of Armington elasticities:
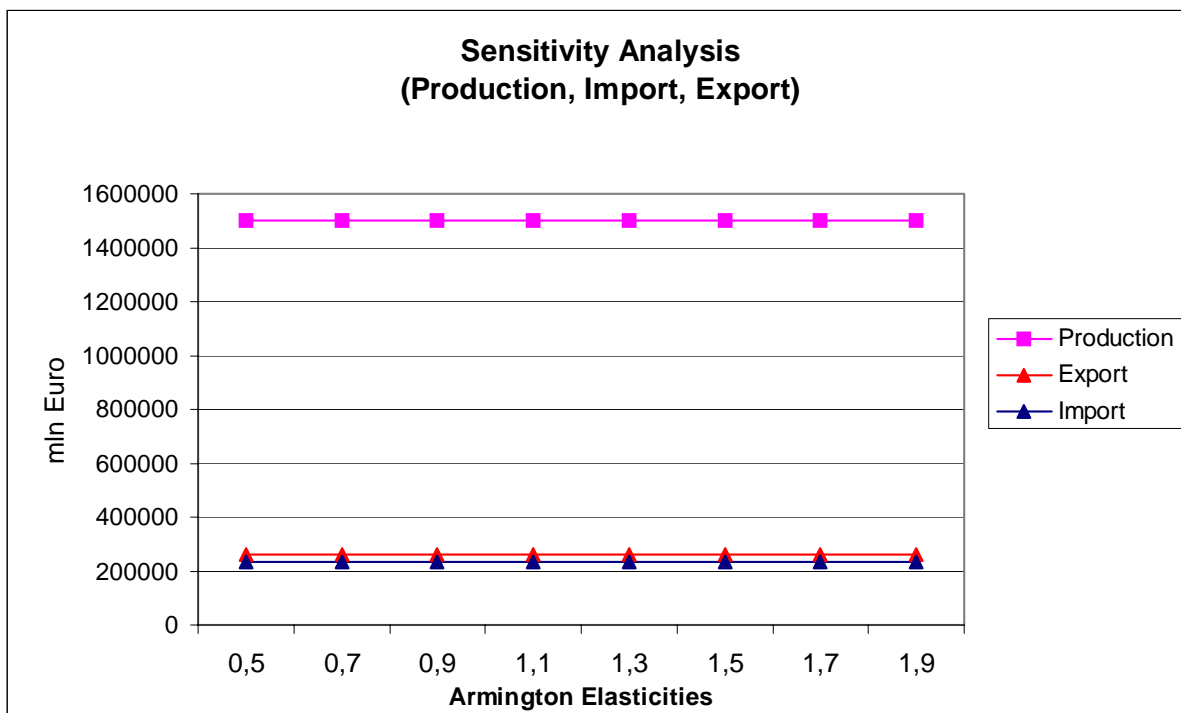
The sensitivity analysis that was made implies that our results are very robust to changes in Armington elasticities. It was shown that Armington elasticities do not influence much the production and trade patterns as well as GDPs.

6   Conclusions

In this research we explored economic consequences of the EU enlargement for Russia. The model that was used analyzed long-run effect of the EU enlargement. That is, the results of the EU enlargement after the economy reaches equilibrium. Therefore, the model cannot describe the changes that can occur during the transition.

The analysis that was made suggests deterioration of Russia's terms of trade in such industries as Oil and Gas production, Nonferrous metallurgy, Chemical industry and oil refinery, Machinery and equipment, Light industry, Electricity and Heat. Another aspect of the changes is the increase of diversification of the production in Russia. Production in the largest Russian sector –Oil and Gas that in our model do not include oil refinery, but include oil products is going to decrease. In Oil and Gas, Nonferrous Metallurgy the Russian exports are going to fall by approximately 0.09% and 0.04% correspondingly which in nominal values account for almost 64 mln euro. On the other hand, Russia's production in such industries as food-processing and agriculture, services in agriculture and forestry rises.

 Analysis of equivalent and compensated variation shows that Russia in not going to lose in terms of utilities and the overall production in Russia is not going to change at all, but, the structure of production in Russia may change a little, decreasing in the exporting sectors as Oil and Gas and increasing in the others.

Sensitivity analysis with respect to elasticities implies that the results of our model are robust to rather large changes of Armington elasticities. It was shown that such macro indicators as production, exports and imports do not change much when Armington elasticities vary.

It is worth noting that in the model we implicitly make a very important assumption – all the markets are perfectly competitive. This assumption seems to be reasonable for most sectors, but it is quite unreasonable for such a monopolistic industry as gas industry. Nevertheless, all the results of the research are still sensible and the directions of the changes can be explained by a simple economic intuition.

Future work should be devoted to the incorporation of nontariff barriers, which account for a sizable share of Russia trade barriers and an improvement of the model by implementing more realistic market structures as monopoly and monopolistic competition into some industries is also needed .

7   <u>**Bibliography**</u>

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Appendix 1: Description of the data

Classification mapping system.

The challenging point in the collection of the data was the problems with the mapping system between Russian classification of the data on production and trade in goods and services and that of in the EU and the candidates countries. Basing on 5-digit Russian production classification system OKONH we choose 15 sectors that included 10 industries, and 5 sectors presented by agriculture and services. Then, using mapping system between OKDP and OKONH provided by GOSKOMSTAT we selected 4-digit positions in ISIC (International Standard Industrial Classification of all Economic Activities) that corresponded to these sectors. Finally, corresponding positions of ISIC were mapped to NACE (classification system of the EU). As the result we obtained the mapping system between OKONH and NACE, which is presented in table [1.2]. Since the candidates use the same system as the European Union, this mapping system was also used for the data on the candidates.

Production in Russia.

The basing source of data on the Russian production was the official data provided by GOSKOMSTAT, Russian statistical year-book. The data there is presented in rubbles, therefore it was transferred to USD$ through PPP (5.41 rubles for 1$) and then to EURO through the exchange rate (0.94 EURO/1$).

It is well known that the data on production in power industries, which account for almost all Russian exports, is skewed toward zero since Russian exporters have incentives for diminution of the exports and do have enough power to implement their policies . Therefore we had to subtract the share of the production that is exported and price it by means of exports prices. The rest of the production was taken just as it was presented in the official data.

Production in the European Union.

The data on production in the EU was mostly taken from "European business 2002" (EUROSTAT). Nonetheless, not all the data was presented for the basing year of our model, therefore we had to take the table "Production in constant prices (1995-2000)" (EUROSTAT) and "Development of output prices in the EU (1995-2000)" (EUROSTAT) in order to account for the changes in prices and volumes. For some sectors, the data was available only in metric systems, and it was transferred to mln. EURO by means of prices given in database COMEXT (EUROSTAT, 2002).

Production in the candidates.

The database "Business in candidate countries: facts and figures (1995-1999)" (European Commission, 2002) provided us the data for the candidates. As in the case with the European Union, production in this database was given for the year 1998, therefore it was corrected for the rise in prices and changes in volumes using "Industrial production volumes by activities (1999-2001)" (CONSTAT), and "Manufacturing volume indices by selected branches(1999-2001)" (CONSTAT).

Note that the data in the database "Business in candidate countries: facts and figures (1995-1999)" (European Commission, 2002) was presented in EURO and transferred into EURO through exchange rates from the domestic currencies of the candidates. And in order to be consistent we transferred this data back into domestic currencies and then into EURO through PPPs, PPPs for these countries was taken from EUROSTAT, "Statistics in focus: economy and finance. Prices and purchasing power parities", European communities, 2002 and provided in table[1.1]. Data on Malta was not presented in this database, it was taken from http://www.nso.gov.mt/.

Production in agriculture was estimated with the help of "Preliminary economic accounts for agriculture in 12 candidate countries (1998-1999)" (EUROSTAT).

Production in the "Rest of the World".

Production in the "rest of the world" was estimated as a residual of subtracting production of the European Union, the candidates, and Russia from the total world's production. The data on the total world's production was provided by "World development report" (The World Bank, 2003). The overall production in all the sectors in the world was splitted into 15 sectors using shares of these sectors in the total world's production.

Trade Data.

For Russia we used an official custom database and the figures on Russian exports presented in the database COMEXT for the European Union as values imported from Russia. A classification system of Russian trade statistics TNVED was mapped to OKONH and then into the 15 sectors. For trade by the European Union COMEXT database was used and for trade by the candidates - UNCTAD-TRAINS. Trade by the "Rest of the World" was taken as a residual.

Russian tariffs.

Database "Consultant+" was taken as a main database for Russian tariffs calculation. 4-digit tariffs were weighted by the values of imports in order to get division into 15 sectors. Estimations of tariffs in the services sectors was provided in the work by Zemnitsky [1].

Tariffs of the European Union.

As an approximation of the EU tariffs the binding levels of the Uruguay Round of WTO tariffs were taken. And then they were aggregated into the 15 sectors by weighting with the imports of the European Union.

Tariffs in the candidates.

Database TRAINS was used in calculation of tariffs rates fro the candidates. Preferences in trade used by the candidates were also taken into account. Then this 6-digit system was aggregated into our 15 sectors also by weighting with the intensity of import.

Tariffs in the "Rest of the World".

Tariffs for the rest of the world were calculated as weighed average of the tariffs of all the other regions, where weights depended of the intensity of imports of this or that region.

Tables.

Table [1.1]: PPP for countries-candidates.

Country-Candidate	PPP
Cyprus (CY)	0,464054
Czech Republic	15,2133
Estonia (EE)	7,01593
Hungary (HU)	114,716
Latvia (LV)	0,262703
Lithuania (LT)	1,59778
Poland (PL)	2,01804
Slovakia (SK)	16,2184
Slovenia (SI)	133,567

Table [1.2]: Mapping system between OKONH and NACE.

	OKONH	NACE
Electricity and heat	-11100	(40.1), (40.3)
Oil and Gas	(11220),(11230)	(11.1 /0.5/), (23.2), (11.1 /0.5/), (11.2)
Other Fuels	-11300	(10.1), (10.2), (10.3)
Ferrous metallurgy	-12100	(13.1), (40.2), (23.1), (26.26), (27), (37.1)
Nonferrous metallurgy	-12200	(13.2), (14.5), (27.4), (37.1)
Chemical industry and oil refinary	-13000	(14.3), (19.3 /0.5/), (22.3), (24.1), (24.2), (24.3), (24.6), (24.7), (25)
Machinery and equipment	-14000	(22.3), (26.2), (27.5), (28), (29), (30), (31), (32), (34), (35), (33 /исключая 33.1/), (50.2 /0.5/)
Light industry	-17000	(17), (18), (19.1), (19.2), (19.3 /0.5/), (52.7)
Food-processing Industry	(18000), (19200)	(14.4), (5), (15), (16), (24.5)
Other industries	(19700), (19100), (19310), (19320), (19330), (19400), (19800), (19900), (16100)	(20.5), (24.4), (33.1), (15.7), (22.2), (14.1), (14.2), (14.5), (26.1), (26.2 /исключая 26.26/), (26.3), (26.4), (26.5), (26.6), (26.7), (26.8)
Agriculture, services in agriculture and forestry	(20000), (40000), (15000), (30000)	(1), (5), (20), (2), (21), (22.2), (36)
Construction	-60000	(11.2), (45)
Transport & Comunication	-50000	(50.2 /0.5/),(60), (61), (62), (63), (64), (71.1), (71.2)
Other services	(90000 /исключая 96000/),(80000),(70000)	(41), (5), (22.14), (55.1), (55.2), (71), (72), (73), (75), (80), (85), (90), (91), (92), (93), (95), (22.1), (37.2), (70), (74), (50 /исключая 50.2 (0.5)/), (51), (52), (55.3), (55.4), (55.5)
Finance, banking and insurance	-96000	(65), (66), (67)

Table [1.3]: Russian Tariffs

	Imported from the EU	Imported from CEEC	Imported from the ROW
Electricity and heat	5	5	5
Oil and Gas	5	5	5
Other Fuels	5	5	5
Ferrous metallurgy	8.41	8.41	8.41
Nonferrous metallurgy	8.67	8.67	8.67
Chemical industry and oil refinary	8.82	8.82	8.82
Machinery and equipment	10.78	10.78	10.78
Light industry	15.19	15.19	15.19
Food-processing Industry	9.79	9.79	9.79
Other industries	11.74	11.74	11.74
Agriculture, services in agriculture and forestry	10.7	10.7	10.7
Construction	0	0	0
Transport & Comunication	0	0	0
Other services	20	20	20
Finance, banking and insurance	25	25	25

Table [1.4]:Tariffs in the EU.

	Imported from Russia	Imported from CEEC	Imported from the ROW
Electricity and heat	0	0	0
Oil and Gas	0.61	0.31	0.61
Other Fuels	0	0	0
Ferrous metallurgy	1.14	0.57	1.14
Nonferrous metallurgy	1.37	0.69	1.37
Chemical industry and oil refinary	4.47	2.24	4.47
Machinery and equipment	3.64	1.82	3.64
Light industry	9.5	4.75	9.5
Food-processing Industry	9.48	4.74	9.48
Other industries	2.03	1.02	2.03
Agriculture, services in agriculture and forestry	9.26	4.63	9.26
Construction	0	0	0
Transport & Comunication	0	0	0
Other services	2.11	1.06	2.11
Finance, banking and insurance	0	0	0

Table [1.5]:Tariffs in the candidates.

	Imported from the EU	Imported from CEEC	Imported from the ROW
Electricity and heat	5	5	5
Oil and Gas	5	5	5
Other Fuels	5	5	5
Ferrous metallurgy	8.41	8.41	8.41
Nonferrous metallurgy	8.67	8.67	8.67
Chemical industry and oil refinary	8.82	8.82	8.82
Machinery and equipment	10.78	10.78	10.78
Light industry	15.19	15.19	15.19
Food-processing Industry	9.79	9.79	9.79
Other industries	11.74	11.74	11.74
Agriculture, services in agriculture and forestry	10.7	10.7	10.7
Construction	0	0	0
Transport & Comunication	0	0	0
Other services	20	20	20
Finance, banking and insurance	25	25	25

Table [1.6]: Tariffs in the ROW.

	Imported from Russia	Imported from the EU	Imported from CEEC
Electricity and heat	5	5	5
Oil and Gas	5	5	5
Other Fuels	5	5	5
Ferrous metallurgy	9.42	9.42	9.42
Nonferrous metallurgy	8.24	8.24	8.24
Chemical industry and oil refinary	9.4	9.4	9.4
Machinery and equipment	11.71	11.71	11.71
Light industry	17.61	17.61	17.61
Food-processing Industry	11.16	11.16	11.16
Other industries	12.78	12.78	12.78
Agriculture, services in agriculture and forestry	12.09	12.09	12.09
Construction	0	0	0
Transport & Comunication	0	0	0
Other services	0	0	0
Finance, banking and insurance	0	0	0

Table [1.7]: WTO tariffs.

	Tariff rate
Electricity and heat	5
Oil and Gas	5
Other Fuels	5
Ferrous metallurgy	8.22
Nonferrous metallurgy	8.56
Chemical industry and oil refinary	7.28
Machinery and equipment	9.19
Light industry	13.76
Food-processing Industry	9.22
Other industries	9.78
Agriculture, services in agriculture and forestry	10.48
Construction	0
Transport & Comunication	0
Other services	0
Finance, banking and insurance	0

Table[1.8]: Production by regions.

	RUS	EU	CEEC	ROW
Electricity and heat	66420.2	251124	50167.48	1151036.7
Oil and Gas	133188.49	249171.5	23570.15	1235768.17
Other Fuels	9328	13598.85	7818.93	78262.03
Ferrous metallurgy	51811.87	232835.45	50183.86	1061617.62
Nonferrous metallurgy	90553.47	64192.35	6371.27	372361.75
Chemical industry and oil refinery	49266.32	426937	57504.04	714481.49
Machinery and equipment	129532.75	1642861.33	155659.67	1034826.82
Light industry	15914.91	137774.8	22201.13	1081742.19
Food-processing Industry	131851.69	627522.7	137054.14	2091683.26
Other industries	79947.39	323965.34	51173.19	2567117.55
Agriculture and services and forestry	154445.26	583629.33	92956.46	1451547.34
Construction	117860.5	590910.97	87935.71	1462679.56
Transport & Communication	124200.41	1141157.48	82433.88	2493969.75
Other services	242926.46	7545301.44	696990.47	1.77E+07
Finance, banking and insurance	121091.51	1056642.88	29819.23	2097934.02

Appendix 2: Consumption and consumer prices.

Table [2.1]: PPP for countries-candidates.

Country-Candidate	PPP
Cyprus (CY)	0,464054
Czech Republic	15,2133
Estonia (EE)	7,01593
Hungary (HU)	114,716
Latvia (LV)	0,262703
Lithuania (LT)	1,59778
Poland (PL)	2,01804
Slovakia (SK)	16,2184
Slovenia (SI)	133,567

Table[2.2]: Production by regions.

	RUS	EU	CEEC	ROW
Electricity and heat	66420.2	251124	50167.48	1151036.7
Oil and Gas	133188.49	249171.5	23570.15	1235768.17
Other Fuels	9328	13598.85	7818.93	78262.03
Ferrous metallurgy	51811.87	232835.45	50183.86	1061617.62
Nonferrous metallurgy	90553.47	64192.35	6371.27	372361.75
Chemical industry and oil refinery	49266.32	426937	57504.04	714481.49
Machinery and equipment	129532.75	1642861.33	155659.67	1034826.82
Light industry	15914.91	137774.8	22201.13	1081742.19
Food-processing Industry	131851.69	627522.7	137054.14	2091683.26
Other industries	79947.39	323965.34	51173.19	2567117.55
Agriculture and services and forestry	154445.26	583629.33	92956.46	1451547.34
Construction	117860.5	590910.97	87935.71	1462679.56
Transport & Communication	124200.41	1141157.48	82433.88	2493969.75
Other services	242926.46	7545301.44	696990.47	1.77E+07
Finance, banking and insurance	121091.51	1056642.88	29819.23	2097934.02

Table [2.3]: Consumption in Russia of goods either produced domestically (column RUS) or imported from other regions (columns EU, CEECs, ROW correspondingly) and consumer prices.

		RUS			imported from EU			imported from CEEC			imported from ROW		
		Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change
Electricity and heat	Trade Volume	64808	64815	0.0109%	54.69	54.754	0.1170%	10.53	10.686	1.4815%	29.29	29.303	0.0444%
	Consumer Prices	0.9972	0.9972	0.0000%	1.0471	1.0456	-0.1421%	1.0471	1.0269	-1.9296%	1.0471	1.0466	-0.0427%
Oil and Gas	Trade Volume	82728	82751	0.0277%	4662.4	4668.2	0.1253%	1774.5	1799	1.3810%	2416.4	2417.6	0.0533%
	Consumer Prices	1.1189	1.1188	-0.0114%	1.1748	1.1732	-0.1414%	1.1748	1.1539	-1.7870%	1.1748	1.1743	-0.0455%
Other Fuels	Trade Volume	8381	8381.5	0.0056%	173.51	173.71	0.1176%	25.37	25.724	1.3953%	294.83	294.96	0.0451%
	Consumer Prices	1.015	1.0151	0.0076%	1.0658	1.0642	-0.1419%	1.0658	1.0464	-1.8138%	1.0658	1.0653	-0.0453%
Ferrous metallurgy	Trade Volume	24972	24974	0.0074%	2161	2163.6	0.1221%	755.91	766.58	1.4121%	6175.7	6178.7	0.0498%
	Consumer Prices	1.0222	1.0223	0.0146%	1.1082	1.1066	-0.1382%	1.1082	1.0879	-1.8282%	1.1082	1.1077	-0.0420%
Nonferrous metallurgy	Trade Volume	36097	36104	0.0207%	4980.2	4985.9	0.1164%	361.7	365.92	1.1653%	3419.9	3421.7	0.0524%
	Consumer Prices	1.0117	1.0116	-0.0079%	1.0994	1.098	-0.1264%	1.0994	1.0839	-1.4097%	1.0994	1.0989	-0.0472%
Chemical industry and oil refinary	Trade Volume	27813	27823	0.0363%	7661.3	7671.8	0.1371%	2307.5	2340.1	1.4131%	10688	10695	0.0609%
	Consumer Prices	1.0522	1.052	-0.0166%	1.145	1.1434	-0.1414%	1.145	1.1256	-1.6978%	1.145	1.1445	-0.0472%
Machinery and equipment	Trade Volume	87544	87561	0.0192%	6382.9	6390.9	0.1254%	14313	14479	1.1652%	44468	44496	0.0630%
	Consumer Prices	1.0562	1.0562	0.0036%	1.1701	1.1686	-0.1246%	1.1701	1.1541	-1.3646%	1.1701	1.1695	-0.0493%
Light industry	Trade Volume	11491	11495	0.0384%	20949	20966	0.0824%	4940.4	4951.2	0.2193%	19475	19487	0.0628%
	Consumer Prices	1.0515	1.0514	-0.0061%	1.2112	1.2102	-0.0811%	1.2112	1.2074	-0.3134%	1.2112	1.2106	-0.0477%
Food-processing Industry	Trade Volume	123684	123672	-0.0093%	9150.8	9160	0.0998%	3212.3	3270.2	1.8020%	30298	30312	0.0468%
	Consumer Prices	1.1311	1.1313	0.0198%	1.2418	1.2406	-0.0962%	1.2418	1.2186	-1.8724%	1.2418	1.2413	-0.0399%
Other industries	Trade Volume	60841	60837	-0.0067%	2844.3	2847.7	0.1182%	1902.9	1929.3	1.3848%	7357.5	7361.1	0.0489%
	Consumer Prices	1.0422	1.0425	0.0274%	1.1646	1.163	-0.1306%	1.1646	1.1446	-1.7094%	1.1646	1.1641	-0.0430%
Agriculture and services and forestry	Trade Volume	139357	139352	-0.0031%	4007.2	4011.2	0.1000%	422.86	428.82	1.4097%	3504.3	3505.8	0.0442%
	Consumer Prices	1.0169	1.0171	0.0167%	1.1257	1.1244	-0.1120%	1.1257	1.1063	-1.7219%	1.1257	1.1252	-0.0424%
Construction	Trade Volume	115878	115883	0.0040%	18.45	18.468	0.0976%	167.72	169.72	1.1943%	1273	1273.4	0.0354%
	Consumer Prices	1.0372	1.0373	0.0087%	1.0372	1.0357	-0.1426%	1.0372	1.0173	-1.9219%	1.0372	1.0368	-0.0429%
Transport & Comunication	Trade Volume	104102	104121	0.0176%	731.12	731.89	0.1055%	233.47	235.89	1.0378%	1144.1	1144.6	0.0428%
	Consumer Prices	1.0138	1.0137	-0.0058%	1.0138	1.0123	-0.1520%	1.0138	0.9967	-1.6828%	1.0138	1.0133	-0.0477%
Other services	Trade Volume	234296	234301	0.0024%	2564.4	2566.8	0.0958%	818.91	828.52	1.1729%	4012.9	4014.3	0.0350%
	Consumer Prices	0.75	0.7501	0.0129%	0.9	0.8987	-0.1424%	0.9	0.8828	-1.9080%	0.9	0.8996	-0.0413%
Finance, banking and insurance	Trade Volume	119849	119854	0.0041%	748.99	749.71	0.0960%	239.18	241.92	1.1435%	1172.1	1172.5	0.0358%
	Consumer Prices	1.0002	1.0003	0.0096%	1.2503	1.2485	-0.1433%	1.2503	1.227	-1.8613%	1.2503	1.2497	-0.0432%

Table [2.4]: consumption in EU of goods either produced domestically (column EU) or imported from other regions (columns RUS, CEECs, ROW correspondingly) and consumer prices.

		imported from RUS			EU			imported from CEEC			imported from ROW		
		Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change
Electricity and heat	Trade Volume	40.04	39.987	-0.1324%	248905	248892	-0.0053%	150.67	153.13	1.6334%	556.54	556.01	-0.0949%
	Consumer Prices	1.05	1.05	0.0000%	1.05	1.0485	-0.1421%	1.05	1.0297	-1.9296%	1.05	1.0496	-0.0428%
Oil and Gas	Trade Volume	10753	10739	-0.1230%	228681	228668	-0.0060%	942	958.8	1.7839%	56381	56329	-0.0924%
	Consumer Prices	1.0765	1.0764	-0.0114%	1.07	1.0685	-0.1414%	1.0733	1.0509	-2.0905%	1.0765	1.076	-0.0454%
Other Fuels	Trade Volume	3.18	3.176	-0.1258%	13332	13331	-0.0056%	802.37	814.61	1.5256%	4463.2	4459.1	-0.0925%
	Consumer Prices	1.15	1.1501	0.0076%	1.15	1.1484	-0.1418%	1.15	1.1291	-1.8138%	1.15	1.1495	-0.0453%
Ferrous metallurgy	Trade Volume	8240.1	8228.1	-0.1463%	208434	208416	-0.0089%	3266.4	3333.6	2.0598%	15850	15835	-0.0955%
	Consumer Prices	1.1631	1.1633	0.0146%	1.15	1.1484	-0.1382%	1.1566	1.129	-2.3847%	1.1631	1.1626	-0.0420%
Nonferrous metallurgy	Trade Volume	17364	17342	-0.1261%	34001	33995	-0.0194%	2065.5	2102.2	1.7789%	39112	39077	-0.0908%
	Consumer Prices	1.1658	1.1657	-0.0079%	1.15	1.1485	-0.1264%	1.1579	1.1338	-2.0853%	1.1658	1.1652	-0.0472%
Chemical industry and oil refinary	Trade Volume	10860	10847	-0.1183%	353149	353128	-0.0059%	5002.9	5176	3.4601%	49225	49181	-0.0908%
	Consumer Prices	1.2014	1.2012	-0.0166%	1.15	1.1484	-0.1414%	1.1758	1.1305	-3.8516%	1.2014	1.2008	-0.0471%
Machinery and equipment	Trade Volume	25178	25144	-0.1365%	1E+06	1E+06	-0.0210%	35647	36632	2.7641%	311399	311123	-0.0888%
	Consumer Prices	1.1919	1.1919	0.0036%	1.15	1.1486	-0.1247%	1.1709	1.1343	-3.1278%	1.1919	1.1913	-0.0493%
Light industry	Trade Volume	2991.1	2987.3	-0.1277%	72970	72926	-0.0603%	7988.9	8342	4.4206%	63437	63380	-0.0903%
	Consumer Prices	1.2593	1.2592	-0.0061%	1.15	1.1491	-0.0810%	1.2046	1.1464	-4.8338%	1.2593	1.2586	-0.0477%
Food-processing Industry	Trade Volume	2467.2	2463.5	-0.1510%	580571	580300	-0.0467%	1428.9	1513.3	5.9034%	29126	29098	-0.0974%
	Consumer Prices	1.1495	1.1498	0.0198%	1.05	1.049	-0.0962%	1.0998	1.0303	-6.3131%	1.1495	1.1491	-0.0398%
Other industries	Trade Volume	11170	11152	-0.1579%	219042	219007	-0.0156%	5930	6069.9	2.3592%	62935	62876	-0.0945%
	Consumer Prices	1.1733	1.1737	0.0274%	1.15	1.1485	-0.1307%	1.1617	1.1303	-2.7019%	1.1733	1.1728	-0.0430%
Agriculture and services and forestry	Trade Volume	5856.7	5848	-0.1482%	552295	552116	-0.0324%	5684.6	6006.2	5.6576%	42032	41992	-0.0951%
	Consumer Prices	1.2565	1.2567	0.0167%	1.15	1.1487	-0.1120%	1.2032	1.1302	-6.0709%	1.2565	1.256	-0.0424%
Construction	Trade Volume	769.4	768.32	-0.1410%	581643	581615	-0.0049%	754.88	767.16	1.6264%	5581.1	5575.8	-0.0946%
	Consumer Prices	1.15	1.1501	0.0087%	1.15	1.1484	-0.1426%	1.15	1.1279	-1.9219%	1.15	1.1495	-0.0430%
Transport & Comunication	Trade Volume	7801.3	7791.3	-0.1280%	984547	984582	0.0036%	17918	18170	0.0000%	132475	132356	0.0000%
	Consumer Prices	1.15	1.1499	-0.0058%	1.15	1.1483	-0.1520%	1.15	1.1306	-1.6828%	1.15	1.1495	-0.0477%
Other services	Trade Volume	3350.1	3345.3	-0.1449%	7E+06	7E+06	-0.0050%	10438	10707	2.5823%	77171	77097	-0.0961%
	Consumer Prices	1.0722	1.0723	0.0130%	1.05	1.0485	-0.1425%	1.0611	1.03	-2.9370%	1.0722	1.0717	-0.0413%
Finance, banking and insurance	Trade Volume	482.21	481.53	-0.1418%	1E+06	1E+06	-0.0042%	1509.5	1533.2	1.5698%	11160	11150	-0.0944%
	Consumer Prices	1.2	1.2001	0.0096%	1.2	1.1983	-0.1433%	1.2	1.1777	-1.8613%	1.2	1.1995	-0.0432%

Table [2.5]: consumption in CEECs of goods either produced domestically (column CEEC) or imported from other regions (columns RUS, EU, ROW correspondingly) and consumer prices.

		imported from RUS			imported from EU			CEEC			imported from ROW		
		Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change
Electricity and heat	Trade Volume	969.99	959.23	-1.1097%	6.11	6.003	-1.7512%	49949	49879	-0.1417%	138.43	136.95	-1.0713%
	Consumer Prices	1.0591	1.05	-0.8625%	1.05	1.0485	-0.1421%	1.05	1.0297	-1.9296%	1.0591	1.0496	-0.9049%
Oil and Gas	Trade Volume	1975.8	1955	-1.0516%	1850.2	1835.9	-0.7716%	20068	20013	-0.2722%	979.81	969.72	-1.0300%
	Consumer Prices	1.0865	1.0764	-0.9272%	1.0819	1.0685	-1.2377%	1.07	1.0509	-1.7870%	1.0864	1.076	-0.9511%
Other Fuels	Trade Volume	11.49	11.523	0.2872%	10.38	10.262	-1.1368%	6854.8	6837.8	-0.2477%	103.55	103.9	0.3332%
	Consumer Prices	1.1783	1.1501	-2.3936%	1.1581	1.1484	-0.8360%	1.15	1.1291	-1.8138%	1.1783	1.1495	-2.4452%
Ferrous metallurgy	Trade Volume	769.61	792.65	2.9940%	3135.4	3132.7	-0.0859%	45642	45535	-0.2345%	829.62	854.61	3.0116%
	Consumer Prices	1.2276	1.1633	-5.2414%	1.1717	1.1484	-1.9906%	1.15	1.129	-1.8283%	1.2272	1.1626	-5.2595%
Nonferrous metallurgy	Trade Volume	1342.7	1356.3	1.0172%	1422.1	1411	-0.7762%	3667.3	3644.7	-0.6159%	468.34	473.31	1.0616%
	Consumer Prices	1.2039	1.1657	-3.1789%	1.1629	1.1485	-1.2326%	1.15	1.1338	-1.4097%	1.2041	1.1652	-3.2262%
Chemical industry and oil refinary	Trade Volume	1102.1	1096.7	-0.4860%	9263.9	9207.2	-0.6126%	49287	49113	-0.3536%	2841.3	2824.5	-0.5937%
	Consumer Prices	1.2202	1.2012	-1.5526%	1.1648	1.1484	-1.4132%	1.15	1.1305	-1.6978%	1.2183	1.2008	-1.4340%
Machinery and equipment	Trade Volume	2041.4	2061.5	0.9861%	46606	46791	0.3960%	98221	97576	-0.6566%	15413	15560	0.9492%
	Consumer Prices	1.2306	1.1919	-3.1457%	1.1782	1.1486	-2.5131%	1.15	1.1343	-1.3647%	1.2295	1.1913	-3.1065%
Light industry	Trade Volume	107.27	105.29	-1.8477%	7641.7	7725.5	1.0969%	4759.7	4683.5	-1.6001%	2619.2	2568.8	-1.9242%
	Consumer Prices	1.2596	1.2592	-0.0335%	1.1878	1.1491	-3.2637%	1.15	1.1464	-0.3134%	1.258	1.2586	0.0528%
Food-processing Industry	Trade Volume	490.09	523.84	6.8855%	3806.9	4283.5	12.5210%	132239	131982	-0.1942%	1718.3	1835.1	6.7989%
	Consumer Prices	1.2644	1.1498	-9.0668%	1.2214	1.049	-14.1130%	1.05	1.0303	-1.8724%	1.2625	1.1491	-8.9850%
Other industries	Trade Volume	2580.9	2621	1.5527%	10315	10291	-0.2250%	42421	42276	-0.3431%	2341.6	2377.4	1.5310%
	Consumer Prices	1.2193	1.1737	-3.7461%	1.17	1.1485	-1.8387%	1.15	1.1303	-1.7095%	1.2182	1.1728	-3.7231%
Agriculture and services and forestry	Trade Volume	749.06	780.5	4.1966%	3006.6	3298.6	9.7119%	86160	85874	-0.3316%	1085.9	1130.6	4.1235%
	Consumer Prices	1.3434	1.2567	-6.4559%	1.3004	1.1487	-11.6661%	1.15	1.1302	-1.7220%	1.3416	1.256	-6.3829%
Construction	Trade Volume	98.4	97.561	-0.8526%	1102	1094.1	-0.7176%	86819	86689	-0.1488%	347.08	344.46	-0.7537%
	Consumer Prices	1.1635	1.1501	-1.1479%	1.1635	1.1484	-1.2974%	1.15	1.1279	-1.9219%	1.1641	1.1495	-1.2575%
Transport & Comunication	Trade Volume	997.76	979.08	-1.8724%	18572	18248	0.0000%	61160	60935	-0.3674%	5658.1	5554.3	0.0000%
	Consumer Prices	1.15	1.1499	-0.0058%	1.15	1.1483	-0.1520%	1.15	1.1306	-1.6828%	1.15	1.1495	-0.0477%
Other services	Trade Volume	428.47	443.83	3.5855%	9526.2	9471.3	-0.5764%	683990	682886	-0.1615%	3179.3	3299.2	3.7737%
	Consumer Prices	1.1388	1.0723	-5.8425%	1.064	1.0485	-1.4531%	1.05	1.03	-1.9081%	1.1405	1.0717	-6.0322%
Finance, banking and insurance	Trade Volume	61.67	60.85	-1.3297%	3221.4	3182.9	-1.1940%	27555	27499	-0.2043%	949.23	937.39	0.0000%
	Consumer Prices	1.2076	1.2001	-0.6165%	1.2076	1.1983	-0.7685%	1.2	1.1777	-1.8613%	1.208	1.1995	-0.7085%

Table [2.6]: consumption in ROW of goods either produced domestically (column ROW) or imported from other regions (columns RUS, EU, CEEC correspondingly) and consumer prices.

		imported from RUS			imported from EU			imported from CEEC			ROW		
		Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change	Benchmark	Counterfactual	Percentage Change
Electricity and heat	Trade Volume	602.62	602.39	-0.0382%	2158.3	2160.2	0.0898%	56.84	57.823	1.7294%	1E+06	1E+06	0.0002%
	Consumer Prices	1.084	1.084	0.0000%	1.084	1.0825	-0.1422%	1.08402	1.0631	-1.9297%	1.0324	1.032	-0.0427%
Oil and Gas	Trade Volume	37732	37721	-0.0280%	13978	13990	0.0892%	785.85	798.402	1.5973%	1E+06	1E+06	0.0027%
	Consumer Prices	1.1406	1.1405	-0.0114%	1.1406	1.139	-0.1414%	1.14062	1.12023	-1.7870%	1.0863	1.0858	-0.0455%
Other Fuels	Trade Volume	932.3	931.88	-0.0450%	82.95	83.024	0.0892%	136.44	138.653	1.6220%	73400	73402	0.0026%
	Consumer Prices	1.1603	1.1603	0.0076%	1.1603	1.1586	-0.1419%	1.16025	1.13921	-1.8138%	1.105	1.1045	-0.0453%
Ferrous metallurgy	Trade Volume	17830	17821	-0.0513%	19105	19121	0.0862%	519.89	528.394	1.6357%	1E+06	1E+06	-0.0005%
	Consumer Prices	1.2117	1.2119	0.0146%	1.2117	1.21	-0.1382%	1.21172	1.18956	-1.8282%	1.1074	1.1069	-0.0420%
Nonferrous metallurgy	Trade Volume	35751	35739	-0.0311%	23789	23807	0.0757%	276.82	280.272	1.2470%	329361	329375	0.0043%
	Consumer Prices	1.1949	1.1948	-0.0079%	1.1949	1.1934	-0.1265%	1.19486	1.17802	-1.4096%	1.1039	1.1034	-0.0472%
Chemical industry and oil refinary	Trade Volume	9491.8	9489.6	-0.0233%	56863	56913	0.0892%	906.27	919.994	1.5143%	651726	651754	0.0042%
	Consumer Prices	1.2224	1.2222	-0.0166%	1.2224	1.2207	-0.1414%	1.22244	1.20168	-1.6979%	1.1174	1.1169	-0.0472%
Machinery and equipment	Trade Volume	14769	14763	-0.0415%	343520	343774	0.0741%	7479.78	7569.96	1.2056%	663546	663588	0.0062%
	Consumer Prices	1.2497	1.2498	0.0036%	1.2497	1.2482	-0.1247%	1.24974	1.23268	-1.3647%	1.1187	1.1182	-0.0493%
Light industry	Trade Volume	1325.9	1325.5	-0.0327%	36215	36228	0.0348%	4512.14	4523.17	0.2445%	996211	996259	0.0048%
	Consumer Prices	1.3139	1.3138	-0.0061%	1.3139	1.3128	-0.0811%	1.3139	1.30978	-0.3134%	1.1172	1.1166	-0.0478%
Food-processing Industry	Trade Volume	5210.8	5207.8	-0.0560%	33994	34010	0.0484%	174.21	177.131	1.6767%	2E+06	2E+06	-0.0023%
	Consumer Prices	1.1972	1.1975	0.0198%	1.1972	1.1961	-0.0962%	1.19723	1.17481	-1.8723%	1.077	1.0766	-0.0398%
Other industries	Trade Volume	5355.3	5351.9	-0.0629%	91765	91838	0.0795%	918.93	932.944	1.5250%	2E+06	2E+06	0.0006%
	Consumer Prices	1.2564	1.2568	0.0275%	1.2564	1.2548	-0.1306%	1.25644	1.23497	-1.7094%	1.1141	1.1136	-0.0431%
Agriculture and services and forestry	Trade Volume	8482.7	8478.1	-0.0532%	24320	24336	0.0627%	689.24	699.832	1.5368%	1E+06	1E+06	-0.0001%
	Consumer Prices	1.2393	1.2395	0.0167%	1.2393	1.2379	-0.1120%	1.2393	1.21796	-1.7219%	1.1056	1.1052	-0.0423%
Construction	Trade Volume	1114.4	1113.8	-0.0460%	8147.5	8154.9	0.0902%	194.6	197.953	1.7230%	1E+06	1E+06	0.0004%
	Consumer Prices	1.1124	1.1125	0.0087%	1.1124	1.1108	-0.1426%	1.1124	1.09102	-1.9219%	1.1124	1.1119	-0.0429%
Transport & Comunication	Trade Volume	11299	11295	-0.0329%	137307	137443	0.0000%	3122.42	3169.27	0.0000%	2E+06	2E+06	0.0048%
	Consumer Prices	1.1046	1.1045	-0.0059%	1.1046	1.1029	-0.1520%	1.1046	1.08601	-1.6828%	1.1046	1.1041	-0.0477%
Other services	Trade Volume	4852.2	4849.8	-0.0499%	70430	70494	0.0000%	1743.55	1773.37	1.7101%	2E+07	2E+07	0.0011%
	Consumer Prices	0.95	0.9501	0.0129%	0.95	0.9486	-0.1424%	0.95	0.93187	-1.9081%	0.95	0.9496	-0.0437%
Finance, banking and insurance	Trade Volume	698.41	698.08	-0.0468%	23817	23838	0.0909%	515.09	523.674	1.6665%	2E+06	2E+06	0.0007%
	Consumer Prices	1.1334	1.1335	0.0095%	1.1334	1.1318	-0.1434%	1.1334	1.1123	-1.8613%	1.1334	1.1329	-0.0432%

Appendix 3: Relative producer prices.

Table [3.1]: Relative producer prices on the Russian goods (base price – price of electricity produced by Russia)

	Benchmark	EU Enlargement	Percentage Change
Electricity and heat	1	1	0.0000%
Oil and Gas	1	0.99989	-0.0114%
Other Fuels	1	1.00008	0.0076%
Ferrous metallurgy	1	1.00015	0.0146%
Nonferrous metallurgy	1	0.99992	-0.0079%
Chemical industry and oil refinery	1	0.99983	-0.0166%
Machinery and equipment	1	1.00004	0.0036%
Light industry	1	0.99994	-0.0061%
Food-processing Industry	1	1.0002	0.0198%
Other industries	1	1.00028	0.0275%
Agriculture and services and forestry	1	1.00017	0.0167%
Construction	1	1.00009	0.0087%
Transport & Communication	1	0.99994	-0.0059%
Other services	1	1.00013	0.0130%
Finance, banking and insurance	1	1.0001	0.0095%

Table [3.2]: Relative producer prices on EU goods (base price – price of electricity produced by Russia)

	Benchmark	EU Enlargement	Percentage Change
Electricity and heat	1	0.99858	-0.1421%
Oil and Gas	1	0.99859	-0.1414%
Other Fuels	1	0.99858	-0.1419%
Ferrous metallurgy	1	0.99862	-0.1381%
Nonferrous metallurgy	1	0.99874	-0.1265%
Chemical industry and oil refinery	1	0.99859	-0.1414%
Machinery and equipment	1	0.99875	-0.1247%
Light industry	1	0.99919	-0.0810%
Food-processing Industry	1	0.99904	-0.0962%
Other industries	1	0.99869	-0.1307%
Agriculture and services and forestry	1	0.99888	-0.1120%
Construction	1	0.99857	-0.1426%
Transport & Communication	1	0.99848	-0.1520%
Other services	1	0.99858	-0.1425%
Finance, banking and insurance	1	0.99857	-0.1434%

Table [3.3]: Relative producer prices on CEECs goods (base price – price of electricity produced by Russia)

	Benchmark	EU Enlargement	Percentage Change
Electricity and heat	1	0.9807	-1.9296%
Oil and Gas	1	0.98213	-1.7870%
Other Fuels	1	0.98186	-1.8138%
Ferrous metallurgy	1	0.98172	-1.8283%
Nonferrous metallurgy	1	0.9859	-1.4097%
Chemical industry and oil refinery	1	0.98302	-1.6979%
Machinery and equipment	1	0.98635	-1.3647%
Light industry	1	0.99687	-0.3134%
Food-processing Industry	1	0.98128	-1.8724%
Other industries	1	0.98291	-1.7094%
Agriculture and services and forestry	1	0.98278	-1.7220%
Construction	1	0.98078	-1.9219%
Transport & Communication	1	0.98317	-1.6828%
Other services	1	0.98092	-1.9081%
Finance, banking and insurance	1	0.98139	-1.8613%

Table [3.4]: Relative producer prices on ROW goods (base price – price of electricity produced by Russia)

	Benchmark	EU Enlargement	Percentage Change
Electricity and heat	1	0.99957	-0.0427%
Oil and Gas	1	0.99955	-0.0454%
Other Fuels	1	0.99955	-0.0453%
Ferrous metallurgy	1	0.99958	-0.0420%
Nonferrous metallurgy	1	0.99953	-0.0472%
Chemical industry and oil refinery	1	0.99953	-0.0471%
Machinery and equipment	1	0.99951	-0.0494%
Light industry	1	0.99952	-0.0477%
Food-processing Industry	1	0.9996	-0.0399%
Other industries	1	0.99957	-0.0431%
Agriculture and services and forestry	1	0.99958	-0.0424%
Construction	1	0.99957	-0.0429%
Transport & Communication	1	0.99952	-0.0477%
Other services	1	0.99959	-0.0413%
Finance, banking and insurance	1	0.99957	-0.0432%