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ON POSSIBILITIES TO CONSTRUCT

A MODEL FOR TRADE FLOWS AND

FACTORS OF PRODUCTION MOVEMENTS

BETWEEN THE EU AND EASTERN EUROPE

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Abstract: Since the collapse of communism the Eastern European transition economies have redirected their foreign trade strongly towards the Western industrialised countries, particularly towards the European Union. The subject of this study is to survey possibilities to build a model for trade flows and factors of production movements between the European Union and the Eastern European countries. The main efforts are devoted to a survey of whether there already exist relevant databases related to the subject of the study. Summaries of the current economic situation in Eastern Europe and of the economic interactions between the European Union and the Eastern European countries are included, too.

The model for which the data availability and adequacy is surveyed, is a computable general equilibrium model (CGE model). With that kind of model we may take into account the intersectoral linkages of the economy when analysing the effects of different policies. The data search indicates that we may get sufficient data for the model if we adhere to the aggregate level enough with respect to regions and economic sectors. However, the reliability of the Eastern European statistics is at the moment questionable due to the still ongoing transition process. So, it is not very sensible to build a numeric equilibrium model based on this kind of deficient data.

Key words: Economic integration, European Union, trade, transition countries

Tiivistelmä: Itä-Euroopan ns. transitio- eli siirtymätalousvaltiot ovat kommunismin kukistumisesta lähtien pyrkineet siirtämään ulkomaankauppansa painopistettä yhä enemmän läntisten teollisuusmaiden ja etenkin Euroopan Unionin suuntaan. Tutkimuksen tarkoituksena onkin pyrkiä tutkimaan mahdollisuuksia rakentaa malli kuvaamaan kauppavirtojen ja tuotantopanosten liikkumisen lisääntymisen vaikutuksia sekä Eu:n että siirtymätalouksien näkökulmasta. Tutkimuksen pääpainona on selvittää, onko soveltuvaa tilastollista aineistoa saatavissa mallin rakennuksen pohjaksi. Tutkimukseen sisältyy myös lyhyt katsaus Itä-Euroopan taloustilanteeseen sekä Eu:n ja Itä-Euroopan maiden välisiin taloussuhteisiin.

Teoreettinen malli, johon tilastoaineiston riittävyyttä ja saatavuutta kartoitetaan, on ns. numeerinen yleisen tasapainon malli (CGE-malli). Tällaisella mallilla voidaan huomioida toimialojen väliset vuorovaikutukset analysoitaessa eri politiikkavaihtoehtojen vaikutuksia talouteen. Tilastoaineiston kartoituksen tulos on, että jos tarkasteltavien alueiden ja toimialojen suhteen tyydytään riittävän aggregoituun tasoon, aineistoa voidaan saada. Itä-Euroopan maiden tilastojen luotettavuus ei kuitenkaan ole paras mahdollinen johtuen esimerkiksi vielä jatkuvasta talouksien siirtymävaiheesta kohti markkinataloutta. Numeerisen tasapainomallin rakentaminen tällaisen epäluotettavan datan varaan ei ole kovinkaan tarkoituksenmukaista.

Avainsanat: Taloudellinen integraatio, Euroopan unioni, kauppa, transitiomaat

SUMMARY

Since the collapse of communism the Eastern European transition economies have redirected their foreign trade strongly towards the Western industrialised countries. Especially the ex-socialist Central and Eastern European countries (CEECs) executed this procedure with astonishing speed and nowadays their biggest trade partner is the European Union. The Eastern European countries are also willing to integrate their economies closer to the European Union. On the other hand, the importance of the trade with the CEECs and the former Soviet Union countries is increasing for the European Union, too.

The subject of this preliminary study is to survey possibilities to build a model for trade flows and factors of production movements between the European Union and the Eastern European transition countries. Eastern Europe is divided into two regions, which are 1) the Central and Eastern European countries (*CEECs*) including the Balkan states, the Czech and Slovak Republics, Hungary and Poland, and 2) the states of the former Soviet Union (*FSU*) including the Baltic states, Russia, Ukraine, etc. The main efforts of the study are devoted to a survey of whether there exist relevant databases and whether there are models already constructed related to the subject of the study. The study includes surveys of the current economic situation in Eastern Europe and of the economic interactions between the European Union and Eastern Europe, too.

A theoretical model in the background of the study is a multi-region computable general equilibrium model. This kind of model was chosen because we are interested in the effects of different policies on more than one branch of the economy only. We would also like to model imperfect competition and increasing returns to scale for some industries of the economy, but this seems to be difficult or even impossible due to data problems particularly in the case of Eastern Europe.

The data search indicates that if we stick to a sufficiently aggregate level with respect to the number of regions and the economic sectors, there could be the sufficient data available. However, particularly in the case of the Eastern European countries the reliability of the statistics is at the moment questionable. One example of this is that trade figures in these countries between the country of origin and the country of destination may deviate by dozens of percents. So, it is not very sensible to build a numeric equilibrium model based on this kind of deficient data.

A conceivable data source and a potential version of the multi-region computable general equilibrium models could be the one called GTAP. It includes the regions considered and the data matching process is already completed. However, at the moment the data base includes information for the perfect competition and constant returns to scale model only. The input-output structure of the two Eastern European regions is mainly estimated by the structure of the other regions, too. Yet, the GTAP model could be considered as a potential starting point in the actual modelling process. The other possibility could be to try to feed the Eastern European data into some existing imperfect competition CGE model, which would already include the data for the European Union countries.

YHTEENVETO (Finnish summary)

Tutkimuksen tarkoituksena on tutkia mahdollisuuksia rakentaa kansainvälisen talouden malli kuvaamaan kauppavaihtoa ja tuotannontekijöiden liikkuvuutta Euroopan Unionin ja Itä-Euroopan transitiomaiden välillä. Tutkimus on luonteeltaan esitutkimus ja siinä kartoitetaan lähinnä tilastollisen aineiston saatavuutta ja riittävyyttä mallin pohjaksi. Tutkimus sisältää myös lyhyen katsauksen aihealueesta tehtyihin malleihin ja yhteenvedot itäisen Euroopan taloustilanteesta sekä Euroopan Unionin ja Itä-Euroopan välisistä taloussuhteista.

Teoreettinen malli, johon tilastoaineiston riittävyyttä selvitetään, on numeerinen yleisen tasapainon malli. Tällaisen mallin avulla voidaan mm. huomioida eri toimialojen väliset riippuvuussuhteet ja talouden resurssirajoitteet tuotannontekijöiden suhteen analysoitaessa esim. jonkin kauppapoliittisen toimenpiteen, kuten tullien alentamisen tai poistamisen vaikutuksia. Mallin yhtenä erityispiirteenä olisi mallintaa osalle tuotantosektoreista kasvavat skaalatuotot ja epätäydellinen kilpailu, mutta tämä näyttäisi olevan tilastoaineiston suhteen melko mahdotonta etenkin Itä-Euroopan kohdalla.

Tilastokartoitus osoittaa lisäksi, että aineistoa on tietyssä määrin saatavissa pysyttäessä tarpeeksi karkeassa jaottelussa alueiden ja toimialojen suhteen. Toimialojen lukumäärän suhteen olisi ainakin aluksi syytä pysyä alle kymmenessä toimialassa. Tämä helpottaisi myös mallin käsiteltävyyttä. Aluejaon suhteen Eu:n kohdalla on mahdollista hajauttaa tarkastelua koko Unionia pienempiin osiin, mutta Itä-Eurooppaa pitäisi käsitellä suurempina kokonaisuuksina, koska useimmista alueen maista ei ole vielä riittävää aineistoa saatavissa. Itä-Eurooppa olisi mahdollista jakaa esim. kahteen alueeseen siten, että entisen Neuvostoliiton alueelle syntyneet valtiot muodostaisivat yhden kokonaisuuden ja Keski- sekä Itä-Euroopan ex-sosialistivaltiot toisen kokonaisuuden. Itä-Euroopan maiden tilastojen luotettavuus on kuitenkin vielä tällä hetkellä kyseenalainen johtuen mm. yhä jatkuvasta talouksien siirtymävaiheesta kohti markkinataloutta, sekä itse tilastointijärjestelmien uudistamisesta. Yhtenä esimerkkinä tilastojen epäluotettavuudesta on, että ulkomaankauppatilastoissa kohde- ja alkuperämaan luvut saattavat erota useita kymmeniä prosentteja. Numeerisen tasapainomallin rakentaminen tällaisen epäluotettavan datan varaan ei ole kovinkaan tarkoituksenmukaista.

Yksi mahdollinen tietokanta tarvittavan aineiston lähteenä ja samalla numeerinen yleisen tasapainon malli on nimeltään GTAP. Se sisältää mielenkiinnon kohteena olevat alueet, ts. EU:n, keskisen Itä-Euroopan ja ex-Neuvostoliiton alueet. Lisäksi aineiston yhteensovittamistyö kauppavirtojen ja tuotannon suhteen on jo tehty. Tietokanta sisältää tällä hetkellä aineistoa kuitenkin vain täydellisen kilpailun ja vakioisten skaalatuottojen malliin. Lisäksi tietokannan heikkoutena voi pitää, että Itä-Euroopan alueiden osalta panos-tuotos-rakenteet ovat pitkälti arvioitu käyttäen hyväksi muiden alueiden vastaavia taulukoita. Heikkouksista huolimatta mallia ja sen tietokantaa voitaisiin ajatella varsinaisen tutkimuksen lähtökohdaksi. Toinen vaihtoehto olisi yrittää liittää Itä-Eurooppaa koskeva aineisto sellaiseen valmiiseen cge-malliin, joka sisältäisi jo aineiston Euroopan Unionin osalta.

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1   INTRODUCTION

In the recent years there has been a growing interest in analysing and estimating the effects of the Eastern European economic restructuring process on these so-called transition economies themselves as well as on the rest of the world. The economic models made are usually focused, however, on some specific subjects, like e.g. foreign direct investment flows. The aim of the present study is to supplement analyses already performed by researching possibilities to build a more comprehensive model for trade flows and factors of production movements between the European Union and the Eastern European countries. The study is a preliminary one and concerns mainly empirical data issues related to building such a model.

An original idea was that the model would include Finland and its eastern and southern neighbours, i.e. near-by regions of Russia and the Baltic countries. However, due to lack of data, it was later decided to widen the regional scope. Hence, the data search is based on the following four regions: the European Union, the Central and Eastern European Countries (CEECs), Russia and other former Soviet Union countries (FSU) and the Rest of the World (ROW). The ROW plays no active role in the model; it is included for accounting completeness only. Thus, for example, trade flows to and from the ROW are exogenous.

An interesting point would be to try to disaggregate the regional structure further and treat, for example, the Baltic states as a separate region. It would be interesting to divide the CEECs and EU regions into more homogenous sub-regions, too. However, according to the tentative data survey, these sorts of disaggregations could be realised only in the case of the European Union, the required country-specific data from the Eastern Europe seems to be in many cases non-existent. The disaggregation of the regions may be possible later as the Eastern European countries' statistical systems improve.
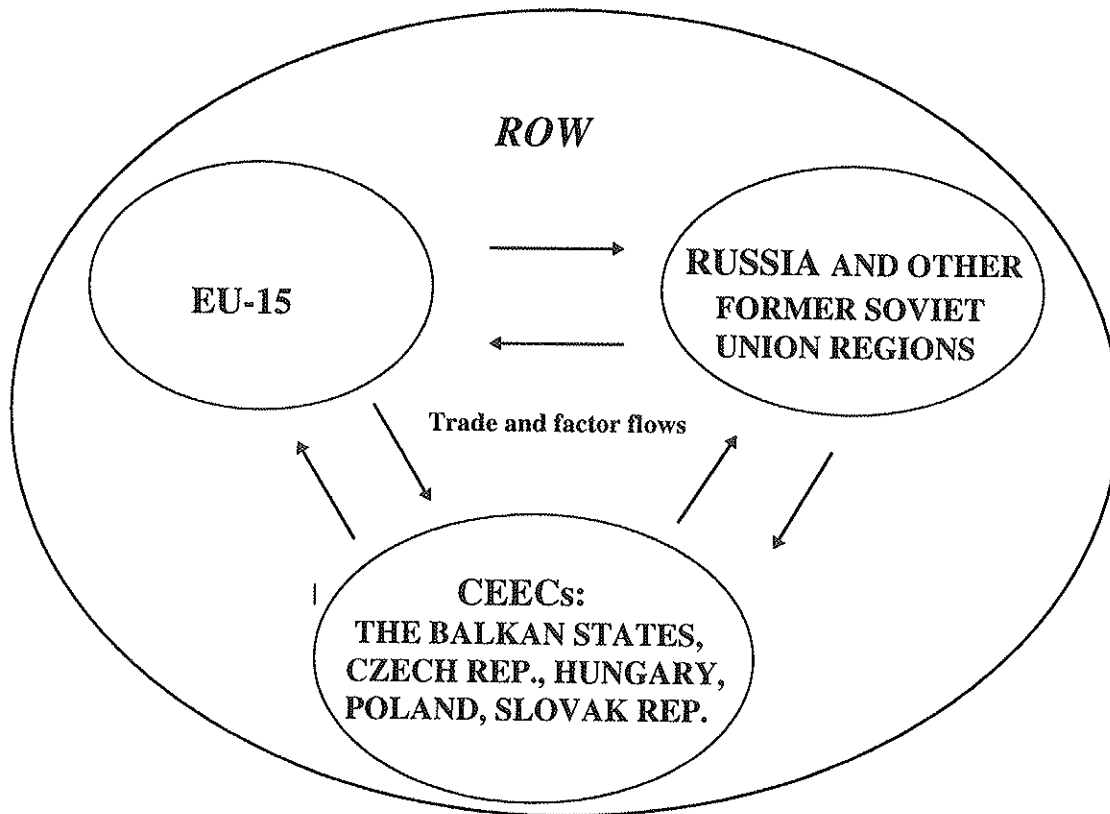
Figure 1. Regions of the model.

1.1 Theoretical framework of the study

The theoretical framework of the model is a multi-region computable general equilibrium model. These kinds of models have recently been built to analyse, for instance, European Union internal integration.[1] A simplified procedure while constructing a computable general equilibrium model is that after spesifying a suitable theoretical model which matches with the research problem, one calibrates the model to the relevant empirical data for some base period.

One possibility could be to analyse the trade and factors of production movements from a partial equilibrium point of view. However, as Gasiorek et al. (1992,35) remark, the partial equilibrium approach is incomplete and potentially misleading for at least two

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[1] See e.g. Gasiorek et al. (1992), Haaland & Norman (1992), Willenbockel (1994).

reasons. First, partial equilibrium analyses assume that input supply curves are horizontal, so that resources are available to the industry at a constant price. If the input supply curves are in fact upward sloping, the partial equilibrium approach over-estimates the quantity effects of the policy. Secondly, the approach assumes that resources drawn to the industry are available at prices equal to social opportunity cost. If one industry's expansion is, because of overall resource constraints, another's contraction, then this assumption is invalid, and we may over-estimate the welfare gains (or losses) associated with the policy. So, it is preferable to use a general equilibrium approach as long as one is interested in the effects of the policy on the whole economy and as long as one wants to take into account the intersectoral linkages of the economy, too.

The computable general equilibrium model that we have considered here would consist of the earlier mentioned four regions, some six to ten economic branches and three inputs: capital, labour and an intermediate commodity. Economic branches would include agriculture, mining and quarrying, 4-8 manufacturing sectors and the rest of the economy (ROE), which would be an aggregated sector including all other branches of the economy. The manufacturing sectors could include for example the food, textiles, wood-processing, metal and chemical industries. Agriculture, mining and quarrying and manufacturing sectors would be assumed to be tradable good branches, i.e. there would be trade between the regions in these sectors, while the ROE is assumed to be a non-tradable good sector. Furthermore, capital would be mobile between regions while labour would be immobile at the beginning. One interesting point would be to disaggregate further the labour component, for example, into different skill types like in the models of Gasiorek et al. (1992,1994), but this may be impossible in our case due to data problems related to the Eastern European economies.

With the aid of the model we could analyse, for instance, the following issues and calculate their magnitudes for the regions considered:
- What kind of influence do different kinds of integration and trade policies, e.g. reduction or abolishment of tariffs and other barriers to trade have on the regions ?

- What effects do the increase of trade and economic integration between the regions have ?

- How do economies react when labour mobility increases between the regions ?

One point of interest would be to try to model in some branches of the economy imperfect competition and increasing returns to scale. This is because casual observation as well as the empirical industrial organisation literature suggests that perfect competition and constant returns to scale do not approximate well enough the market structures and technology conditions prevailing in tradable good branches of industrialised countries. Also arguments which rely on the presence of imperfect competition and unexploited economies of scale have always played a prominent role in the discourse on the gains from trade barrier removals and economic integration in general.

Furthermore, by allowing for product differentiation among firms within the same industry, which is one way to model imperfect competition, and a corresponding love for variety by the consumers on the demand side, our model would take explicit account of the scale-variety trade-off and overcome a drawback of conventional factor endowment models in the spirit of Heckscher-Ohlin-Samuelson. The failure of these conventional models is that they give no explanation for the phenomenon of intra-industry trade, i.e. two-way trade in similar products, which constitutes a large fraction of trade flows among industrialised countries.[2] Instead, the models with imperfect competition, economies of scale in production and consumers' love for variety can give us a plausible explanation for intra-industry trade. However, imperfect competition is quite a new assumption in the multi-region computable general equilibrium models, and there are some theoretical difficulties in the modelling process related, for example, to the competition assumptions within the industries. The inclusion of imperfect

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[2] In the CGE models of perfect competition a so-called Armington assumption is usually applied as a justification of intra-industry trade flows and to reduce the sensitivity of trade flows to changes in relative prices. The Armington assumption is a purely ad hoc assumption according to which goods of different origin are qualitatively different.

competition and increasing returns to scale to the model may be difficult or even impossible due to data problems, too.

1.2   Economic situation in Eastern Europe

Before we discuss data issues, it is perhaps worthwhile to make a short excursion to the recent economic situation in Eastern Europe. As everyone knows, in the 1990's there has been in the Eastern European former socialist countries going on a transition process towards a market-oriented economic system. This process has included, for example, opening of domestic markets to foreign competition and dismantling the state monopoly in foreign trade as well as in production. The transition countries have chosen different kind of strategies to reshape their economies. This was partly due to the varied economic situation in different states, and partly due to the political atmosphere. However, there were some common features in each country at the beginning of the process, for instance the fall of domestic industrial production and the sharp rise of inflation as a consequence of price liberalisation.

Some CEECs, especially the Czech Republic, Hungary and Poland adopted a fast-paced approach in their economic liberalisation process. As one can see from table 1 on the following page these countries have also performed pretty well compared to some other transition countries. For example, in the case of the Czech Republic in 1995 gross domestic product increased about five percent, industrial production more than nine percent, inflation was under control, unemployment almost non-existent and the government budget balanced. A liberal view toward economic restructuring has also been adopted in Estonia, which among other things has abolished all barriers in the trade of agricultural products.

Table 1. Selected economic indicators in some Eastern European countries in 1995. (Annual changes in percents)

	Bulgaria	Czech Republic	Estonia	Hungary	Poland	Russia
Gross domestic product	2.6	4.8	2.5	1.5	7.0	-4.0
Industrial Production	5.4	9.2	4.7	4.8	9.4	-3.0
Consumer price index	62.2	9.1	28.9	28.2	27.8	198.0
Unemployment rate (official level)	11.1	2.9	1.8	10.9	14.9	3.2

Source: WIIW (The Vienna Institute for Comparative Economic Studies).

A more conservative and slower way was chosen in Bulgaria, Romania and in the majority of the states of the former Soviet Union (*FSU*). These countries have undertaken the transition process perhaps in more difficult internal and external conditions than the former ones. In addition, particularly the countries of the FSU have extensive economic and trade interdependence, so establishment of a new regime is an even harder task for them. Furthermore, in Russia for instance, there are quite powerful political and other forces, which have tried to decelerate the transformation process. These forces include some former state monopoly companies, defence industry complexes and interest groups close to them.

One negative feature in the transition process is that in most of the transition countries a quite remarkable share of economic transactions has been absent in official statistics. For example, in Russia there are still in use some statistical procedures based on the old communist system. That system includes procedures whereby until recently only the biggest (ex-state owned) companies have reported their production figures ("targets") to the statistical officials. This data gathering procedure has excluded many small and medium-sized companies especially in the service sector. Thus the size of the service sector has usually been estimated by using some rough ad hoc measures.

Another negative point, among many other things, is that as a consequence of transition and an unfavourable economic situation some companies are unable to pay wages on time. In addition, the wages in the state sector are relative low. As a result, the work ethic has taken a turn even for the worse than before. In this kind of situation, for instance, the official foreign trade statistics may have distortions due to omissions in statistical work, or because of the growth of smuggling, corruption and other criminal activities, which increase non-officially registered transactions.

1.3   Eastern Europe and the EU

There is a huge welfare gap between the EU and the Eastern European countries, as can be seen from table 2. Even in Slovenia, which was the wealthiest Eastern European country as measured by gross domestic product per capita in 1993, that figure was only 1/3 of the EU average (Eurostat 1995, 395). In addition, one can note from table 2 that the economic structure was in 1993 fairly identical in the CEECs and Russia, but differed quite considerably from that of the EU countries: Agricultural and industrial sectors still have a relatively large role in the Eastern economies and, on the other hand, the service sector is much smaller than in the EU.

Table 2. Gross domestic product comparison of the EU, the CEECs and Russia in 1993.

	EU-12	CEECs	Russia
GDP per Capita (ECU)	15944	1799	1002
Proportion (in %) of GDP			
Agriculture	2.6	8.1	8.6
Industry	22.3	33.2	32.0
Services	64.3	49.4	42.2
Other sectors	10.8	9.3	17.2

Sources: Eurostat; GDP shares for Russia: Goskomstat.

However, it is worth noting that before the transition process began, the Eastern economies were typically overindustrialised and the service sector played a very minor role in the official economic policy. Keeping that in mind, the fall in the industrial

production and the rapid growth of the service sector after economic liberalisation was a quite natural outcome. It is presumable that the weight of services in the GDP will increase also in the future and approach the typical share in the Western market economies. On the other hand, the proportion of agricultural and industrial sectors in the GDP will decrease further as the transition process proceeds.

The volume of Russian and CEEC foreign trade is quite negligible compared to the EU or even to some individual EU countries. Table 3 reports total exports and imports of Russia, the CEECs, the EU, Sweden and Finland. As one can note from the table, Russian and the CEEC trade flows are about the same size as in the case of Sweden. This is a bit surprising keeping in the mind the differences in the size and the resources of these regions.

Table 3. Total trade flows in 1994. (Billion USD)		
	Exports	Imports
Russia	51.5	28.3
CEECs	64.4	78.3
EU-12	2057.3	1941.6
Sweden	72.2	63.8
Finland	34.9	28.7
Sources: ECE Economic Survey of Europe in 1995-1996 for Russia and the CEECs; OECD Annual National Accounts for the EU, Finland and Sweden.		

After analysing table 3, it is not very surprising that with respect to foreign trade the EU is much more important to Russia and the CEECs than they are to the EU. For example, in 1994 the share of Russia and other Commonwealth of Independent States (CIS) in both extra-EU exports and in extra-EU imports was less than four percent. However, there has been some increase in the EU-Russia trade since the collapse of the Soviet Union. On the other hand, the EU has become the largest trade partner of the former

European socialist countries, absorbing more than 50 percent of manufacturing exports from Poland, Hungary and other CEECs.

In fact, after the breakdown of the Council for Mutual Economic Assistance (CMEA) one of the biggest challenges for the CEECs was to redirect their trade flows from the CMEA towards the West. This process of redirection was executed with an astonishing speed. The redirection was fostered partly by the EU's willingness to reorganise trade relations with the CEECs very quickly after the break in 1989. The trade negotiations started with trade and co-operation agreements which led to the so-called Europe Agreements (EA). One aim of the Europe Agreements is to establish free trade in industrial products between contractors within ten years, i.e. by 2000-2002. According to the Europe Agreements the CEECs are associated countries of the EU, and they will be taken into consideration as potential EU members, too. Nowadays the EU has signed Europe Agreements with ten Eastern European countries including the three Baltic States.

The redirection of trade can be noticed also in table 4, in which the EU, the CEECs and Russian foreign trade flows are reported by region in 1989 and 1994. Compared to the situation in 1989, in 1994 both in the export and import side of the CEECs there is a remarkable decrease in the trade with the Former Soviet Union regions, as well as in the intra-CEEC trade. This is compensated for by the increase of the trade with developed market economies, which cover almost 70 percent of the trade in both imports and exports. The same trend is also seen in the case of Russia. From the columns of the EU one can see that particularly the share of the CEECs has increased both in the exports and imports. The trade share increase of the Former Soviet Union countries is more moderate.

Table 4. EU, CEECs and Russian foreign trade by region. Shares of regions in percent of total exports/imports.

	CEECs		Russia		EU-12*	
	1989	1994	1989	1994	1989	1994
Exports to:						
Former Soviet Union	25.5	9.4			2.9	3.1
CEECs	15.8	7.6	24.4	12.6	4.8	7.2
Developed market economies	42.6	68.0	41.8	67.0	52.4	48.3
Other regions	16.1	15.0	33.8	20.4	39.9	41.4
Imports from:						
Former Soviet Union	23.5	14.7			3.4	3.7
CEECs	16.4	5.6	26.4	8.5	4.3	6.2
Developed market economies	44.0	69.5	50.1	69.2	56.0	51.8
Other regions	16.1	10.2	23.5	22.3	36.3	38.3

Sources: ECE Economic Survey of Europe in 1995-1996 for the CEECs and Russia, Eurostat Comext database for the EU-12.
* Shares of extra-EU exports/imports.

Though the trade between the EU and Eastern Europe has grown substantially in recent years, there still exists potential for a further increase in trade. The trade potential can be estimated, for example, by a so-called gravitation model. The potential trade growth in the gravitation models usually depends on the countries' income levels and their growth rates, population, mutual distance, cultural similarities, etc. In table 5 there are illustrated as an example actual bilateral trade in 1994 and the estimates of the gravitation model for potential trade in 2000 and 2010 between Germany, Poland and Russia.

Table 5. Actual trade in 1994 and trade potential in 2000 and 2010, million USD in constant 1994 prices.

Exporter	Importer	Exports	Potential Exports	
		1994	2000	2010
Germany	Poland	6419	25403	69404
Poland	Germany	6150	22595	61731
Germany	Russia	6644	21059	57535
Russia	Germany	5355	17017	46491
Poland	Russia	935	7075	19330
Russia	Poland	1129	6428	17561
Source: Hernesniemi (1996).				

According to the figures the trade between these countries will increase considerably in all cases, and in the short run especially between Poland and Russia. The latter observation is quite natural taking into account the low trade volume between these two countries in 1994.

In addition, although there are already some signs of increased intra-industry trade between the Eastern European countries and the EU, the exports of the former ones are still strongly biased away from capital-, R&D- and skill-intensive branches and towards energy- and labour-intensive branches. For example in the case of the EU-Russia trade, the main EU imports from Russia in 1994 were fuels, raw materials and other low-technology products, as figure 2 on the following page illustrates. On the other hand, the main EU export articles to Russia were machinery and electrical equipment (figure 3).

In Russia there was also a substantial demand for the agricultural and food products of the EU countries, which partly reflects the Russian consumers' adverse attitude to the quality of domestic products. This is partly due to the unsatisfactory supply in Russian agricultural and food production, too. All in all, in the future as the transition process proceeds it is presumable that the intra-industry trade will grow substantially between

the EU and the Eastern European countries. One factor which supports this argument is the rich human capital resources available in several Eastern European countries. This should contribute to technological progress and development of competitive products in these countries.

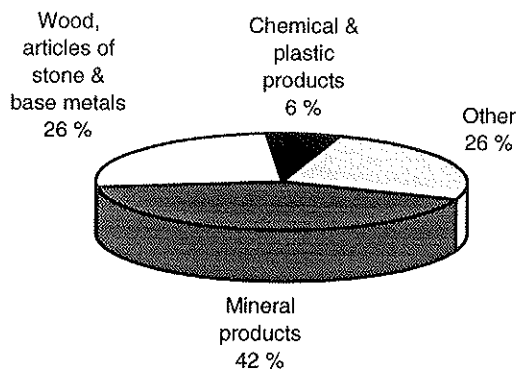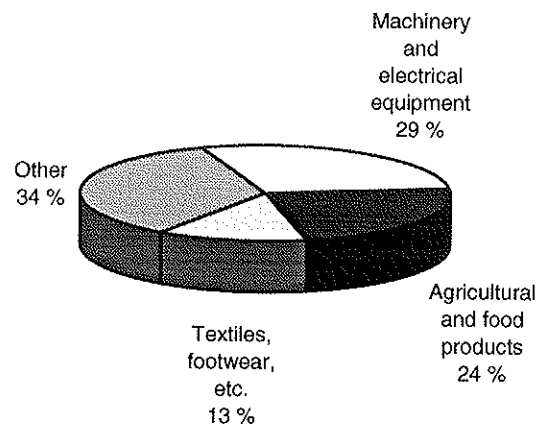**Figure 2. EU imports from Russia by main products, 1994.**

Figure 3. EU exports to Russia by main products, 1994.

Data source: Eurostat Comext-database.

2   DATA SEARCH

2.1   Method

The data search was started by creating a list of the data needed and possible data sources. The principal data requirements are:

- complete foreign trade and domestic sales data for a certain year broken down by regions and industries

- a range of industry-specific parameters

Industry-specific parameters include the share of value added in production, the share of each input in the value added, the share of final and intermediate demand in the output, the elasticity of substitution between factors of production and further, in the case of imperfect competition, the degree of returns to scale in the industries concerned and a measure of market power (industry concentration index). In principle the majority of the production, input usage and factor reward data should be available in the input-output tables. However, especially in Eastern Europe, those statistics may be out-of-date, or totally non-existent.

Potential data sources covered consisted of international organisations, research institutes and national statistical offices. The surveyed material included published articles, electronic databases and some unpublished preliminary statistical material supplied by statistical offices. In some parts of the data search Internet resources were also utilised. The strategy of the data search was the following: as much as possible of the data needed should be gathered from the same source to avoid any substantial distortions in the data. This strategy was implemented by starting the data search from the international statistical publications and by studying if there already exists an usable database for the purpose. Later on the study was extended to include national statistical offices and other possible sources, too.

The international organisations, their publications and statistical databases studied were:
- European Bank for Reconstruction and Development (EBRD);
- European Union and its statistical office Eurostat;
- International Monetary Fund (IMF);
- OECD and its sub-organisation the Centre for Co-operation with the Economies in Transition (CCET);
- the United Nations and its relevant sub-organisations, like Economic Commission for Europe (ECE), Industrial Development Organisation (UNIDO) and International Labour Organisation (ILO);
- World Trade Organisation (WTO);

Research institutes and projects included, among many others, were e.g.:

- The Vienna Institute for Comparative Economic Studies (WIIW);

- Centre for Economic Policy Research (CEPR);

- Centre for Russian and East European Studies at the University of Pittsburgh, USA;

- GTAP ('Global Trade Analysis Project') at the Purdue University, USA;

The study also included numerous journal articles, economic reviews, books and other publications.

2.2   Results of the data search

Foreign trade data between the regions concerned are quite well reported. For example, trade flows between the EU, the CEECs and Russia can be gathered from Eurostat's COMEXT database. There are also many other sources, like the IMF's Direction of Trade Statistics and the UN's databases. A problem related to foreign trade statistics, especially in the case of the Eastern European countries, is that there are considerable deviations in the trade figures between the country of origin and the country of destination. This point is illustrated on the following page in table 6, in which percentage differences in the Baltic Rim countries' import and export statistics are shown. As we can notice, the magnitude of the differences in the Baltic Rim countries' foreign trade statistics range from zero to over 300 percent.

Another problem is that production and trade data are in general incompatible in the sense that trade data are collected on a commodity basis, while production data are collected on an activity basis. In addition, trade data usually include re-exports, and hence tend to exaggerate trade flows.

Table 6. Differences in Baltic Rim countries' import and export statistics in 1994, %.

Importing countries	Exporting countries								
	Rus	Est	Lat	Lith	Pol	Ger	Den	Swe	Fin
Russia		34.4	27.6	51.8	1.2	15.1	24.1	30.3	-5.8
Estonia	17.0		3.9	17.0	30.4	0.1	-3.8	25.2	76.9
Latvia	54.1	60.1		57.7	15.1	47.9	34.9	30.2	32.2
Lithuania	-27.6	46.6	-17.6		17.2	33.5	13.5	22.3	13.3
Poland	-28.7	4.2	48.3	22.4		7.7	9.1	-2.1	-6.0
Germany	-52.3	-33.3	-155.5	-12.5	-2.1		23.3	-6.9	-9.6
Denmark	-40.7	12.0	-310.4	-114.8	-9.5	5.9		7.5	-3.2
Sweden	11.1	-17.3	-243.4	-30.3	-4.2	0.0	15.4		-0.5
Finland	-5.0	7.4	-33.1	-25.8	1.5	-1.8	26.1	17.5	
Total	-27.2	17.1	-52.5	26.7	-1.8	6.4	20.7	2.9	-3.0

The percentage differences are calculated according to the following equation: Difference-% = (value of exports reported by exporting country - value of imports reported by importing country) / exports reported by exporting country. Source: Hernesniemi (1996).

The reliability of the foreign trade data is not, however, the only problem in the required data set. More problems emerge, as we move to the production and factors of production data. A promising international industry-specific source of data including also the transition economies seems to be UNIDO's International Yearbook of Industrial Statistics.

This publication reports by ISIC industry classification the following data:

- number of establishments
- number of employees
- wages and salaries paid to employees
- output in factor values or at producers' prices
- value added in factor values or at producers' prices

- the share of value added in output

- share of wages and salaries in value added

The most recent Yearbook of Industrial Statistics covers the data from 1993, or in some cases from 1992. Unfortunately, this information applies to industrial branches only, so it does not include agriculture, mining and quarrying, and service sectors. A negative point is also that depending on the reporting country, the value figures are given either in factor values or at producers' prices.

When surveying input-output data for the EU and Eastern Europe, one can note that there are quite good data available from the EU countries. The main data source in the case of the European Union countries is of course Eurostat. Other sources are reported, for example, in Gasiorek et al. (1992). In the case of the EU the problem is that even this data is a bit out of date, too. For example, complete input-output tables including the whole EU(12) are from 1985. Available measures for the economies of scale and industry concentration are from the early 1980's, too. Nevertheless, there exists a consolidated input-output table from 1991 including the EU as an entity and fewer economic branches than in the complete tables.

In the case of the Eastern European countries a quite extensive database is the WIIW Economic Database for Eastern Europe. It includes the following ten countries: Bulgaria, Czech Republic, Croatia, Hungary, Poland, Romania, Slovenia, Slovak Republic, Russia and Ukraine. Data from these countries include, for example, information on national income, production, labour markets and foreign trade. The information in the database is based on the data provided by national statistical offices, supplemented by the data provided by international organisations and the research by the WIIW itself.

So, we can get, for example, production data for Eastern Europe quite easily, but the input-output tables based on international standards are at the moment exceptional. Some experimental input-output statistics have nevertheless been made by the principles

of the System of National Accounts (SNA) for example in Bulgaria for 1991 and Russia for 1992.[3] These statistics are, as mentioned, highly experimental and are mainly converted from the old pre-transition statistical system. The principles of that system deviated substantially from the Western standards. The conversion of the statistics is a difficult task and the validity of the statistics questionable. Anyhow, these preliminary tables give at least some clue about the input usage in different economic sectors. Statistical offices in Eastern Europe are also updating their statistical systems with a striking speed to correspond to international standards and presumably in the near future we may get up to date input-output data from the Eastern European transition economies, too.

As one comes to measures of economies of scale and industry concentration indexes in the transition economies, the search exercise becomes even more difficult. Some studies have been published about industry concentration, for example, in the case of Russia based on the old Soviet Union data (see Brown et al. 1993), but the validity of these studies is debatable. This is partly due to the already mentioned convertibility process of the transition economies' statistics and partly due to the transition process itself. This is because the transition process surely has an influence on the structure of the economy and so older figures may not correspond to the current situation. For example, in most of the Eastern European transition economies even the officially registered number of the firms has increased strikingly compared to the socialist era, not to mention unofficial estimates.

2.3   On the models related to the research topic

One aim of this preliminary study was to survey if there already exist useful models related to the topic, and secondly, if there exists such a database that includes all the regions we are interested in and in which, for instance, trade and production figures match each other.

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[3] Russia: National Accounts for Russia 1989-1994. (in Russian), Goskomstat 1995;
  Bulgaria: National Accounts for Bulgaria, OECD 1996.

According to the literature survey done, such a multi-region CGE model which would include all the regions we are interested in, and in which the Eastern European countries would be modelled separately and explicitly, seemed not to exist. There are some partial equilibrium models related to the topic, as well as some CGE models, but the substance of these models is different from ours. Partial equilibrium models are built, for instance, to analyse changes in a specific industry, as the integration between the EU and the Eastern European countries increases (see e.g. Nagarajan 1994).

In the general equilibrium context the closest model to our goal is perhaps that of Gasiorek et al. (1994), in which they analyse the effects of the trade increase between the EU countries and the Central and East European countries. However, they model only the EU countries explicitly, while the CEECs are modelled with respect to trade flows only. So, their analysis does not consider the effects of trade increases on the CEECs economies.

One tempting possibility is to try to utilise a model called GTAP. It is a multi-region CGE model, with perfect competition and constant returns to scale in production. The model has been developed at Purdue University in the United States, and it was originally focused to analyse agricultural policy. Later on the model has been expanded to cover more countries and sectors of production. The GTAP data base includes information on bilateral trade, transport and protection data characterising economic linkages among regions, linked together with individual country input-output databases which account for 37 sectors within each region. The most recent version covers 30 regions in the world and the base year for the data set is 1992.

A point that makes the GTAP database interesting is that it covers the main regions, in which we are interested. For the EU the database is comprised of two regions, the old 12 members as one entity and the new members Austria, Finland and Sweden as the other one. Eastern Europe is divided into two regions: One region is the CEECs including Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovak Republic and Slovenia.

The second one covers the 15 states of the Former Soviet Union including, for instance, the Baltic states, Russia, Ukraine etc.

Another positive feature of the GTAP database is that, for example, the trade and production data for each region has been matched to correspond to each other. One weakness of the database is that the data for Eastern Europe is not very accurate, because for example the input-output tables for these countries are rather out of date or non-existent. Input-output structures for the Eastern European regions have been solely estimated based on the input-output tables of other regions, accompanied by available trade, production, factors of production and protection information. This may produce inaccuracy in the model simulations, but as long as one uses more aggregated data, this problem can be avoided or at least decreased.

All in all, the GTAP model and database may be considered to be utilised in our research project. Good features of the GTAP are that the database includes the regions of our interest, and secondly that the data matching and other data work has already been completed. A negative feature is perhaps that some Eastern European information, for instance the input-output structure has been mainly estimated by using the tables of other regions. However, this is quite understandable and, on the other hand, even unavoidable, since as mentioned earlier, the Eastern European countries' own statistics are not yet fully comparable to the Western standards. Shortcomings of the GTAP-model itself are some of its assumptions, like perfect competition and constant returns to scale in the production sector and the Armington assumption as a justification for bilateral trade flows. Nevertheless, the model has some innovative aspects, too. Those include, for instance, explicit treatment of international trade and transport margins and the treatment of private household preferences using the non-homothetic functional form.

3 CONCLUSIONS

The subject of this preliminary study has been to survey possibilities to build a model for trade flows and factors of production movements between three regions: the European Union, the former socialist countries of Central and Eastern Europe and the states of the former Soviet Union. A type of theoretical model considered would be a multi-region computable general equilibrium model. One reason why the general equilibrium model should be chosen is that with this kind of model we could analyse the effects of different economic policies on the whole economy by taking into account the intersectoral linkages of the economy, too. One point of interest would be to model in some branches of the economy increasing returns to scale and imperfect competition, because according to a casual observation, as well as the empirical industrial organisation literature, perfect competition and constant returns to scale do not approximate well enough the market structures and technology conditions prevailing in industrial countries.

With the model we could compute, for example, the economic effects of the EU's eastern enlargement both on the EU and Eastern Europe. The main efforts of this study have been focused on a survey of whether there is appropriate statistical material available for our purpose. A survey of possible useful and already constructed models was also carried out. In addition, surveys of the current economic situation in the Eastern European transition economies and of the economic interactions between the EU and the Eastern European countries were drawn up, too.

In the 1990's the Eastern European former socialist countries have transformed their economies towards the system of market economies. This transition process has included in some form, among other things, dismantling the state monopoly in foreign trade as well as in production, and opening domestic markets to foreign competition. The transition process is still going on, for in the transition countries for instance the shares of agriculture and industry in the gross domestic product are larger than in the Western industrialised countries on average.

The transition economies have redirected their foreign trade, too. Former intra-trade between the socialist countries has collapsed and particularly the Central and Eastern European countries (CEECs) have executed their trade redirection with an astonishing speed. Nowadays the biggest trade partner of the CEECs is the European Union. On the other hand, the importance of the CEECs and the former Soviet Union (FSU) countries in the foreign trade of the EU has also increased since the collapse of communism. In fact, the European Union has signed so-called Europe Agreements (EA) with ten Central and Eastern European countries including the Baltic States. One aim of the Agreements is to establish free trade in industrial products between the contractors. The countries that have signed the EA are considered as potential EU members, too.

Although the trade between the EU and Eastern Europe has increased, there is still potential for a further trade growth. Factors to support this argument are, for example, that at present the intra-industry trade between the regions considered is insignificant, and on the other hand as the transition process proceeds and incomes in the transition countries increase, the demand for products and services will grow substantially. Some transition countries have also large natural resources as well as human resources, so they should be attractive to foreign trade partners and investors, too.

The data search was started by surveying the international organisations, their publications and databases. Later on the search was extended to some research institutes and national statistical publications, too. One result of the data search is that if we adhere to a sufficiently aggregate level, for example, with respect to the number of economic sectors, then there can be sufficient data available. However, particularly in the case of the Eastern European countries the reliability of the statistics is at the moment questionable. That is partly because in that region the transition process is still going on, so the economic structure in the statistics does not coincide with the real situation very well. Also the statistics themselves are under reforms to correspond to international standards, and this may cause some distortions in the data, too. One example of the data distortions is that there can be several dozens of percents

differences in the trade figures between the country of origin and the country of destination. So, it is not very sensible to build a numeric equilibrium model based on this kind of deficient data. There have nevertheless been some promising attempts to develop economic databases including more reliable figures from the Eastern European countries. One of these is the WIIW (the Vienna Institute for Comparative Economic Studies) database, which covers macroeconomic data series on ten transition countries.

Another potential data source and a basic model to utilise could be the one called GTAP. The current version of the GTAP database covers 30 regions in the world. A positive feature of the database is that it includes the regions we are interested in, i.e. the EU-15, the CEECs and the FSU. Another positive feature is that the data matching for example between production and trade flows has been already completed. One weakness of the database is that the Eastern European input-output structure has been mainly estimated by the structure of other regions.

The GTAP model itself is a multi-region computable general equilibrium model with perfect competition and constant returns to scale in production. However, it may be possible to introduce increasing returns to scale and imperfect competition to the current model. Another possibility would be to utilise already constructed CGE models with imperfect competition. Perhaps the closest subject of these models to our point of interest has been the study of the effects of the EU-CEEC trade increase on the European Union countries (Gasiorek et al. 1994). One might develop, for example, this model by modelling the East European countries explicitly. In that case one might be able to disaggregate the EU to more than one region; On the other hand, one would have to do some data matching oneself.

REFERENCES

Brown A., Ickes B. & Ryterman R. 1993. *The myth of monopoly: A new view of industrial structure in Russia*. The World Bank. Washington.

Eurostat. 1995. *Europe in figures*. Luxemburg.

Gasiorek M., Smith A. & Venables A. 1992. '1992': Trade and welfare- a general equilibrium model. In Winters L.A. (ed.): *Trade flows and trade policy after 1992*, 35-66. Cambridge University Press.

Gasiorek, M., Smith A. & Venables A. 1994. *Modelling the effect of Central and East European trade on the European Community*. European Economy 6/1994, 519-539.

Haaland J. & Norman V. 1992. Global production effects of European integration. In Winters L.A. (ed.): *Trade flows and trade policy after 1992, 67-91*. Cambridge University Press.

Hernesniemi H. 1996. *Barriers to economic co-operation of Baltic rim countries*. ETLA Discussion Papers nr. 555. Helsinki.

Nagarajan, N. 1994. *EU-CEEC trade in a sensitive sector - The case of textiles and clothing*. European Economy 6/1994, 483-519.

Willenbockel, D. 1994. *Applied general equilibrium modelling: Imperfect competition and European integration*. Wiley Series in Financial Economics and Quantitative Analysis. West Sussex.

MAIN DATA SOURCES

European Bank for Restructuring and Development (EBRD): Transition Reports 1994 and 1995

European Commission: European Economy publication

Eurostat: Comext database and various publications

GTAP database, the Purdue University, USA

Goskomstat, Russia: E.g. Natsionalnii cjeta Rossii b 1989-1994 gg. (Russian national accounts 1989-1994)

Government of the Russian Federation: Russian Economic Trends publication

IMF: Direction of trade statistics, International Financial Statistics

ILO: Yearbook of labour statistics

OECD: Economic surveys and databases

Centre for Co-operation with the Economies in Transition (*CCET*): Short term economic indicators

Oesterreichische Nationalbank: Focus on Transition publication

Statistics Finland

UNIDO: International yearbook of industrial statistics 1996

UN's Economic Commission for Europe (*ECE*): Economic survey of Europe 1995-1996.

Vienna Institute for Comparative Economic Studies (*WIIW*): Economic database Eastern Europe; Countries in transition 1995, 1996 publications

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