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How Far Has Trade Integration Advanced? An Analysis of Actual and Potential Trade of Three Central and Eastern European Countries

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Abstract

This paper investigates the trade integration of three Central and Eastern European countries, namely the Czech Republic, Hungary and Poland, using the gravity model for trade as an analytical device. Beside the usual variables in such a model, we have also incorporated the FDI variables. According to our results, in the context of the most important Western European relations, it is Hungary that achieved the highest level of integration. Czech exports have also integrated, but there is still a very considerable potential there. Poland has integrated in exports to a much smaller extent than in imports. CEFTA-oriented trade has also gone up considerably, although the level of actual trade has not yet reached its full potential, except in the Czech Republic. Vis-a-vis South-East Asia, we have found overintegration for imports, but could see no signs of convergence for export towards this region. Our estimates support the trade-enhancing role of bilateral FDI. Paradoxically, the potential trade of the three countries estimated with FDI variables appears to be less than that suggested by the basic setup of the gravity model. We formulated two hypotheses to explain this, and supported one by a probit model. Finally, we tested for convergence and found that actual data indeed converged toward the estimated trade potential.

INTRODUCTION

This paper investigates the equilibrium level and the country-structure of external trade for three Central and Eastern European (CEE) countries: the Czech Republic, Hungary and Poland. In the past nine years these countries have experienced high rates of trade growth, especially vis-à-vis the European Union (EU) economies. Trade with CEFTA countries has also developed rapidly. At the same time, Czech and Hungarian trade with the successor states of the former Soviet Union has fallen considerably. By contrast, Poland has increased its trade with this region in terms of both absolute figures and share. In other words, while a clear reintegration from East to West can be observed in the case of the Czech Republic and Hungary, the trend for Poland has not been so obvious. Reintegration was accompanied by high inflows of foreign direct investment (FDI) into these countries. In the light of these developments, this paper focuses on three main questions:

1. To what extent do these processes reflect movements toward equilibrium, as was predicted by earlier empirical studies (Wang and Winters (1991), Baldwin (1993))?
2. Assuming that these movements represent convergence toward equilibrium, how close have these countries come to their potential trade?
3. What role might FDI play in the development of trade in these countries?

As an analytical tool for answering these questions we used the gravity equation. This model determines the level of bilateral trade flows by taking into account the incomes and populations of exporters and importers, the distances between them, their relative prices and other factors enhancing or impeding trade (such as preferential trade agreements, etc). We also included several variables that represent FDI in the equations, to be able to determine its impact on trade flows. We estimated the basic gravity model for a panel of 53 countries for the period between 1990 and 1997, using pooled and panel regression techniques. Unfortunately, FDI-data were available for a much smaller sample of countries. Hence, we could estimate the extended gravity equation (including FDI variables) only for a highly unbalanced sample of the 28 OECD countries. It is important to emphasize that the results yielded by the gravity equation characterize a static equilibrium that is sensitive to changes in explanatory variables. Consequently, an analysis of the state of trade integration of the given economies always applies to a specific year or time interval. The equilibrium level of trade can well change in the future for these countries.

According to the estimated basic gravity model, Hungary reached the highest level of integration into the world economy: by 1997 it had practically approached its overall trade potential. The gap between actual and potential exports and imports by the Czech Republic was narrowing at a slower pace than Hungary's throughout the period under consideration. Surprisingly, Polish exports did not move significantly closer to its equilibrium level, i.e. potential exports increased at the same pace as did the actual one. Imports, however, showed quite a similar speed of convergence as in Hungary, that is, it was well above the corresponding Czech rate.

Concerning the extended gravity model with FDI-variables we found that both inward and outward bilateral FDI stocks significantly stimulate bilateral trade flows. We also checked whether FDI stocks in third countries play a trade diverting role. According to our results there is a significant trade diverting effect of FDI in third countries. In terms of this setup, Hungary

did not only seem to be the most integrated, but its exports even exhibited a slight measure of "overintegration". In the case of the Czech Republic and Poland, estimations suggest that trade by these countries has come close to equilibrium.

Comparison of the two different sets of estimates for potential trade led to the surprising conclusion that while the effect of bilateral FDI on bilateral trade was positive, the equilibrium level for these countries was lower in the model extended with FDI variables than in the basic model. This, however, can be explained by the fact that FDI undertaken in these countries was more export-oriented than FDI between developed economies. This hypothesis was tested and verified with a probit model.

Finally, it had to be checked whether actual trade flows indeed converged towards the estimated equilibrium levels. We used error-correction equations to justify convergence.

The paper consists of five main sections. The first one gives a sketch of some stylized facts regarding the evolution of trade integration and the role of FDI in the three CEE countries. The second part deals with the theoretical considerations underlying the gravity equation. In the third section earlier empirical results are reviewed, while in the fourth we present and interpret our findings, with the fifth part including our conclusions.

1. SOME STYLIZED FACTS

The trade relations across the three CEE countries - the Czech Republic, Hungary and Poland - have substantially changed since the beginning of the transition, 1990 (see Table 1). The former integration, the COMECON[2], dissolved almost overnight and these countries had to find new markets in the developed world, particularly in Western Europe and the EU. To a large extent this requirement has been fulfilled.

In this paper, however, we claim that integration is far from being complete, especially with regard to the Czech Republic and Poland. Hungary's exports to the EU rose by almost 130%, the Czech Republic doubled its exports, while Poland's exports increased by 60% between 1993 and 1997.[3] As discussed later, these figures indicate that Hungary was able to exploit its export potential to the EU to the greatest extent. Poland also gained markets, but it has not reached its full potential yet. Our estimates imply the largest gap between levels of potential and actual trade in the case of the Czech Republic.

However, the developments in terms of exports to the EFTA region appeared to be just the opposite. Hungary had the slowest growth rate, the Czech Republic was the most dynamic, and Poland's export also rose remarkably. Regarding trade relations with other developed (ODEV[4]) countries Hungarian export showed the largest increase, the Czech Republic was also able to rise its exports considerably, but the growth rate of Polish exports was more moderate.

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[2] Council for Mutual Economic Assistance. The trade bloc of formerly socialist countries.

[3] In analyzing the growth of trade flows 1993 is taken as the base year, because no data were available before that for the Czech Republic as a whole and for several important trading partners of the other two countries (such as Russia).

[4] In order to analyze trade developments in a more comprehensive way, the following five regions have been added to the main classifications of the EU, EFTA and CEFTA: Other developed countries (ODEV): Australia, Canada, Iceland, Japan, New Zealand, the USA; Other Central and Eastern European countries (OCE): Bulgaria, Estonia, Latvia, Lithuania, Russia, the Ukraine; South East Asian countries (SEA): China, Hong Kong, Korea, Malaysia, Philippines, Singapore, Thailand; the Western Hemisphere (WH): Argentina, Brazil, Chile, Colombia, Mexico; and Middle East (ME): Israel, Turkey. Because of their small share in the trade of CEE countries, the latter two are not analyzed in the paper.

Exports to the CEFTA-region also increased rapidly, with Poland leading in terms of growth rates. Note, however, that since Slovakia and the Czech Republic had formed one country in the past, Slovakia's share in Czech trade is very significant in the base year. This may cause a downward bias in the trade growth figures for the Czech Republic vis-à-vis the CEFTA region.

Exports to other Eastern European (OCE) countries also increased, but it is worth mentioning that Poland had by far the highest and Hungary the lowest growth rate.

The three countries considered were not very successful in Southeast Asian (SEA) markets. Only Hungary was able to increase its exports (following a large decline), while Polish and Czech exports stagnated in most of the period with even a fall in 1997.

As far as imports from the EU region are concerned, the integration of these countries also gained momentum. Polish imports grew at a stable rate (130% in 5 years), with Hungary also experiencing robust growth(95%). Czech data also showed dynamic increase until 1996, but as a result of the exchange rate crisis, some deceleration can be observed in 1997. Still, growth rates for the whole period amount to over 100%.

While Hungarian imports from the EFTA region stagnated, Polish imports were rising at a stable pace. At the same time, Czech imports from EFTA fell dramatically in 1994, but substantial growth can be observed from that time.

Imports from ODEV and CEFTA countries went up rapidly for each country. As regards trade with the latter group, Poland exhibited an especially high growth (260%). As mentioned above, the relatively slow growth rate for the Czech Republic vis-à-vis CEFTA, was probably due to the fact that Slovakia had formerly been a member country of Czechoslovakia, and traditional trade relations remained mostly intact.

It is interesting that imports from the OCE countries did not increase very rapidly except for Poland (110%). Hungary's imports even declined by 15%.

As our estimations confirmed, import-related integration with SEA countries advanced very rapidly: all countries increased their imports substantially (by more than 300%).

Table 1

The evolution of foreign trade in the three CEE countries

Exports									
(index number in USD, 1993=100)									
Czech Republic									
	EU	EFTA	ODEV	CEFTA	OCE	WH	SEA	ME	TOTAL
1993	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1994	131.4	131.5	120.2	136.9	111.1	281.0	81.4	57.1	128.7
1995	176.9	199.7	138.6	159.1	148.1	376.2	82.0	58.6	164.9
1996	186.2	212.7	172.2	158.0	159.7	471.4	82.7	52.3	172.3
1997	198.7	223.5	201.2	173.0	132.2	376.2	55.3	50.4	182.4
Hungary									
1993	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1994	123.0	109.3	115.7	118.7	137.1	110.9	64.8	66.1	121.0
1995	169.6	140.6	129.6	187.5	198.0	272.3	86.4	91.1	167.5
1996	193.7	152.1	155.5	210.3	156.5	326.0	101.0	111.3	186.0
1997	228.7	179.9	250.0	273.5	162.9	545.1	146.3	120.4	225.5
Poland									
1993	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1994	120.9	120.7	133.7	107.6	147.9	82.1	87.8	81.8	119.9
1995	160.2	169.2	142.2	211.5	293.8	83.9	95.2	77.4	164.2
1996	155.9	174.0	141.4	287.5	277.1	62.8	113.0	84.8	163.4
1997	159.7	200.0	156.6	322.1	348.7	66.6	67.9	98.1	171.2

Imports									
(index number in USD, 1993=100)									
Czech Republic									
	EU	EFTA	ODEV	CEFTA	OCE	WH	SEA	ME	TOTAL
1993	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1994	87.4	59.7	88.6	82.2	94.9	92.1	95.1	37.3	86.4
1995	133.5	95.5	136.4	114.9	144.3	157.0	173.4	60.2	130.2
1996	238.6	170.5	242.3	143.9	163.4	263.9	387.9	201.2	209.9
1997	202.1	167.3	260.9	132.4	145.2	246.4	415.7	180.4	186.1
Hungary									
1993	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1994	132.9	116.8	101.5	152.5	76.3	115.6	137.7	155.7	118.8
1995	139.7	112.3	99.9	151.3	82.7	133.1	169.4	174.6	124.7
1996	142.2	103.9	114.0	176.2	87.1	144.6	211.2	201.3	130.7
1997	195.7	107.7	183.1	192.6	84.9	194.5	420.2	211.4	172.1
Poland									
1993	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
1994	115.8	112.3	91.7	134.0	110.8	179.6	127.1	122.3	115.1
1995	155.1	134.0	122.5	234.1	149.1	213.1	185.6	136.4	156.0
1996	197.2	139.8	179.3	298.6	197.2	399.3	315.8	171.1	203.8
1997	224.6	155.5	207.7	356.4	208.1	394.2	414.4	229.5	233.2

Source: OECD

Other intriguing conclusions can be drawn from changes in the country-structure of trade across the three countries (see Table 2). The share of EU imports rose for Hungary and the Czech Republic, but remained almost unchanged for Poland. The share of exports to the EU increased for the Czech Republic, stagnated for Hungary and decreased for Poland. The share of ODEV trade did not have a clear trend. CEFTA trade gained momentum over the period of study , except for the Czech Republic, where figures are biased downward due to effects already mentioned. Less surprisingly, trade with OCE countries declined during the period, with only Poland increasing its exports to the region. Each country stepped up its imports from SEA , while the share of exports had hardly changed or even diminished.

Table 2

The country structure of foreign trade in the three CEE countries (%)

	Exports							
	EU	EFTA	ODEV	CEFTA	OCE	WH	SEA	ME
Czech Republic								
1993	58.6	1.3	3.9	25.9	5.4	0.2	2.4	2.3
1994	59.9	1.3	3.6	27.6	4.6	0.4	1.5	1.0
1995	62.9	1.6	3.3	25.0	4.8	0.4	1.2	0.8
1996	63.4	1.6	3.9	23.8	5.0	0.5	1.1	0.7
1997	63.9	1.6	4.3	24.6	3.9	0.4	0.7	0.6
Hungary								
1993	71.2	2.0	7.2	7.9	8.0	0.4	1.8	1.5
1994	72.4	1.8	6.9	7.7	9.1	0.3	1.0	0.8
1995	72.1	1.7	5.6	8.8	9.4	0.6	1.0	0.8
1996	74.2	1.6	6.0	8.9	6.7	0.6	1.0	0.9
1997	72.2	1.6	8.0	9.6	5.8	0.9	1.2	0.8
Poland								
1993	75.5	1.4	5.0	3.9	6.3	2.4	4.7	0.8
1994	76.1	1.4	5.5	3.5	7.8	1.6	3.5	0.6
1995	73.6	1.5	4.3	5.0	11.3	1.2	2.7	0.4
1996	72.0	1.5	4.3	6.9	10.7	0.9	3.3	0.4
1997	70.4	1.6	4.6	7.3	12.8	0.9	1.9	0.5

	Imports							
	EU	EFTA	ODEV	CEFTA	OCE	WH	SEA	ME
Czech Republic								
1993	55.6	2.7	5.2	22.2	11.4	0.6	1.7	0.5
1994	56.3	1.8	5.4	21.1	12.5	0.6	1.9	0.2
1995	57.1	2.0	5.5	19.6	12.6	0.7	2.3	0.2
1996	63.3	2.2	6.1	15.2	8.9	0.8	3.2	0.5
1997	60.4	2.4	7.4	15.8	8.9	0.8	3.8	0.5
Hungary								
1993	56.7	3.0	7.3	6.6	22.4	1.3	2.2	0.4
1994	63.5	2.9	6.2	8.5	14.4	1.3	2.5	0.6
1995	63.6	2.7	5.8	8.1	14.9	1.4	3.0	0.6
1996	61.7	2.4	6.3	8.9	14.9	1.5	3.5	0.7
1997	64.5	1.9	7.7	7.4	11.1	1.5	5.4	0.5
Poland								
1993	69.7	3.8	7.9	4.3	9.2	0.8	3.7	0.6
1994	70.2	3.7	6.3	5.0	8.9	1.2	4.1	0.6
1995	69.3	3.2	6.2	6.4	8.8	1.1	4.5	0.5
1996	67.4	2.6	7.0	6.2	8.9	1.6	5.8	0.5
1997	67.1	2.5	7.1	6.5	8.2	1.3	6.7	0.6

Source. OECD

In general one can conclude, that the three CEE countries seemed to be integrating quite fast into the world economy. This is in line with earlier results that projected a double-digit growth path for external trade during transition (Baldwin (1993)). Integration was especially rapid in relation to the developed countries. At the same time, OCE trade with the Czech Republic and Hungary was losing momentum, with CEFTA economies playing an increasing role in respect of both exports and imports by the three countries. However, the growth of trade with the SEA economies was limited to the growth of imports.

1.1. The role of foreign direct investment

In assessing the equilibrium level of trade flows, the role of FDI should also be taken into account, as the three CEE countries had experienced high FDI flows after 1990 especially in the latter part of the decade. In Table 3 one can see that the three CEE countries experienced annual FDI inflows of about 2-10 % of GDP.

Table 3

The role of FDI in the three CEE countries

	1993	1994	1995	1996	1997
Czech Republic					
FDI (million USD)	568	862	2562	1428	1300
FDI as a % of GDP	1.8	2.4	5.4	2.7	2.5
Stock of FDI (million USD)	2519	3381	5943	7371	8671
Stock of FDI per capita (USD)	244	327	575	714	842
Hungary					
FDI (million USD)	2339	1146	4453	1983	2085
FDI as a % of GDP	6.1	2.8	10	4.4	4.6
Stock of FDI (million USD)	5795	6941	11394	13377	15462
Stock of FDI per capita (USD)	563	677	1115	1313	1523
Poland					
FDI (million USD)	1715	1875	3659	4498	4908
FDI as a % of GDP	2	2	3.1	3.3	3.6
Stock of FDI (million USD)	2799	4674	8333	12831	17739
Stock of FDI per capita (USD)	73	121	216	332	459

* The stock of FDI is accumulated from flows.
Source: Oszlay (1999)

Before 1995 Hungary had played a leading role in terms of all FDI figures. By 1997 it had lost its priority in absolute terms, retaining its first place, however, in GDP and per capita terms. Looking at the sectoral distribution of FDI inward positions, one can conclude that in the early phase of the transition (until 1993) the largest amount of FDI had landed in the manufacturing sectors of each of these countries. After that the structure of FDI became quite similar to that of the OECD-average in Hungary and in the Czech Republic (Table 4), but not in Poland, where almost two-thirds of the FDI stock was in manufacturing in 1997.

It is arguable that FDI into the manufacturing sector is more trade-oriented than FDI into services, as the former produces a much larger share of tradable products than the latter. In our sample the share of FDI into manufacturing is higher than that into the service sector in the CEE countries considered, while in the OECD average the case is just the opposite. From this one can conclude that FDI in the three CEE countries is expected to be more export-oriented than FDI in the OECD as a whole. Another reason for this could be that FDI between countries of similar levels of development can be empirically verified to be horizontal (Markusen 1985), while FDI between countries at different levels of development mostly takes the form of outsourcing or vertical FDI. Since the latter is more export-oriented[5], the elasticity of trade with respect to FDI is expected to be higher in the CEE countries than for the OECD-average. As will be seen later in the paper, this may put a downward bias on the estimates of potential exports and imports by the CEE countries.

Table 4

[5] Country studies for the case of small open economies support this hypothesis. See Barry and Bradley (1997) for Ireland and Oszlay (1999) for Hungary.

The sectoral distribution of the FDI stock

	1991	1992	1993	1994	1995	1996	1997
Czech Republic							
Primary sector*	0.0	0.0	0.0	0.0	1.5	1.3	..
Manufacturing sector	84.4	65.4	66.6	63.0	43.9	45.0	..
Service sector	14.1	26.9	27.9	27.9	48.4	49.7	..
Non allocated	1.3	7.7	5.5	9.1	6.2	4.1	..
Hungary							
Primary sector*	..	2.3	2.5	2.3	2.1	2.5	2.0
Manufacturing sector	..	52.9	49.6	48.8	42.9	38.8	39.0
Service sector	..	44.8	47.8	48.9	55.0	59.0	59.0
Non allocated	..	0.0	0.0	0.0	0.0	-0.3	0.0
Poland							
Primary sector*	..	..	..	0.7	0.5	0.6	2.0
Manufacturing sector	..	..	..	63.7	48.8	45.0	61.0
Service sector	..	..	..	35.7	28.8	30.2	38.0
Non allocated	..	..	..	0.0	21.8	24.2	1.0
OECD-average							
Primary sector*	..	..	..	..	..	9.4	..
Manufacturing sector	..	..	..	..	..	36.4	..
Service sector	..	..	..	..	..	53.7	..
Non allocated	..	..	..	..	..	0.5	..

*Agriculture, fishing, hunting, forestry and mining
Source: OECD, Authors' calculations.

2. THEORETICAL BACKGROUNDS

2.1. The theoretical foundation of the gravity equation

In analyzing potential trade flows the gravity equation is used as the fundamental device. This section gives a brief summary of the theoretical underpinnings of the model. As we will see later, the gravity type equation is general enough to be consistent with several assumptions regarding the structure of product markets - perfectly competitive and monopolistically competitive markets alike.

The gravity equation has been a rather successful tool in analyzing different kinds of bilateral flows between two geographic units, which typically imply countries. As this study provides an analysis of bilateral trade flows across pairs of countries, our gravity equation takes the form:

Equation 1

$$X_{ij} = a Y_i^{b_1} L_i^{b_2} Y_j^{b_3} L_j^{b_4} D_{ij}^{b_5} A_{ij}^{b_6}$$

where X_{ij} is the dollar value of the flow of goods from country i to country j; Y_k and L_k (k=i,j) are the dollar value of nominal GDP and population in k respectively; D_{ij} is the distance between the capital cities of i and j, and A_{ij} contains any other factor(s) promoting or hindering trade between i and j. Taking into account the above specification, typical parameter estimates for b_1 and b_3 are positive, while for b_2, b_4 and b_5 they are negative. The sign of b_6 depends on whether the other factors in A_{ij} are promoting or hindering trade. Although the gravity equation performed quite well in analyzing international trade flows as early as the sixties (providing good fit, high statistical explanatory power), a strong theoretical foundation for its validity had not been produced until the eighties (Bergstrand (1985), Helpman and Krugman (1985), Bergstrand (1989)).

The original justification for its use by Linnemann (1966) was based on a partial equilibrium model of export supply and import demand. The gravity equation turned out to be a reduced form of this model under some simplifying assumptions. As discussed, however, by many authors (e.g. Bergstrand (1985)) this partial equilibrium model could not explain even the multiplicative form of the equation, leaving, moreover, some of its parameters unidentified. Linnemann's justification excluded prices from the gravity equation, and Bergstrand (1985) argued that this was the main reason behind the unidentified nature of some parameters. Note, however, that in the case of perfectly competitive markets for goods, the model could, even without prices, produce a gravity equation in the Hecksher-Ohlin framework (proof is given by Evenett and Kellner (1998)). In fact Bergstrand's (1989) model leads to the same conclusions with respect to monopolistic competition, provided that goods are perfect substitutes, and competition is complete in product markets.

A formal theoretical foundation for the gravity equation, when products are nationally differentiated by monopolistic competition, can be found in Bergstrand (1985). He develops a general equilibrium world trade model with N countries, with one (aggregate) tradable and one domestic good and one factor of production internationally immobile in each country. Consumers' demand in each country is driven by the same CES utility function, the specification of which allows for differences between the elasticity of substitution between domestic and traded (imported) goods and that between traded (imported) goods of different origins. Expenditures on different goods in country j are constrained by income, with prices affected by bilateral exchange rates, tariff rates and transport costs as well. By maximizing consumer utility with respect to the expenditure constraint one can derive $N(N\text{-}1)$ bilateral demand equations for importable goods and N domestic demand equations. Assuming profit maximization on the part of firms in each country where , as a constraint, firms have to decide on the allocation of a single factor of production between production for home and for the various export markets according to a two-level[6] CET technology (shared by all countries), one can again derive $N(N\text{-}1)$ bilateral supply equations for exports and N domestic supply equations. Examining the resulting N^2 equilibrium conditions leads to a reduced form expressed for the bilateral flow of goods across pairs of countries. However , this is not yet a gravity equation, since exporter and importer incomes are endogenous in this model and can be eliminated from the reduced form. One therefore has to make the assumption that bilateral trade flows between pairs of countries are small relative to the sum of all bilateral trade flows. This renders all countries under examination small open economies, so that price levels, exchange rates and incomes can be treated as exogenous for all of them. Under this assumption, and since CES and CET functions were identical for all countries (securing constant parameters across all country pairings), the resulting reduced form of the model can indeed be termed as the generalized gravity equation.

In a later contribution, Bergstrand (1989) extended his model by adding a further factor of production to incorporate factor intensities and the factor-proportions theory of trade into the gravity equation. Leaving the number of industries the same (two), but separating them differently (manufactured and non-manufactured goods replacing the classification of domestic and importable goods), he employed a nested Cobb-Douglas-CES-Stone-Geary utility

[6] Similarly to the CES function used in deriving demand equations, this CET function allows for different elasticity of transformation of supply between home and foreign markets and between foreign markets themselves.

function to derive import demand functions for the two types of goods. He also made an assumption of the minimum consumption requirement of non-manufactured goods, and again set identical consumer preferences across countries. On the production side he assumed a market with monopolistic competition among firms, using labor and capital as factors of production. The monopolistic competition requirement assures that firms produce uniquely differentiated products under increasing returns to scale. When, however, they allocate their products between markets, they face diminishing returns. This is described by an appropriate CET function. Profit maximization with respect to the applied technology yields marginal export cost equations for both products. Investigating equilibrium conditions and expressing the model for the bilateral flow of manufactured goods across pairs of countries, the generalized gravity equation again appears as a reduced form of this model. However, further assumptions should be made to relate this equation to the one presented in Equation 1, since it is only *j*'s GDP that enters explicitly the reduced form, *i*'s income enters as national output in terms of units of capital. Populations enter the reduced form only as per capita incomes: GDP per capita in the case of country *j* and capital per capita in the case of country *i*. In Equation 1, therefore, GDP per capita is the proxy variable for income, and per capita capital stock is the proxy variable for per capita income in the case of country *i*. Distance cannot be found in the reduced form either, but the c.i.f./f.o.b. ratio can be a relatively good proxy. This model also makes some recommendations as to what variables should be included in A_{ij} of Equation 1. Not surprisingly, the elements of A_{ij} should include *j*'s tariff rate on *i*'s exports, the bilateral exchange rate and the appropriate price variables. .

Based on the parameters of the model, it becomes clear that the price and exchange rate variables can only be excluded when products are perfect substitutes for one another in consumer preferences and can be costlessly transported between markets. This, however, takes us back to the standard Hecksher-Ohlin setting. One can thus see that the gravity equation can be established both under perfectly competitive and monopolistic market structures. As regards the latter, relative prices and the exchange rate should be included among the variables in the gravity equation.

2.2. The effects of FDI on international trade flows – theoretical considerations

FDI can well influence international trade flows, an effect that should also be taken into account[7]. There are several theories explaining why a firm in country *i* decides to export capital to country *j*. These range from the early theories which stress the role of different factor endowments (locational factors) also present in the Heckser-Ohlin and the new trade theory - to more recent ones that underscore different ownership and internalization motives. However, if one is after analyzing FDI's effect on trade, it is worth dividing the motives into two main categories (Altzinger (1999)): notably market-driven and supply-based FDI.

[7] In principle, international flows of other factors of production can also have an effect on foreign trade, therefore one could also consider including migration of workers. Since the latter cannot be regarded as mobile as the cross-border flow of capital, the effect would be ambiguous. We decided to keep this issue out of our analysis.

From the point of view of the host country[8], market-driven FDI means that a foreign company invests in the country in order to access its market (or a third country's market) more easily. In this case the investing company makes this decision mainly because

1. restrictions on or transaction costs of trade between the host country and the investing country are high, or
2. the host country is a member of a larger, more integrated market of which the investing country is not a member, thus the investor company can access this larger market with lower transaction costs.

This type of investment therefore mainly implies horizontal integration between the parent company and its foreign subsidiary.

As regards supply-based FDI, the donor country invests in order to get access to the competitive advantages of the host country (cheap labour, human capital), and uses its capacity for exporting from the host country. This typically implies vertical integration at the firm level, i.e. the investor allocating different stages of production into different countries.

If FDI is mostly of a horizontal nature, one might expect the export of the donor country and FDI to be substitutes, as investing firms replace export with local production. The export of the host country may, however, increase if the firm decides to supply a larger market from the host country. Regarding vertical FDI, the effect on trade is more likely to be positive than in the previous case, as the donor company outsources its activity and increases the export of intermediate goods and management services to the host country, while increasing the imports of final goods from there. As a result, there is an additional trade diverting effect, since the increase in the export to the host country may substitute for exports to third countries.

It should be noted, however, that the effect of FDI on trade is far from evident. One can have reasonable guesses on the primary effects, and may argue that supply-based FDI is more export enhancing than the market-driven one. On the whole, however, the direction of the relationship depends on both direct and indirect effects, forward and backward linkages that cannot be determined theoretically a priori. It should also be considered that the causality between FDI and trade works both ways . If a firm has a tradition of trading with firms in another country, it has some informational advantage on the given country's market that may stimulate FDI flows. This effect *per se* would imply a positive correlation between FDI and trade.

3. EARLIER EMPIRICAL RESULTS

3.1. Earlier estimations of the trade potential of CEE-economies

As mentioned earlier, the use of the gravity equation as an empirical device is much older than its sound theoretical foundation. More restricted specifications than Equation 1 – e.g. one without population variables - were used by Tinbergen (1962), Poyhonen (1963a, 1963b), Pulliainen (1963), Geraci and Prewo (1977), Prewo (1968) and Abrams (1980), while exporter and importer population variables were included in Linnemann (1966), Aitken (1973), Sattinger(1978) and Sapir (1981). Bergstrand (1985) and Bergstrand (1989) was the first to incorporate price and exchange rate variables into the gravity equation, because– as

[8] In this paper we are mainly interested in the role of FDI from the point of view of the host country, as CEE countries are mainly recepients of FDI.

demonstrated in the previous section – he proved that price terms can be excluded, provided there is infinite elasticity of substitution and transformation between home and foreign products and between different foreign products. Bergstrand (1985) estimates a cross-sectional relationship without population variables, but with price and exchange rate variables. His tests reject the exclusion of price and exchange rate terms. Bergstrand (1989) estimates a "more generalized" gravity equation, adding population variables.

For economic policy in CEE countries the gravity equation as an analytical device came into the focus of attention in the early nineties. The collapse of the COMECON naturally raised the question of where and to what extent should trade be redirected. The issue was addressed by Wang and Winters (1991) and Baldwin (1993)[9], among other authors, with the help of the gravity model.

Both studies estimated a barter type gravity equation, i.e. an equation without price and exchange rate variables. Wang and Winters argued that while on the one hand the inclusion of price terms is against the long-term nature of the model, on the other hand there is a measurement problem with prices, namely price indices are very crude proxies for price levels. Their first claim is not justified in the light of the theoretical considerations presented in the previous section. Price and exchange rate variables can only be excluded if the different elasticities of substitutions and transformations are infinite. This, however, should be tested for. At the same time we agree that the use of price indices is by no means without problems. Not just because they are crude proxies for price levels, but, as Wang and Winters point out correctly, in cross-sectional regression, price indices with different fixed bases cannot explain the *level* of trade flows. However, assuming fixed effects, price indices can be used with no difficulty in a panel framework[10].

Wang and Winters estimated the potential trade matrix for 76 countries for 1985. The main results of their study for CEE economies were the following (see also Table 5):

1. Overall, the potential gains of the reopening of eastern economies to the west are huge, with the ratio of potential to actual trade between 3 and 8.
2. The potential gains are the smallest in relation to developing countries, where potential trade roughly matches the actual data (except for Polish exports to this region).
3. The largest gain can be achieved in trade between Eastern-Europe and non-European developed countries. The percentage deviation of potential and actual trade extends from 483% (Polish export) to more than 2200% (the Czech Republic's imports).

[9] A third study dealing with the estimation of potential trade between Eastern Europe and the West is Collins and Rodrick (1991). Instead of a gravity model, they use a special estimation technique (see Baldwin (1993)). Despite the different technique, their results are broadly in line with those of Wang and Winters (1991).

[10] In panels with fixed effects the influence of the choice of base is shown in the constants of the individual cross-section unit, in panels with random effects it is reflected in a disturbance specific to the individual cross-section unit.

Table 5

Trade integration in the three CEE countries in 1985

Potential/Actual percentage deviation (Wang and Winters (1991))						
	EU	EFTA	EU+EFTA	Other developed	Developing	Overall
Imports						
Czech Republic	855	357	735	2266	134	720
Hungary	293	26	207	504	37	209
Poland	572	447	545	1444	62	519
Exports						
Czech Republic	894	269	719	1977	-15	439
Hungary	391	23	258	802	35	241
Poland	406	282	379	483	1612	728

Source: Authors own calculations based on Wang and Winters (1991)

Regarding the country structure of trade flows in relation to the largest industrialized countries, it is Germany with which the three CEE economies have come almost in touch with their potential trade levels.

To the main conclusions Wang and Winters add that if average income increases in the CEE countries, potential advantages are much larger than estimated. According to their results every 1% increase of GDP increases exports by 1.2% while imports by only 1%. They predict a resulting improvement in the trade balances of the countries under examination during the catching-up process.

Table 6

The trade integration of three CEE countries in 1989
Potential/Actual percentage deviation
Baldwin (1993) medium term estimate

Imports			
	EU	EFTA	EU+EFTA
Czech Republic	255	216	243
Hungary	100	96	99
Poland	143	105	131
Exports			
	EU	EFTA	EU+EFTA
Czech Republic	249	261	252
Hungary	90	96	92
Poland	84	83	83

Baldwin extended Wang and Winter's sample in the estimation phase with twelve countries and updated the estimates for 1989. Instead of analyzing the full country structure of foreign trade, he was mainly concerned with European and especially EFTA trade with the CEE countries. Table 6 shows that the potential/actual trade ratio fell substantially from the 1985 estimates. The three- to eightfold ratio in trade with EC+EFTA in Wang and Winter's study decreased to two- to threefold in Bergstrand's. However, one should be very cautious in drawing conclusions from this, since the two studies use different GDP estimates. Wang and Winters use the Summers and Heston (1988) database, while Baldwin uses the average of estimates by Salay (1992) and CEPR (1992). As the former is based on purchasing power parity (PPP) estimates, it is relatively upward biased compared to the latter two. This can be one explanation for the decrease in the potential/actual trade ratio in Baldwin's paper.

Table 7

Trade integration in the three CEE countries in 1985
Baldwin (1993) long term estimate

Potential/Actual (Percentage deviation)				Annual growth rate of the potential (%)		
Imports						
	EU	EFTA	EU+EFTA	EU	EFTA	EU+EFTA
Czech Republic	1468	1294	1417	14.0	13.4	13.8
Hungary	783	767	778	10.9	10.8	10.9
Poland	971	806	921	12.0	11.1	11.7
Exports						
	EU	EFTA	EU+EFTA			
Czech Republic	1517	1636	1546	13.5	13.9	13.6
Hungary	812	841	821	10.6	10.7	10.6
Poland	782	780	782	10.4	10.4	10.4

Source: Authors own calculation based on Baldwin (1993)

Baldwin also estimated the long-run trade potential of the CEECs by assuming different scenarios for the catching-up process of these countries. In Table 7 the potential/actual ratio is calculated for the medium term catching-up scenario[11]. Visibly, the potential increase in trade is extremely high. The average gain is between eight- and seventeen-fold. These calculations imply double-digit annual export and import growths throughout the period of catching up.

3.2. Earlier estimated relationship between FDI and trade

Unlike for the standard gravity equation, there are hardly any experiments for the gravity equation extended with FDI variables. (The only exception is an unpublished paper by the French Ministry of Finance (ADETEF(1999))). Nevertheless, several studies used some kind of implicit gravity equation, trying to detect the relationship between FDI and trade. Mainly because of the complexity of the problem, the empirical evidence is at best controversial.

An early contribution to assessing the relationship between trade and FDI was made by Lipsey and Weiss (1981, 1984). The authors analyzed the effects of production by foreign subsidiaries set up in the US on the export of the US and other 13 developed countries, in a database of 14 industries. Their general conclusion was that an increase in the production of the foreign affiliate tended to increase the parent country's export and at the same time lessen the export by other competing countries. This all points to a positive relationship between outward FDI and export.

In more recent papers the effect of inward FDI on export is also considered for open economies (e.g. Portugal, the UK and Ireland). Usually, the effect seems to be positive (see Barrell and Pain (1997) for references). In these more recent studies, however, the results for outward FDI and export are mixed. A positive correlation was found by Yawamaki (1991) for Japanese firms investing in the United States, by Pfaffermayer (1994) for the Austrian and Orts and Agluacil (1999) for the Spanish economies. By contrast, negative correlation was

[11] He assumes a constant population everywhere, and an annual GDP-growth of 2% in the developed economies. Baldwin considers three scenarios for the catching-up process of Eastern economies. CEECs achieve 70% of the EC average by either 2005, 2010 or 2020, which implies 5.7%, 4.8% and 3.9% annual rates of GDP growth respectively.

found by Svensson (1996) and Barrell and Pain (1997). Nevertheless, these results should be compared with extreme caution as different authors used different methodologies and data coverage for their estimations. Svensson, for example, used firm-level panel data, and estimated the effects of local and export sales of finished goods and intermediate goods by foreign affiliates separately. Orts and Agluacil (1999) used more aggregate time series data and cointegration tests along with long-run Granger causality.

4. REBUILDING THE GRAVITY EQUATION

We have estimated the equilibrium level of trade with the help of the gravity equation. Our estimates are referred to as potential trade. In order to be able to answer the questions raised in the introduction the gravity equation was reestimated for a large sample of international trade flows, and the basic model extended with FDI variables. The detailed description of data sources can be found in Appendix 1.

We used pooled estimation along with panel techniques with both fixed and random effects. However, the possibility of a fixed effect model with a different constant for every relation had to be excluded a priori, as in that case it would have been impossible to identify separately the effects of time invariant variables: for example distance. We felt that the exclusion of transaction cost related variables would have been against the gravity nature of the model. Hence we used Mátyás (1997) type model-specification for estimating fixed effects. Mátyás (1997) points out that as a result of the specific structure of the gravity model, there are not just relation-specific effects (A_{ij} effects), but there are also local (i) and target (j) country effects separately. Accordingly, in addition to time effects, one can distinguish between three types of effects which need to be taken into account for the consistent estimation of the model. Appendix 2 shows the estimation results.

First the simple pooled model was used for the basic gravity equation and for the gravity equation with FDI as well. Then the presence of individual effects was tested for. As the null-hypothesis of the LM-test for cross–section effects (Breusch-Pagan test for random effects) was rejected at an extremely high (1%) significance level, the model was estimated with random effects as well. However, the Hausman test rejected the null of uncorrelatedness of the individual effects and the regressors at 1 percent significance level. Therefore, the instrumental variable estimation was selected, with the use of the first differences of the explanatory variables as instruments. However, these instruments proved to be very poor resulting in unreasonable and largely insignificant estimated coefficients. The fixed effect estimation based on Mátyás (1997) resulted in substantially different parameters from those produced with the other two methods. This can be attributed to the fact that a large component of the dependent variable variance could be explained by local and target country effect dummies. Consequently , we stuck to the simple pooled estimation in the estimation of equilibrium trade flows. As the residuals for the pooled models proved to be heteroscedastic, weighted least squares and White heteroscedasticity consistent estimators were used. The normality of the residuals was also rejected. Hence, the validity of the test statistics are questionable, although the estimated coefficients in a large sample are consistent and unbiased enabling them to be used for forecasting potential trade flows[12,13]. The models based on fixed effects produced

[12] Looking at the estimation results table, it is clear that our model is not homogenous to the first degree in prices. Consequently, a one-percent increase in all prices does not increase nominal trade by the same amount. Unfortunately this is a standard result in gravity-type equations. (See empirical studies mentioned

systematically higher results for potential trade flows than the pooled model. The dynamics of potential trade became quite similar to that obtained from the pooled estimation[14].

On Figure 1-6 and Table 8 one can analyze the behaviour of actual and potential exports and imports for the three CEE countries considered, estimated with pooled techniques on the basic model. According to our preliminary expectations, imports should have converged more rapidly towards their equilibrium levels than exports, as when trade liberalization had begun in the early nineties import competition was much stronger than export competition, with the CEE countries not producing goods of high quality by western standards. Due to this fact, western producers could easily crowd out domestic CEE producers. However, this seems to be true only with respect to Poland . As regards both the Czech Republic and Hungary, the average speed of convergence[15] of exports exceeded that of imports. The reason for this discrepancy could be that the elasticity of importers' incomes is smaller than exporters', thus a large drop in GDP experienced in these two countries implied a greater decline in potential exports than in potential imports. In the case of Poland, this effect was offset by actual imports growing at a higher pace than actual exports.

As far as total imports are concerned, Hungary experienced the highest speed of convergence during the period of study. Poland also converged quite quickly, with the pace of convergence for the Czech Republic being somewhat slower . In 1997 Hungary almost achieved equilibrium, while Poland's equilibrium rate was almost twice as high as its actual one, with the rate of potential imports for the Czech Republic being twice or three times higher than the actual one. We found similar results compared to previous estimates (Wang and Winters (1991) Baldwin (1993)), with the gap between actual and potential import rates being the smallest for Hungary at the start of the transition. Hungary's integration into the world economy started from a higher initial level and kept its advantage throughout the subsequent years considered.

Out of the three countries Hungary is the most integrated with respect to its imports from EU and ODEV countries, with Poland coming second as regards its relations with the EU. In the case of the ODEV imports, the levels of integration (the gap between potential and actual trade) achieved by the Czech Republic and Poland are very close to each other. The speed of convergence for EU imports is the highest for Hungary, with that for the other two countries not differing significantly. One can observe divergence from potential imports for Poland and Hungary from EFTA, while there are signs of a slow convergence for the Czech Republic.

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earlier.) One explanation for this could be that not all products are tradable. In a world with nontradable products, a one-percent increase in tradable prices pushes up average nominal GDP and price levels by less than 1%. Hence, in order for homogeneity to be a valid assumption the sum of coefficients should be higher than one on nominal variables to enable nominal trade to go up by one percent as well. One can confirm that this statement is consistent with our results. The other explanation might be that the inclusion of price indices instead of price levels may bias the estimated coefficients.

[13] There is another methodological possibility, notably that trade blocs could be considered as one country. This can be supported by the fact that characteristics of intra-bloc-trade can be substantially different from inter-bloc-trade, and the omission of this fact could distort the estimated parameters. By contrast, the inclusion of trade bloc dummies helped successfully control such effects. As in the estimation based on the methodology of Mátyás (1997) the country-specific dummies inside the EU were significantly different, considering the EU as one country would have meant restrictions that are not supported by the data.

[14] The results are available from the authors upon request.

[15] Average speed of convergence=growth rate of equilbrium trade / growth rate of actual trade*100-100. It was calculated since 1993 because of the previously mentioned data reasons.

The Czech Republic was able to exploit the opportunities rising from CEFTA imports to the greatest extent . This result is surely distorted by the country's very strong historical ties with the Slovak Republic (dating back to the former Czechoslovakia). Hungary and Poland also converged towards their potential levels for CEFTA imports, but there are still great opportunities left. This can be explained by the fact that although the trade of manufactured goods is liberalized, food and agricultural products – offering the highest gains from trade - are highly protected by trade restrictions and customs tariffs.

In the case of OCE countries, Hungary and the Czech Republic showed signs of overintegration , while Poland was close to equilibrium. The overintegration can be attributed to the trade relations within the former COMECON, in terms of which Russia exported commodities, fuels and energy to these countries, poorly endowed with natural resources. With logistic networks (gas and oil pipelines) inherited from the past, these commodities can be transported at low transaction costs, whereas building new routes would require large-scale investment and significant fixed costs. Thus , these trade flows are assumed to be permanently higher than what the model projects.

For all countries, imports from SEA are well above potential, with the gap increasing at a steady and relatively high speed, especially in the case of Hungary and Poland. This reflects the fact that it did not take SEA countries very long to accommodate to the opening up of previously centrally planned economies.

As far as total exports are concerned, the pace of convergence towards equilibrium is slightly higher than that for imports, except for Poland. Although not perfectly in line with those of Wang and Winters, our results reinforce Baldwin's conclusion, notably that it is not Hungary, but Poland that came closest to its equilibrium exports in the early phase of transition. We found the pace of convergence for Poland and the Czech Republic to be slower than for Hungary. Surprisingly, total exports by Poland had not converged at all. We suspect that this can be attributed to the fact that exports by Poland, the country with the least advanced export structure out of the three countries, have the smallest share of R&D and skilled-labor intensive products.[16] . While the Czech Republic and Poland were unable to exploit all their opportunities in terms of export, Hungary came quite close to equilibrium in 1997. This means that in the future Hungarian export could expand only as a result of movements in GDP, real exchange rates, population and FDI (see later). Meanwhile, according to our model, Polish and Czech exports are expected to move ceteris paribus faster in the future, as convergence towards equilibrium constitutes another growth factor.

The high degree of integration of Hungarian export is mainly the result of high integration vis-à-vis the European Union. It is worth mentioning that both Hungary and the Czech Republic have very similar levels of actual trade with the EU. However, the potential trade for the Czech Republic is more than two or three times higher than that for Hungary. This can be attributed to two main factors: (1) the Czech Republic has a common border with Germany, the largest market within the EU and (2) the trade-weighted distance between Prague and the EU capital cities is significantly smaller than that between the Hungarian capital of Budapest and the EU. Poland's export to the EU had not converged significantly towards its potential, the gap for 1997 being 114 percent and 105 percent in terms of estimations including GDP and Purchasing Power Parity GDP, respectively.

[16] Such as Machinery and Transport equipments etc.

All the countries considered had converged towards their EFTA-export equilibrium, although these relations were not significant in volume. Regarding ODEV countries, Poland was the only one that moved away from equilibrium (in terms of purchasing power parity GDP estimates), with the Czech Republic and Hungary in particular moving towards equilibrium. The speed of convergence was estimated to be the fastest for Hungary. It is worth noting that Poland experienced a stagnation of actual export rates over the period.

Summing up, as regards export relations with developed economies, Hungary was the fastest in moving towards equilibrium, with the Czech Republic converging at a slower pace, and Poland even diverging in several respects .

Regarding export to CEFTA countries, the Czech Republic appeared to have reached a state of overintegration. Like in the case of imports, this was mainly the result of the special relations and historical ties with Slovakia. Poland and Hungary had significant potential left, the former moving towards equilibrium and the latter not capable of convergence.

In the case of OCE economies, both Hungary and the Czech Republic were well above their potential levels , while this was the only group of countries with which Polish trade is estimated to have approached equilibrium . The overintegration of the Czech Republic and Hungary with the OCE is mainly due to relations with Russia as a result of former linkages. The producers who formerly exported to the COMECON and are still uncompetitive in their trade with western countries kept up a rather high level of trade above equilibrium. Interestingly, as a result of the Russian crisis, trade from Hungary to this region has decreased by more than 50%, which could indicate a rapid movement toward equilibrium.

In all the countries exports to SEA are well below their potential. Despite significant development in equilibrium levels, actual export has stagnated in all countries considered. In comparison with the results for imports, one can conclude that the trade balance of the three central European countries would improve vis-à-vis SEA countries provided there were convergence towards equilibrium.

Imports							
Potential/actual(Percentage deviation)							
Czech Republic							
Model estimated with GDP							
	EU	EFTA	ODEV	CEFTA	OCE	SEA	Total import
1993	221.6	119.5	142.8	-45.9	-70.8	-27.9	116.1
1994	388.7	388.0	291.9	-11.0	-66.4	49.4	234.4
1995	339.6	314.4	233.2	-9.8	-70.4	17.3	204.1
1996	170.3	158.2	111.6	-18.3	-72.1	-38.2	109.0
1997	194.3	142.9	95.5	-11.7	-68.7	-42.4	114.5
Average speed of convergence*							
	-2.2	2.6	-5.3	13.0	1.7	-5.5	-0.2
Model estimated with purchasing power parity GDP							
1993	387.6	217.4	280.5	-30.4	-60.9	10.4	224.8
1994	567.1	514.1	458.9	4.4	-63.8	122.6	352.5
1995	461.1	378.7	380.5	0.7	-70.8	73.6	287.2
1996	233.6	186.9	197.0	-12.3	-75.9	-12.6	157.0
1997	297.6	201.7	179.5	0.7	-74.2	-13.7	186.1
Average speed of convergence*							
	-5.0	-1.3	-7.4	9.7	-9.9	-6.0	-3.1
Hungary							
Model estimated with GDP							
	EU	EFTA	ODEV	CEFTA	OCE	SEA	Total import
1990	210.5	96.3	239.4	142.7	-63.4	-7.3	173.3
1991	84.9	47.5	62.7	164.9	-1.5	-6.1	79.6
1992	84.0	85.2	180.7	193.8	39.6	21.0	93.1
1993	76.3	74.7	120.5	126.8	-76.3	-6.8	47.2
1994	51.3	70.1	148.3	72.5	-68.2	-14.7	41.2
1995	70.8	108.4	186.1	115.5	-66.7	-13.9	59.3
1996	72.9	132.5	161.7	93.7	-72.7	-25.1	56.9
1997	18.2	127.5	77.9	93.7	-69.3	-52.4	19.3
Average speed of convergence*							
	-9.5	6.8	-5.2	-3.9	6.7	-15.5	-5.1
Model estimated with purchasing power parity GDP							
1990	263.4	102.7	324.0	162.8	-49.9	-1.1	218.3
1991	74.2	23.9	59.4	101.5	56.4	-15.8	67.6
1992	59.0	47.2	164.0	111.0	104.1	10.3	67.2
1993	45.8	30.6	81.3	88.6	-83.0	-19.2	20.7
1994	27.0	24.9	107.4	42.7	-81.3	-24.8	16.8
1995	45.2	50.2	158.3	79.7	-80.7	-19.4	34.4
1996	45.9	67.9	140.0	63.7	-83.8	-30.1	32.4
1997	4.8	79.7	62.8	64.9	-83.3	-54.0	4.1
Average speed of convergence*							
	-7.9	8.3	-2.6	-3.3	-0.4	-13.1	-3.6
Poland							
Model estimated with GDP							
	EU	EFTA	ODEV	CEFTA	OCE	SEA	Total import
1990	219.9	24.8	548.2	404.0	-51.1	38.4	212.3
1991	190.8	23.5	384.4	299.7	-69.5	-24.3	180.3
1992	226.6	86.9	306.7	386.3	331.3	-8.2	217.9
1993	150.7	75.6	185.5	182.4	76.4	-22.4	139.7
1994	149.4	79.6	260.1	146.5	50.0	-22.1	137.5
1995	155.7	105.3	252.7	100.3	48.3	-23.6	139.3
1996	124.3	125.2	175.0	80.7	20.1	-48.0	106.1
1997	102.9	106.5	159.3	59.9	24.6	-56.9	87.7
Average speed of convergence*							
	-5.2	4.1	-2.4	-13.3	-8.3	-13.7	-5.9
Model estimated with purchasing power parity GDP							
1990	266.9	28.1	732.1	430.3	-32.7	52.1	262.4
1991	147.8	-4.4	348.1	182.5	-55.2	-35.9	139.5
1992	181.0	51.7	298.3	194.6	205.7	-12.6	175.3
1993	119.3	46.1	163.5	189.1	39.5	-24.2	111.4
1994	126.0	51.8	244.0	144.6	6.6	-21.0	115.0
1995	124.1	64.8	251.0	94.3	-0.4	-20.7	111.5
1996	94.2	77.6	173.7	71.0	-27.0	-47.1	79.4
1997	92.1	79.9	162.5	57.5	-28.1	-53.8	75.6
Average speed of convergence*							
	-3.3	5.3	-0.1	-14.1	-15.3	-11.6	-4.5

Exports

Potential/actual(Percentage deviation)

Czech Republic

Model estimated with GDP

	EU	EFTA	ODEV	CEFTA	OCE	SEA	Total export
1993	182.7	321.5	187.2	-45.3	-48.1	-66.6	102.7
1994	148.3	267.2	193.6	-52.5	-32.6	-16.7	83.8
1995	144.7	211.6	203.1	-37.9	-27.4	27.0	91.8
1996	142.3	207.0	161.1	-28.4	-21.5	68.4	94.2
1997	111.6	171.1	127.1	-33.7	-13.3	125.9	69.0
Average speed of convergence*							
	-7.0	-10.4	-5.7	4.9	13.7	61.2	-4.4
Model estimated with purchasing power parity GDP							
1993	375.5	546.4	385.1	-24.7	-14.3	-31.1	236.1
1994	271.6	400.3	353.4	-40.6	-18.7	37.7	171.1
1995	244.6	308.7	381.3	-25.6	-21.6	102.4	167.4
1996	230.7	285.6	299.7	-18.1	-26.6	150.0	161.2
1997	212.9	262.4	251.6	-19.7	-22.8	255.6	142.9
Average speed of convergence*							
	-9.9	-13.5	-7.7	1.7	-2.6	50.7	-7.8

Hungary

Model estimated with GDP

	EU	EFTA	ODEV	CEFTA	OCE	SEA	Total export
1990	167.5	194.1	143.8	136.6	68.1	-18.9	150.0
1991	71.7	194.7	133.4	181.3	-0.4	-11.1	82.2
1992	55.9	183.8	145.2	137.3	20.1	97.6	69.9
1993	60.2	195.6	136.0	91.7	-56.9	67.9	63.5
1994	46.9	203.3	126.2	186.2	-24.3	213.5	63.8
1995	29.8	182.0	122.8	142.7	-31.7	200.2	45.3
1996	13.5	157.9	87.2	129.2	-15.3	168.8	32.2
1997	-11.8	116.0	25.3	91.9	-5.1	60.4	9.8
Average speed of convergence*							
	-13.9	-7.5	-14.6	0.0	21.8	-1.1	-9.5
Model estimated with purchasing power parity GDP							
1990	214.3	196.2	181.4	132.5	117.3	-10.6	186.8
1991	67.6	149.0	122.2	101.1	64.6	-18.0	73.5
1992	40.0	124.3	125.8	66.2	50.8	82.2	50.8
1993	33.0	114.9	91.8	43.8	-65.2	45.3	33.5
1994	22.8	121.7	88.4	125.2	-53.7	174.7	33.7
1995	9.8	111.1	103.0	91.8	-59.7	175.9	20.7
1996	-3.6	93.7	72.2	83.8	-49.9	143.8	10.5
1997	-22.6	68.4	13.8	54.0	-48.2	49.4	-7.4
Average speed of convergence*							
	-12.7	-5.9	-12.2	1.7	10.5	0.7	-8.7

Poland

Model estimated with GDP

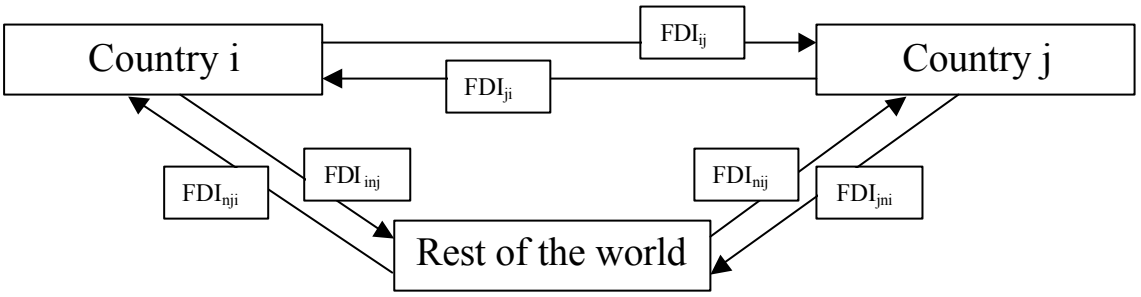
	EU	EFTA	ODEV	CEFTA	OCE	SEA	Total export
1990	105.5	412.8	240.6	-4.6	-50.6	-42.3	97.6
1991	143.8	386.3	289.0	93.6	-14.2	-25.4	140.9
1992	120.9	363.5	302.3	145.3	150.0	-3.9	129.1
1993	117.8	351.4	310.7	197.3	122.8	-21.1	125.7
1994	108.0	328.1	247.8	253.5	112.1	11.0	121.2
1995	104.6	290.8	283.4	203.7	50.1	39.0	113.4
1996	117.3	298.1	307.3	148.5	80.7	66.5	127.7
1997	114.2	249.0	304.4	135.0	67.2	270.7	125.8
Average speed of convergence*							
	-0.4	-6.2	-0.4	-5.7	-6.9	47.2	0.0
Model estimated with purchasing power parity GDP							
1990	160.2	460.4	337.6	4.9	-30.4	-29.0	147.0
1991	127.8	301.2	268.3	41.1	38.0	-31.3	123.5
1992	101.1	281.2	291.6	73.3	121.9	-6.1	108.7
1993	94.1	268.2	275.3	183.2	96.3	-22.9	102.2
1994	91.3	262.2	233.8	231.3	57.1	12.6	101.6
1995	81.5	223.9	286.1	177.0	1.7	41.9	88.6
1996	91.7	225.8	307.2	121.9	8.3	64.8	98.0
1997	105.5	205.5	310.6	119.4	-4.3	287.6	107.9
Average speed of convergence*							
	1.4	-4.6	2.3	-6.2	-16.4	49.8	0.7

* Average growth rate of potential/average growth rate of actual-100

The non-convergence of Polish export and the large gap between actual and potential trade for the Czech Republic may seem a bit puzzling. One reason for this observation could be that we omitted an important factor, namely the role of FDI.

Taking into account the role of FDI we estimated a gravity model extended with FDI-inward position data[17]. Six FDI-variables were constructed to estimate potential trade-enchancing and trade-diverting effects. The following variables were used:

- FDI_{ij}: the FDI-inward position of host country *j* from donor country *i*
- FDI_{ji}: the FDI-inward position of host country *i* from donor country *j*.
-FDI_{nij}: FDI inward position of host country *j* from donor countries different from *i*
-FDI_{nji}: FDI-inward position of host country *i* from donor countries different from *j*
-FDI_{jni}: FDI inward position of host countries different from *i* from donor country *j*
-FDI_{inj}: FDI-inward position of host countries different from *j* from donor country *i*



If the first two variables are positive, in other words, FDI between country *i* an *j* stimulates bilateral trade, then the latter four variables – investments to third countries- may have a trade-diverting effect. It is worth mentioning that the database containing reliable FDI inward position data by countries of origin were available only for OECD countries, and a significant part of the data was missing. Accordingly, the size of our sample decreased from around 17,300 to around 1130. As a result, the estimates are much less stable and powerful than in the previous case. Due to the missing data the estimated values of equilibrium trade for most of the countries can be calculated only for the period between 1993-1996[18]. Our estimated model showed evidence of significant trade-enhancing (direct) effects of foreign direct investments, and of FDI in third countries significantly diverting the trade between country i and j (indirect effects). The other coefficients of the model with FDI-variables did not change substantially compared to the basic model.

Figure 7-12 show the results of the estimation. As far as total imports are concerned, all countries were under-integrated by a small amount. As regards total exports, the Czech Republic and Poland are close to, or somewhat below equilibrium , while Hungary seems to be over-integrated. We have the surprising result that in the case of all three countries, equilibrium import and export rates estimated with FDI variables are smaller than those predicted by the basic model. This discrepancy can be explained by the following two hypotheses:

[17] It is important to note that it is the stock of FDI that determines a country's export-import capacity and not the flows.

[18] Due to constraints on the length of the paper we do not present the results in a table format, just in charts. Results are available from the authors upon request.

-the sample consists mainly of developed countries, and most of the FDI between developed countries flows into the service and banking sectors, which are mainly nontradable and where mergers and acquisitions play a very significant role. As FDI to the three CEE countries flowed into the manufacturing (tradable) sector in a larger proportion than the sample average in the early phase of transition, the estimates reflect equilibrium values with sectoral breakdown normally experienced in developed economies. Additionally, the stylized facts mentioned earlier indicate that FDI between developed countries is more likely to be horizontal (Markusen (1985)), whereas FDI between countries at different levels of development tends to be vertical. According to our hypothesis, vertical integration is more trade-generating than horizontal one. As our sample covers trade between developed economies, the estimated FDI elasticity of trade is smaller than it would be had a greater number of less-developed countries been involved in the sample.

In order to assess the validity of our hypothesis we estimated a probit model. If our null is true, the larger the GDP per capita differences between trading countries, the greater the probability that the potential trade estimates including FDI are lower than those produced by the basic gravity model. Table 8 presents the estimation results. According to the probit model estimates, the coefficient of the gap of GDP per capita increases between two countries is significantly positive, which supports our initial hypothesis.

Table 8.

Estimation results of the probit model

Dependent variable: Prob (x=1)[a]		
Explanatory variable: GDP per capita		
based on	current USD	PPP USD
constant	0.264**	0.576**
	(0.052)	(0.083)
coefficient	0.998**	1.143**
	(0.067)	(0.217)
LR statistic	71.078**	33.411**
H-L Statistic	19.258*	71.704**
Andrews Statistic	19.954*	75.907**

[a] The variable equals one if the estimated trade in the basic model is higher than in the model with FDI variables. Otherwise it equals zero.
* significant at 5% level
**significant at 1% level

- While the former explanation seems to be supported by our probit model there could be another reason why potential trade is smaller in all three countries considered. As the country-structure of FDI is markedly different from the country structure of trade in the three CEE countries – with the USA and the Netherlands being especially over-represented in the FDI positions compared to

their importance in trade-, this may divert the structure of potential trade towards the structure of FDI, thus lowering the trade potential[19].

4.1. Is there convergence of actual trade towards equilibrium ?

So far we have treated the estimated level of trade as representing some kind of equilibrium. As mentioned earlier, this comes from the fact that the gravity model is a reduced form of a general equilibrium system of export and import demand and supply. In addition, the gravity model is flexible enough to encompass a variety of models ranging from perfect product markets to monopolistic competition.

It is worth examining, however, whether the estimated trade flows represent an empirical equilibrium as well, in other words, whether there is convergence of the actual data towards the estimated equilibrium. For this purpose, we estimated a simple error correction model, regressing the change in actual trade values to the difference between actual and potential data in the previous period. Certainly for convergence, the estimated coefficient should be negative. The estimation results can be found in table 9. One can verify that regardless of the estimation technique (pooled, fixed, random), we get negative coefficients for the explanatory variable (GDP and GDP PPP). The estimated coefficients for the model with FDI variables were significantly negative in all cases as well[20]. Hence the convergence of actual trade in our sample towards the estimated level.

Table 9

The convergence of actual trade towards potential trade

The β coefficient of $TRADE_{ij,\,t} = \alpha+\beta\ (TRADE_{ij,\,t-1} - POTENTIAL_{ij,\,t-1})$ regression

(standard errors in parentheses)

	with GDP	with GDP PPP
Exports		
Pooled	-0.024* (0.012)	-0.013 (0.011)
Fixed effects	-0.260** (0.046)	-0.277** (0.044)
Random effects	-0.038* (0.016)	-0.029 (0.015)
Imports		
Pooled	-0.062** (0.016)	-0.056** (0.016)
Fixed effects	-0.563** (0.060)	-0.591** (0.054)
Random effects	-0.080** (0.020)	-0.084** (0.020)

$POTENTIAL_{ij}$ is the estimated trade flow

* significant at 5% level

** significant at 1% level

[19] For example, in the estimation of trade potential, a country relatively far away from Hungary (the USA) may crowd out the potential trade between Hungary and a country that is close to Hungary (Germany) because of the trade diverting effect of FDI.

[20] However the size of the adjustment coefficients seemed to be implausible in several cases.

5. CONCLUSION

In this paper we have estimated potential trade flows for three Central and Eastern European countries (the Czech Republic, Hungary and Poland). For the estimation of equilibrium trade flows we used a reduced form of a medium-term general equilibrium model: the gravity equation. In the case of the basic setup we estimated trade for a panel of 53 countries. The model which incorporated FDI variables was estimated for 28 OECD countries. Several results emerge from the analysis:

(1) Hungary was the fastest in the integration process, approaching equilibrium in terms of both export and import levels in 1997. This means that in the future Hungarian trade can only expand at a pace supported by the evolution of fundamentals, especially of income, real exchange rates and FDI-stocks. However, the fact that the country is close to its equilibrium does not mean that the equilibrium holds unanimously for each region. The country is closest to its potential trade in its relations with the EU countries. The space for future integration is considerable vis-à-vis EFTA, CEFTA and ODEV in terms of exports and imports, and vis-à-vis SEA countries in terms of exports. Overintegration was estimated in respect of both exports and imports with OCE countries, and imports with SEA countries.

(2) The Czech Republic converged at the second fastest pace in terms of exports, while lagging behind Hungary and Poland in terms of imports. It is interesting that while its actual trade level is similar to that of Hungary, the potential trade is two or three times as high because of the geographical proximity to its main trading partner, the EU and especially Germany. The Czech Republic was found to be the closest to equilibrium in terms of its trade with CEFTA. However, this was largely a result of its historically strong relations with Slovakia. A large positive gap was estimated for EU, EFTA and ODEV countries in terms of gross trade and for SEA countries in terms of exports. At the same time, OCE gross trade and SEA imports showed signs of overintegration.

(3) While in the former two countries convergence in terms of exports appeared to be faster than in terms of imports, in the case of Poland imports moved towards equilibrium faster than exports, which is mainly attributable to the fact that actual imports grew more rapidly than exports. The country was nearly at equilibrium vis-à-vis OCE countries, and large trade potentials were left in its relations with the other regions, except for imports from SEA countries.

(4) It is important to stress that in all cases overintegration can be observed in terms of imports from SEA, with exports to SEA lagging far behind potential. This indicates that SEA countries were the most successful in exploiting their trade potential with Central Europe.

(5) We found that the stock of FDI significantly stimulated bilateral trade (trade-enhancing effect), while FDI positions in third countries played a trade-diverting role.

(6) We had the surprising result that the levels of equilibrium trade estimated with FDI variables were lower than the basic model's predictions for the three countries. At first glance, this seems to be against the anecdotal evidence of the role of FDI in these countries. Nevertheless, this can be explained by the different nature of FDI between countries of different levels of development. The dominant form of FDI across developed economies is horizontal, while that of FDI between developed and emerging economies is mainly vertical. As vertical FDI is usually more trade-oriented than the horizontal one, the elasticity of trade with respect to FDI is higher in the former case. Consequently, in a sample with most of the

countries having horizontal FDI, potential trade estimates for countries with vertical FDI tend to be downward biased. This hypothesis was supported by a probability model.

(7) We also checked whether there was convergence towards estimated trade flows, with the help of an error correction model. The results indicated the presence of convergence.

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APPENDIX 1: DATA SOURCES AND DEFINITIONS

In the basic version of the model estimations, an annual panel data set of 53 countries was used for the period between 1990 and 1997. As the gravity model is originally written in multiplicative form, we have linearized the model by taking the natural logarithm of all variables. The source of bilateral trade-flow data was the International Trade by Commodities Statistics (ITCS) database of the OECD for the 28 OECD countries and the Direction of Trade Statistics Yearbooks, published by the IMF for non-OECD countries. The import data for bilateral trade flows were taken in current US-dollars. The variable $TRADE_{ij,t}$ denotes the trade flow from country i to country j at time t (imports of country j from country i at time t). Two measures of income were used: GDP at market prices in current US-dollars (GDP) and GDP at Purchasing Power Parity (PPP) in current international US-dollars (GDPPP). The sources of GDP and GDPPPP data were the database called World Development Indicators (WDI) of the International Bank for Reconstruction and Development (The World Bank). Population data were collected from the International Financial Statistics (IFS). Bilateral exchange rate index data were calculated from the national currency/US-dollar exchange rate data of the International Financial Statistics (IFS) and were computed for a fixed base (1994=100). We used four types of price level data, namely the GDP deflator of the exporter , the GDP deflator of the importer , the export prices of the exporter and the import-prices of the importer. GDP deflator data were calculated from World Development Indicators (WDI) database data and were rebased for the base year of 1994. We used three sources for export and import price data: International Financial Statistics for non-OECD countries, the export and import prices of goods on the diskette called International Trade and Competitiveness Indicators of OECD, as well as data from the National Bank of Hungary. Unfortunately, we encountered a serious problem of missing values in connection with the non-OECD countries. All export and import price data refer to fix-based price levels (1994=100) in national currency units.

The next group of variables describes or proxies the transaction costs of trade between countries. Transaction costs can be derived from the different cultural and legal environment, the different infrastructure and, of course, the economic distance between the two countries. Preferential trade agreements also diminish the transaction costs, because of lower customs rates and/or similar legal systems. The transportation costs were proxied by the geographical distance between the capital cities.[21,22]. The distance data were obtained from the software called PcGlobe 3.0.

The variable BORDER is a dummy-variable which equals to one if the two countries have a common border. The dummy called EFTAEU takes the value of one if both country i and j are members of the European Union or EFTA in 1997 (Austria, Belgium, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the United Kingdom). The variable CEFTA takes the value of one if

[21] The only exception was Israel, where instead of Tel-Aviv Jerusalem was taken as the capital city.

[22] However it is worth noting, that in larger countries (such as the United States or Russia) the geographical distance between the capital cities can be different from the economic distance; the transportation distance between Japan and US would be better measured by the distance between Los Angeles and Tokyo than between Washington D.C. and Tokyo.

both country i and j are members of CEFTA (Czech Republic, Hungary, Poland, Romania, Slovakia, Slovenia). The dummy called NAFTA equals to one if both country i and j are NAFTA countries (Canada, Mexico, the United States). The ASEAN dummy is one if both country i and j are ASEAN members (Indonesia, Malaysia, Philippines, Singapore, Thailand). The variable called MERCOSUR is one if both country i and j are members of MERCOSUR[23] (Argentina, Brazil, Chile[24], Paraguay, Uruguay). In order to capture the effects of common (official) languages, we created variables called ENGLISH and SPANISH, which take the value of one provided both country i and j have the same official language. As the trade relations of transition countries can also have special characteristics we created a dummy called $CEE_{ij,}$ which takes the value one provided that country i or country j is a former planned economy (Bulgaria, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, the Russian Federation, Slovakia, Slovenia, the Ukraine).

As FDI data were not available for all 53 countries, we used a sample of 28 OECD countries. The data source was the OECD direct investment database called International Direct Investment Statistics. As most of the FDI data were published in national currency units they had to be recalculated into US-dollars.

[23] Mercado Comun del Sur
[24] In fact, Chile is an associate member of MERCOSUR.

APPENDIX 2: RESULTS

Dependent variable: $TRADE_{ij}$ (standard errors in parentheses)[a]

Model	Basic model					
	With GDP	with GDP PPP	With GDP	with GDP PPP	with GDP	with GDP PPP
Estimation method	GLS (Cross Section Weights) Common constant		GLS Random effects		OLS Fixed effects based on Mátyás (1997)[b]	
Constant	-23.947**	-35.097**	-23.136**	-35.695**	11.858	3.030
	(0.143)	(0.173)	(0.512)	(0.657)	(7.884)	(7.728)
GDP in country i	0.971**	…..	0.755**	…..	0.274**	…..
	(0.003)	…..	(0.017)	…..	(0.074)	…..
GDP in country j	0.837**	…..	0.862**	…..	0.401**	…..
	(0.003)	…..	(0.017)	…..	(0.079)	…..
GDP PPP in country i	…..	1.610**	…..	1.475**	…..	0.933**
	…..	(0.006)	…..	(0.031)	…..	(0.110)
GDP PPP in country j	…..	1.389**	…..	1.522**	…..	0.892**
	…..	(0.006)	…..	(0.031)	…..	(0.112)
Population in country i	-0.099**	-0.756**	0.093**	-0.625**	-1.168**	-1.994**
	(0.003)	(0.006)	(0.022)	(0.032)	(0.389)	(0.417)
Population in country j	0.003	-0.555**	0.008	-0.670**	0.505	0.048
	(0.004)	(0.006)	(0.021)	(0.032)	(0.391)	(0.413)
GDP – deflator in country I	-0.967**	-0.604**	-0.324**	-0.142**	-0.384**	-0.332**
	(0.033)	(0.038)	(0.026)	(0.026)	(0.106)	(0.093)
GDP – deflator in country j	-0.000	0.323**	0.011	0.249**	0.464**	0.639**
	(0.025)	(0.027)	(0.027)	(0.027)	(0.096)	(0.078)
Exchange rate	-0.287**	-0.202**	-0.111**	-0.092**	-0.314**	-0.321**
	(0.022)	(0.023)	(0.018)	(0.018)	(0.050)	(0.049)
Export price of country I	0.678**	0.416**	0.231**	0.086**	0.075	0.033
	(0.036)	(0.041)	(0.027)	(0.027)	(0.105)	(0.098)
Import price of country j	0.361**	-0.019	0.161**	-0.068*	-0.078	-0.227**
	(0.026)	(0.027)	(0.029)	(0.028)	(0.093)	(0.081)
DISTANCE	-0.934**	-0.976**	-0.958**	-1.010**	-0.893**	-0.894**
	(0.004)	(0.004)	(0.024)	(0.024)	(0.012)	(0.0121)
BORDER	0.719**	0.712**	…..	…..	0.621**	0.619
	(0.012)	(0.012)	…..	…..	(0.039)	(0.0391)**
EFTAEU	-0.306**	-0.183**	…..	…..	…..	…..
	(0.011)	(0.012)	…..	…..	…..	…..

(Continued overleaf)

Estimation Results (continued)

Model	Basic model					
	With GDP	with GDP PPP	with GDP	with GDP PPP	with GDP	with GDP PPP
Estimation method	GLS (Cross Section Weights) Common constant		GLS Random effects		OLS Fixed effects based on Mátyás (1997)[b]	
CEFTA	0.679**	0.400**	…..	…..	-0.341**	-0.338**
	(0.026)	(0.028)	…..	…..	(0.093)	(0.0931)
NAFTA	-0.207*	-0.508**	…..	…..	0.692**	0.691**
	(0.101)	(0.095)	…..	…..	(0.144)	(0.1441)
ENGLISH	1.027**	0.869**	…..	…..	0.685**	0.686**
	(0.015)	(0.016)	…..	…..	(0.059)	(0.0591)
SPANISH	0.144**	-0.149**	…..	…..	1.163**	1.307**
	(0.023)	(0.021)	…..	…..	(0.053)	(0.2181)
ASEAN	1.120**	1.018**	…..	…..	-0.226**	-0.225**
	(0.056)	(0.057)	…..	…..	(0.096)	(0.0961)
MERCOSUR	0.329**	0.640**	…..	…..	0.477**	0.476**
	(0.040)	(0.053)	…..	…..	(0.091)	(0.0911)
CEE	-0.820**	-0.772**	…..	…..	-2.013**	-2.027**
	(0.011)	(0.011)	…..	…..	(0.055)	(0.0551)
R-squared	0.775	0.778	0.389	0.402	0.994	0.861
Adjusted R-squared	0.775	0.778	0.389	0.402	0.860	0.860
Durbin-Watson	0.220	0.228	1.460	1.487	0.670	0.670
Normality (Jarque-Bera)	4812.046**	4332.601**	188779.90**	193478.90**	20309.770**	20229.270**
Hausman-test[25]			597.326**	280.322**		
Breusch-Pagan test for random effects	32878.150**	33090.078**				
Number of observations	8 year	8 year	8 year	8 year	8 year	8 year
Total panel observations	17,334	17,314	17,334	17,314	17,334	17,314
Sample	1990 1997	1990 1997	1990 1997	1990 1997	1990 1997	1990 1997
Number of countries	53	53	53	53	53	53

* Significant at 5% level

** Significant at 1% level

[a] In addition, the specifications contain time effect dummies. These are available from the authors upon request

[b] In addition, the model contains 53 exporter and 53 importer time-specific effects.

[25] The Hausman tests in the table are not exactly for the equations presented in the table. The distance variable is omitted from the calculations of the test the, as fixed effect estimation with time invariant variables, so the Hausman test is not computable in this case. We think, however, that the model without the distance variable is a reasonable approximation of the original model, in the sense that, if the individual effects correlate with the regressors in the former model, then this must be the case for the original model as well.

Model	Models with FDI variables					
	with GDP	With GDP PPP	with GDP	with GDP PPP	with GDP	with GDP PPP
Estimation method	GLS (Cross-Section Weights) Common constant		GLS Random effects		OLS Fixed effects based on Mátyás (1997)[b]	
Constant	-14.944**	-13.748**	-15.122**	-31.801**	62.525*	114.215**
	(0.386)	(0.460)	(1.494)	(2.494)	(28.655)	(34.203)
GDP in country i	0.858**	…..	0.663**	…..	-0.161	…..
	(0.012)	…..	(0.079)	…..	(0.531)	…..
GDP in country j	0.522**	…..	0.565**	…..	1.328**	…..
	(0.011)	…..	(0.077)	…..	(0.494)	…..
GDP PPP in country I	…..	0.974**	…..	1.379**	…..	0.314
	…..	(0.029)	…..	(0.149)	…..	(0.547)
GDP PPP in country j	…..	0.559**	…..	1.538**	…..	1.925**
	…..	(0.023)	…..	(0.136)	…..	(0.541)
population in country I	-0.133**	-0.295**	0.018	-0.748**	-3.142*	-5.074**
	(0.013)	(0.029)	(0.087)	(0.150)	(1.339)	(1.607)
population in country j	0.085**	0.041	0.198*	-0.857**	-0.572	-2.939
	(0.011)	(0.023)	(0.083)	(0.142)	(1.333)	(1.570)
GDP – deflator in country I	-0.352**	0.090	-0.857**	-0.238	1.796**	0.696
	(0.060)	(0.073)	(0.145)	(0.146)	(0.678)	(0.392)
GDP – deflator in country j	-0.287**	-0.175	0.238*	0.515**	-0.737	0.311
	(0.055)	(0.061)	(0.114)	(0.088)	(0.538)	(0.257)
Exchange rate	-0.294**	-0.191*	-0.360**	-0.170**	0.256	-0.286
	(0.036)	(0.033)	(0.093)	(0.064)	(0.529)	(0.199)
Export price of country I	0.429**	-0.223	0.443**	0.077	-0.900*	-0.503
	(0.074)	(0.081)	(0.112)	(0.114)	(0.367)	(0.314)
Import price of country j	0.444**	0.156*	0.365**	-0.014	0.532**	0.090
	(0.029)	(0.028)	(0.063)	(0.056)	(0.202)	(0.174)
FDI_{ij}	0.149**	0.173**	0.068**	0.060**	0.114**	0.119**
	(0.003)	(0.003)	(0.012)	(0.012)	(0.013)	(0.014)
FDI_{ji}	0.128**	0.126**	0.051**	0.034**	0.128**	0.133**
	(0.003)	(0.002)	(0.012)	(0.012)	(0.013)	(0.013)
FDI_{nij}	-0.033**	-0.143**	-0.106**	…..	…..	…..
	(0.006)	(0.006)	(0.036)	…..	…..	…..
FDI_{nji}	-0.068**	…..	…..	…..	-0.113**	-0.086*
	(0.004)	…..	…..	…..	(0.038)	(0.037)
FDI_{jni}	-0.192**	-0.301**	…..	0.090*	-0.371**	-0.135
	(0.005)	(0.004)	…..	(0.038)	(0.106)	(0.094)
FDI_{inj}	-0.078**	…..	-0.043**	-0.052**	-0.129**	-0.163**
	(0.005)	…..	(0.014)	(0.018)	(0.042)	(0.041)
DISTANCE	-0.569**	-0.512**	-0.690**	-0.757**	-0.731**	-0.735**
	(0.003)	(0.005)	(0.045)	(0.046)	(0.024)	(0.024)
BORDER	0.288**	0.366**	…..	…..	0.272**	0.286**
	(0.007)	(0.009)	…..	…..	(0.050)	(0.050)
EFTAEU	…..	0.090**	…..	…..	…..	…..
	…..	(0.015)	…..	…..	…..	…..

(Continued overleaf)

Estimation results (continued)

Model	Models with FDI variables					
	with GDP	with GDP PPP	with GDP	with GDP PPP	with GDP	with GDP PPP
Estimation method	GLS (Cross-Section Weights) Common constant		GLS Random effects		OLS Fixed effects based on Mátyás (1997)[b]	
CEFTA	0.888**	0.832**	…..	…..	…..	…..
	(0.044)	(0.058)	…..	…..	…..	…..
NAFTA	…..	…..	…..	…..	…..	…..
	…..	…..	…..	…..	…..	…..
ENGLISH	0.290**	0.125**	…..	…..	-0.172*	-0.166*
	(0.012)	(0.010)	…..	…..	(0.067)	(0.067)
SPANISH	…..	…..	…..	…..	…..	…..
	…..	…..	…..	…..	…..	…..
ASEAN	…..	…..	…..	…..	…..	…..
	…..	…..	…..	…..	…..	…..
MERCOSUR	…..	…..	…..	…..	…..	…..
	…..	…..	…..	…..	…..	…..
CEE	-0.484**	-0.611**	…..	…..	…..	…..
	(0.020)	(0.030)	…..	…..	…..	…..
R-squared	0.901	0.894	0.995	0.995	0.937	0.935
Adjusted R-squared	0.900	0.892	0.995	0.995	0.933	0.932
Durbin-Watson	0.089	0.089	1.337	1.401	0.916	0.920
Normality (Jarque-Bera)	566.657**	651.978**	1701.371**	2038.504**	589.887**	593.898**
Hausman-test[26]			279.798**	361.861**		
Breusch-Pagan test for random effects	1259.7**	1302.643**				
Number of observations	8 year	8 year	8 year	8 year	8 year	8 year
Total panel observations	1,120	1,124	1,129	1,129	1,127	1,127
Sample	1990 1997	1990 1997	1990 1997	1990 1997	1990 1997	1990 1997
Number of countries	28	28	28	28	28	28

* Significant at 5% level

** Significant at 1% level

[a] In addition, the specifications contain time effect dummies. These are available from the authors upon request

[b] In addition, the model contains 53 exporter and 53 importer time-specific effects.

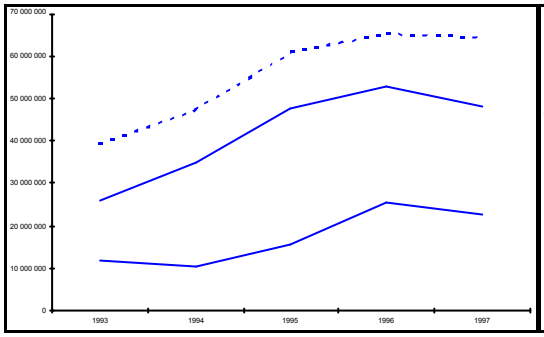
[26] The Hausman tests in the table are not exactly for the equations presented in the table. The distance variable is omitted from the calculations , as fixed effect estimation with time invariant variables, so the Hausman test is not computable in this case. We think, however, that the model without the distance variable is a reasonable approximation of the original model, in the sense that, if the individual effects correlate with the regressors in the former model, then this must be the case for the original model as well.

APPENDIX 3: FIGURES

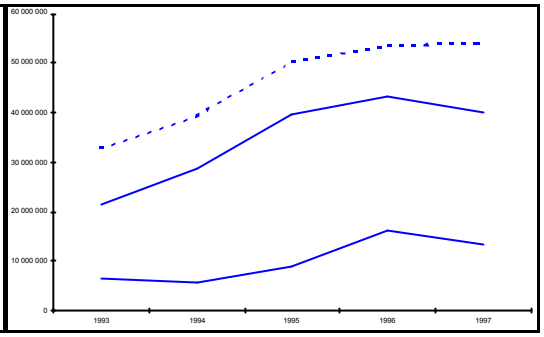
Figure 1.

Evolution of Potential and Actual Imports of Czech Republic

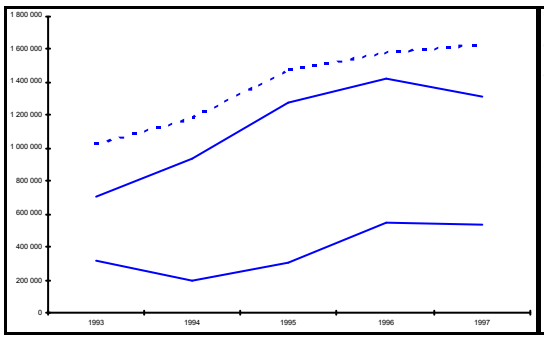
Total Imports



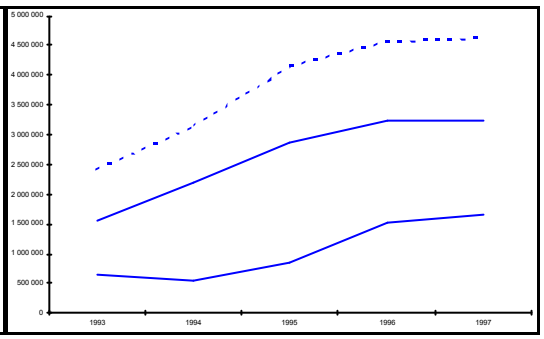
European Union countries



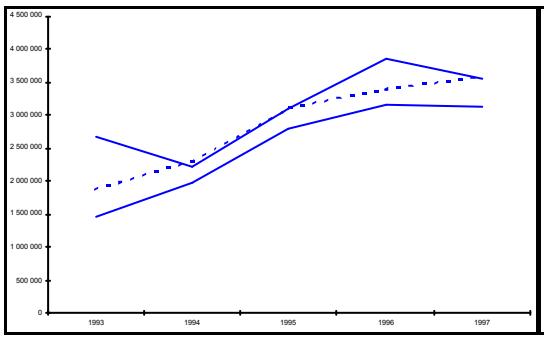
EFTA countries



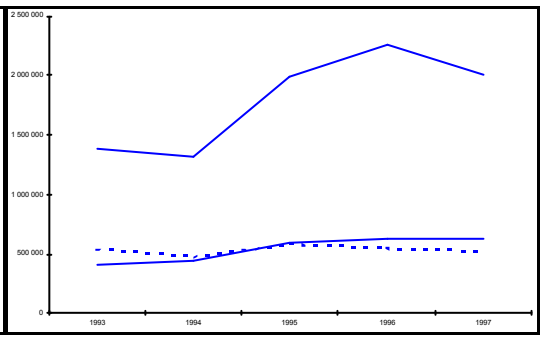
Other Developed countries



CEFTA countries



Other Central and Eastern European countries



South East Asian countries

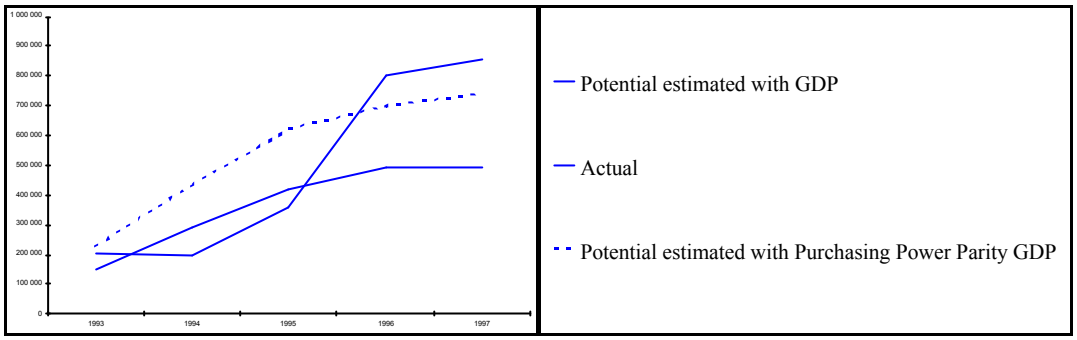
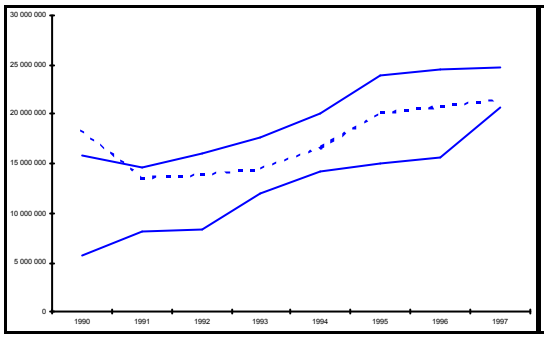


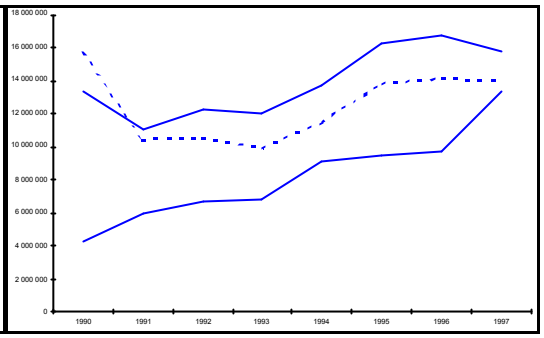
Figure 2.

Evolution of Potential and Actual Imports of Hungary

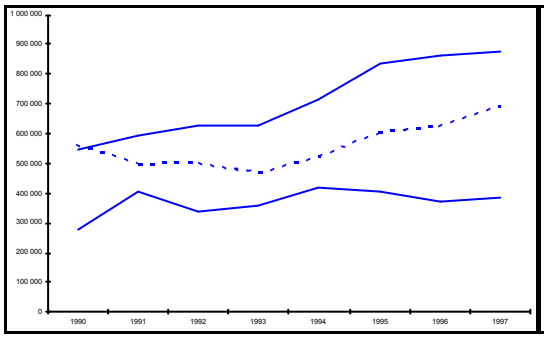
Total Imports



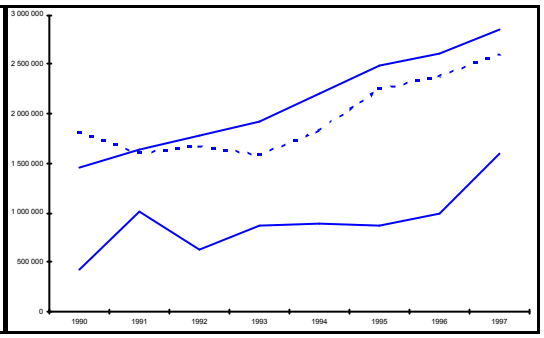
European Union countries



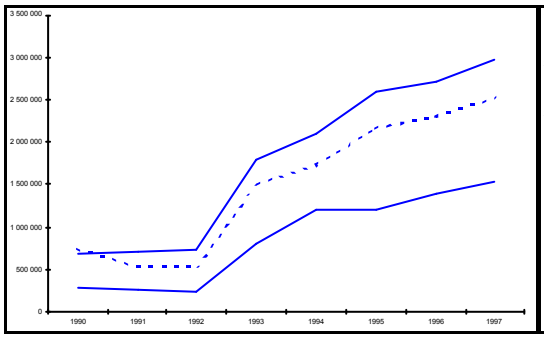
EFTA countries



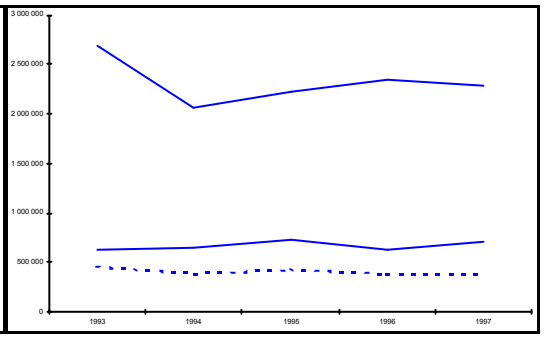
Other Developed countries



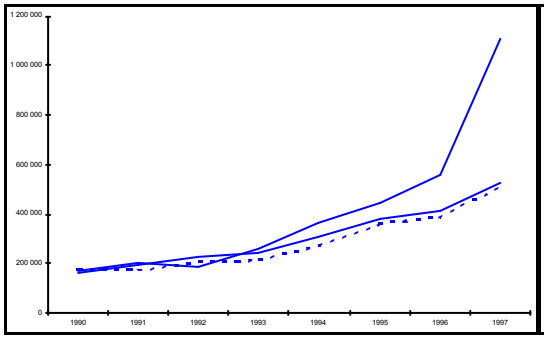
CEFTA countries



Other Central and Eastern European countries



South East Asian countries



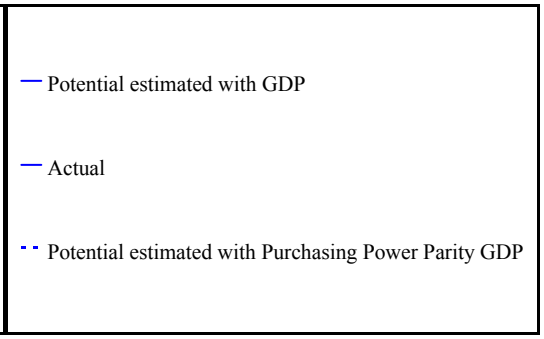
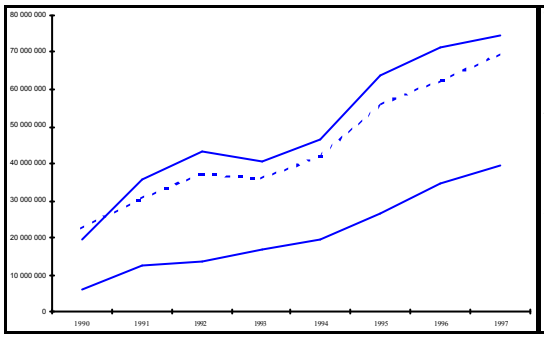


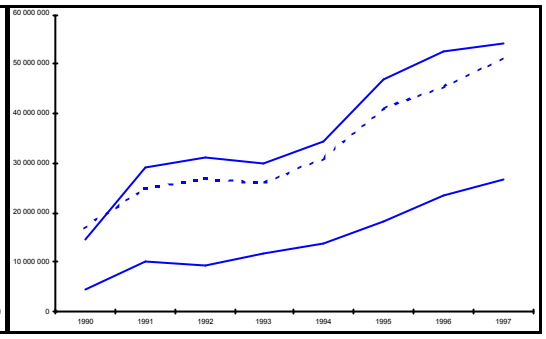
Figure 3.

Evolution of Potential and Actual Imports of Poland

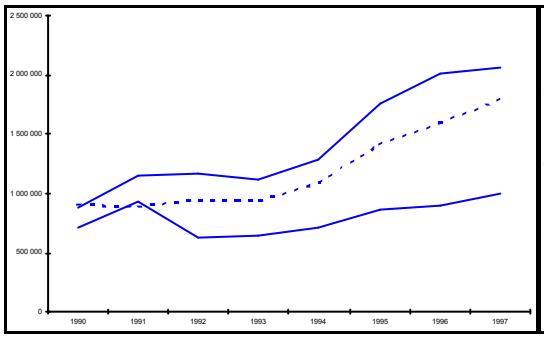
Total Imports



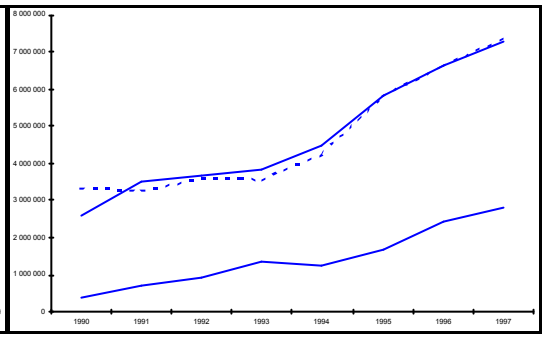
European Union countries



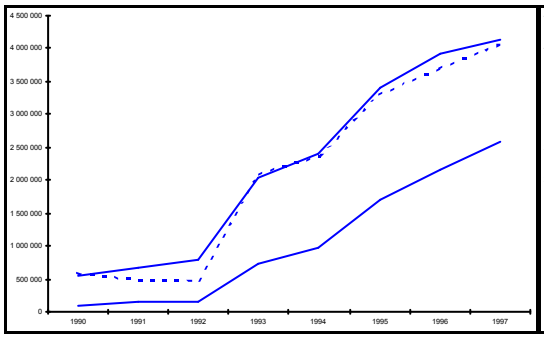
EFTA countries



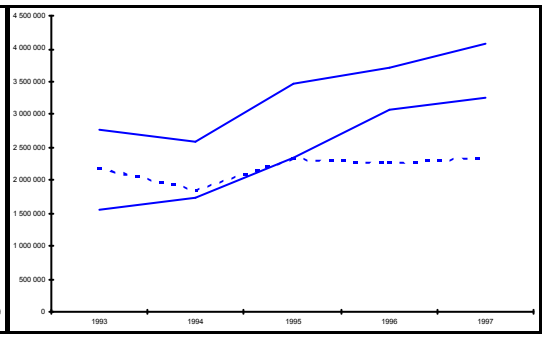
Other Developed countries



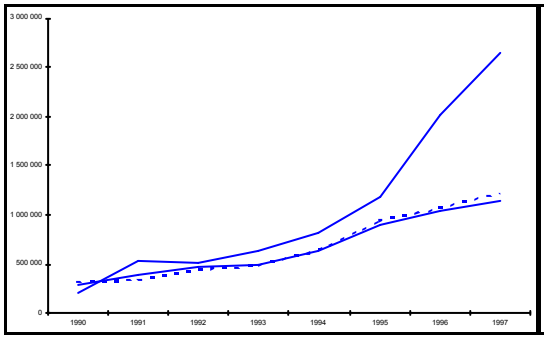
CEFTA countries



Other Central and Eastern European countries



South East Asian countries



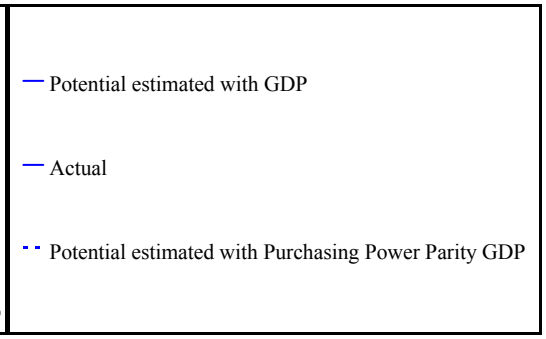
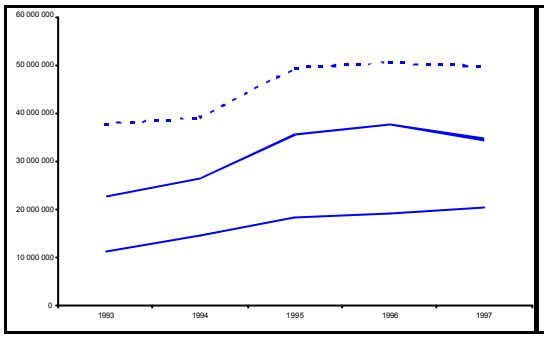


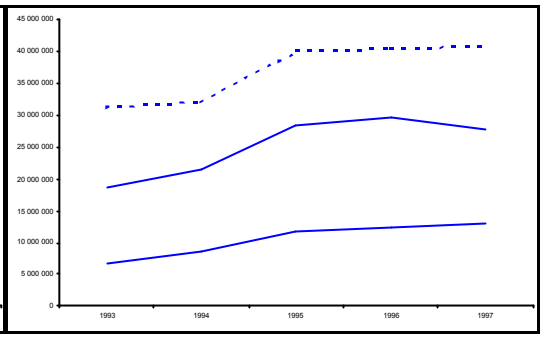
Figure 4.

Evolution of Potential and Actual Exports of Czech Republic

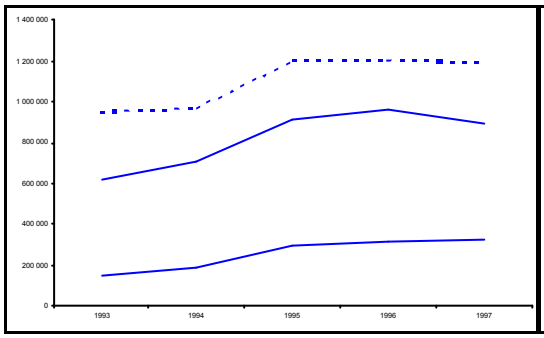
Total Exports



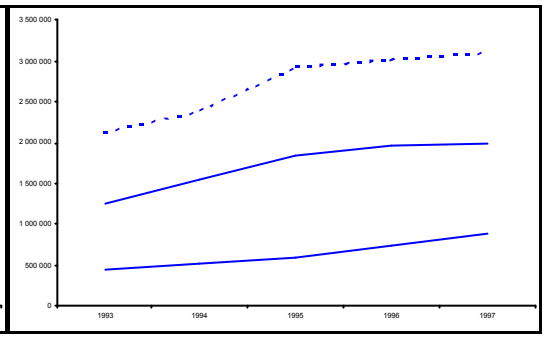
European Union countries



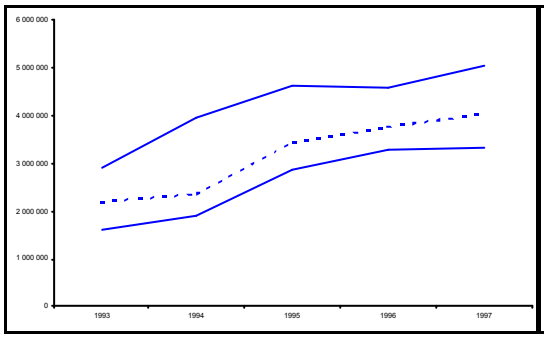
EFTA countries



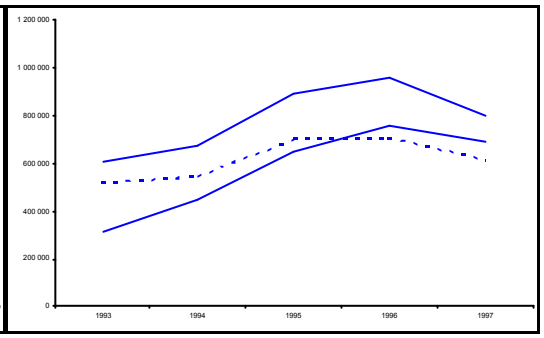
Other Developed countries



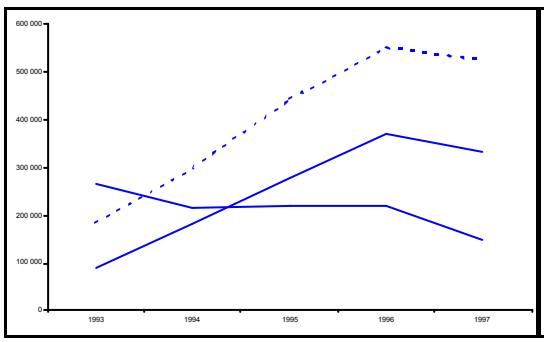
CEFTA countries



Other Central and Eastern European countries



South East Asian countries



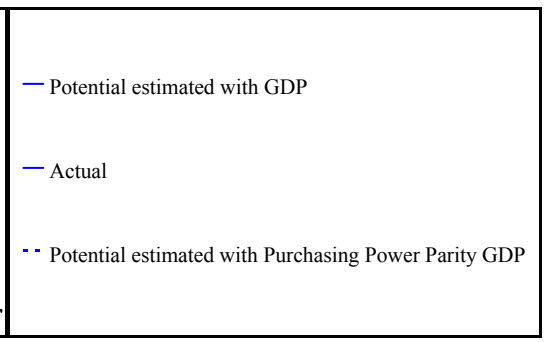
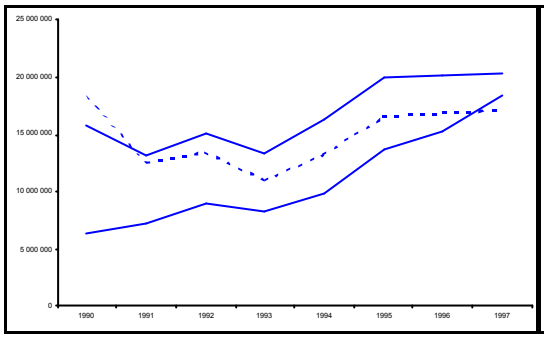


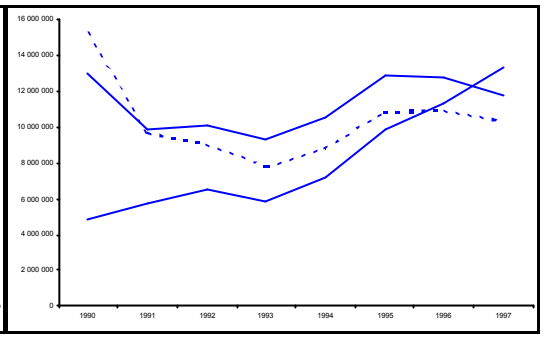
Figure 5.

Evolution of Potential and Actual Exports of Hungary

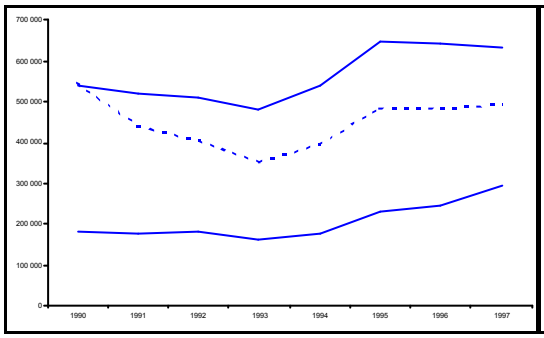
Total Exports



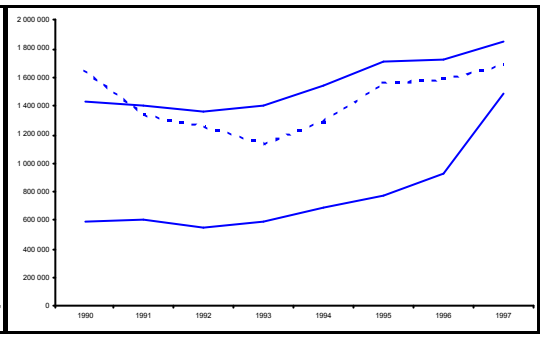
European Union countries



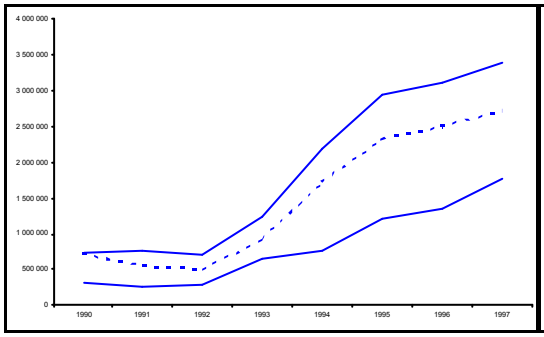
EFTA countries



Other Developed countries



CEFTA countries



Other Central and Eastern European countries

South East Asian countries

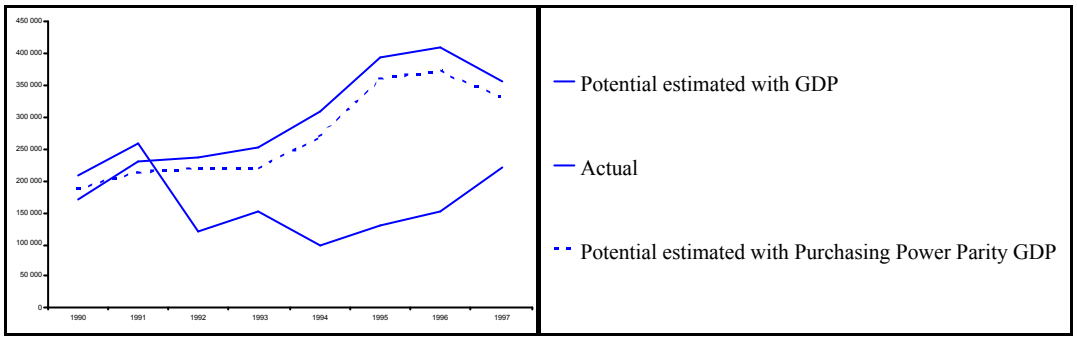
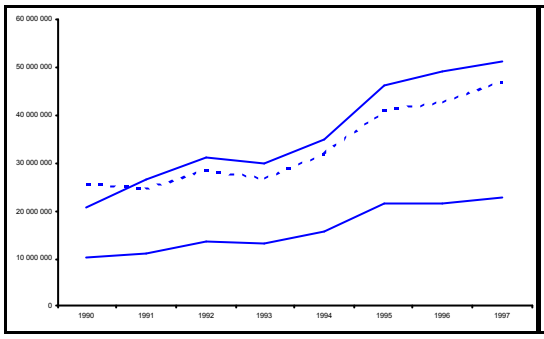


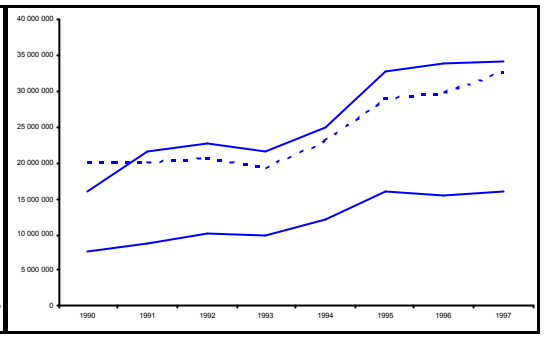
Figure 6.

Evolution of Potential and Actual Exports of Poland

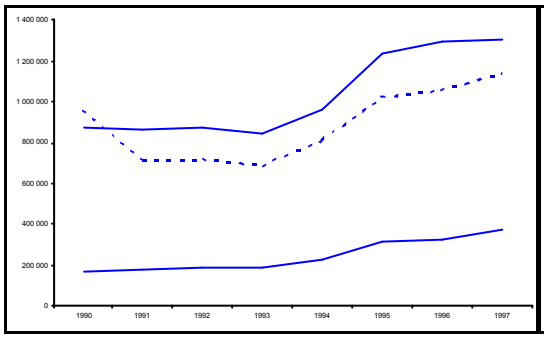
Total Exports



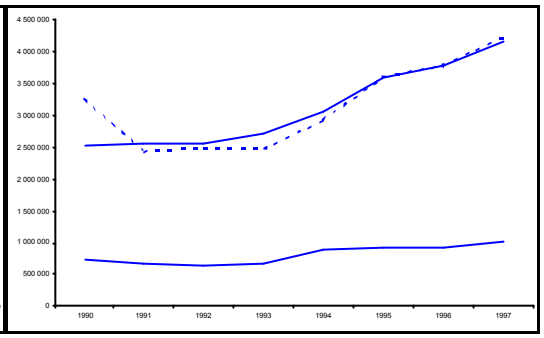
European Union countries



EFTA countries



Other Developed countries



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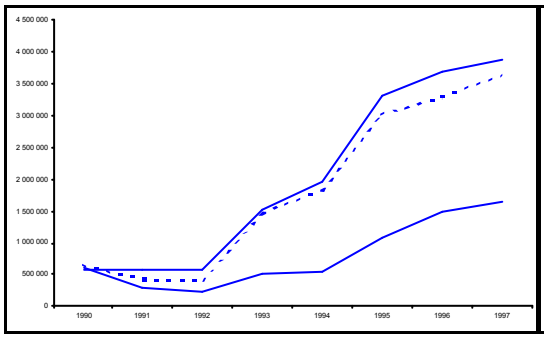
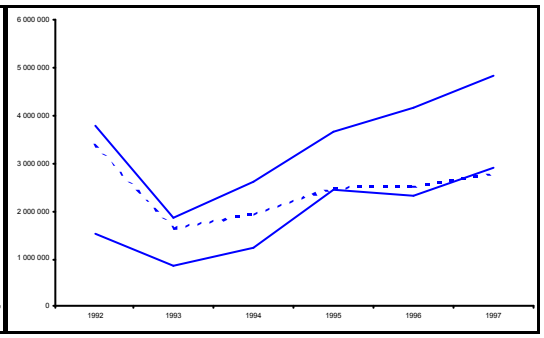
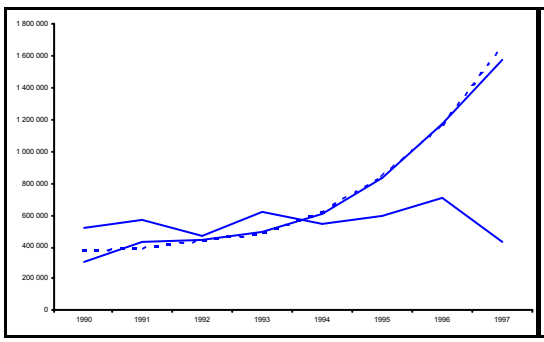


Other Central and Eastern European countries



South East Asian countries



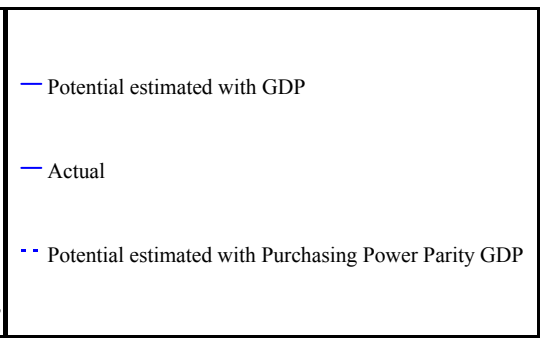
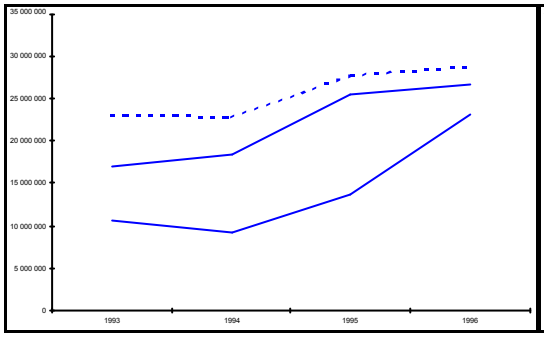
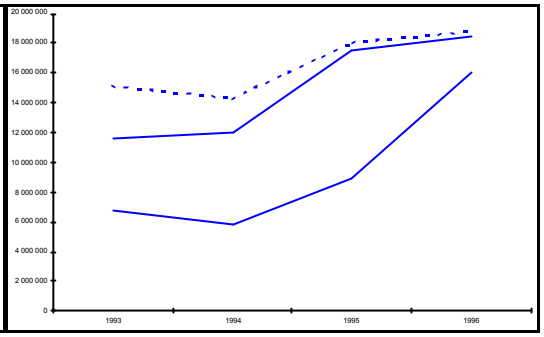


Figure 7.
Evolution of Potential and Actual Imports of Czech Republic, model estimated with Foreign Direct Investment variables

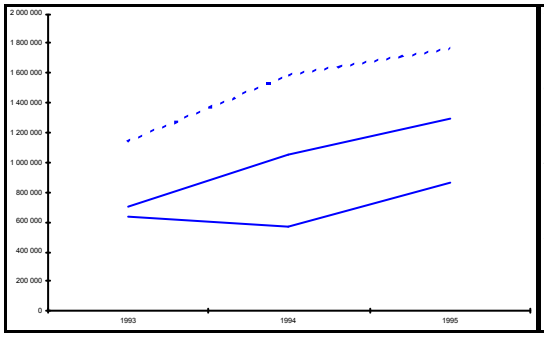
Total Imports



European Union countries



Other Developed countries



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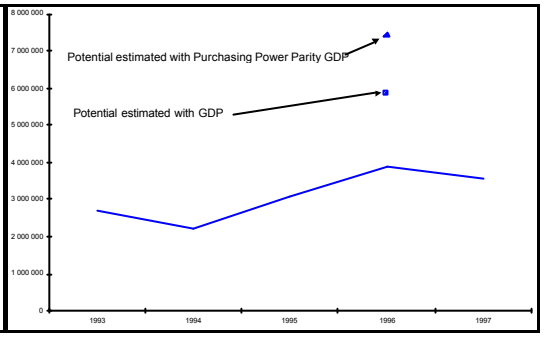


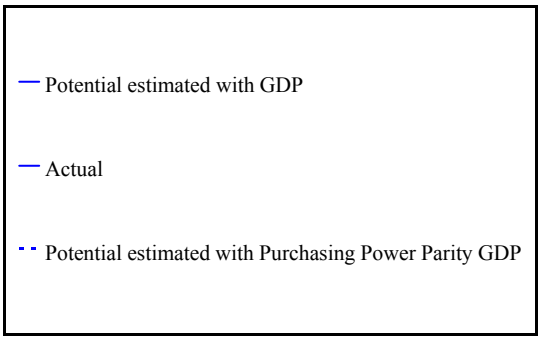
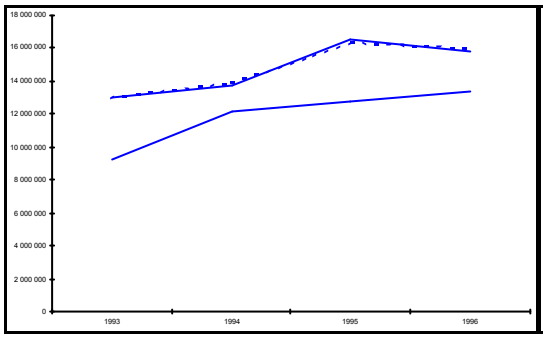


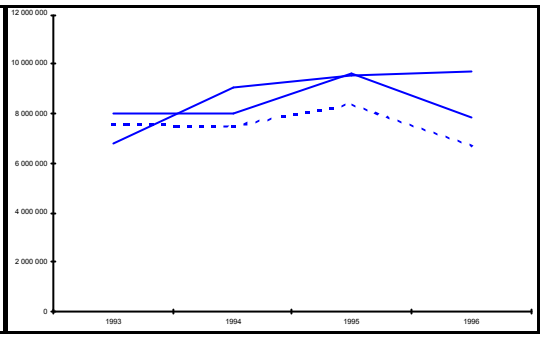
Figure 8.

Evolution of Potential and Actual Imports of Hungary, model estimated with Foreign Direct Investment variables

Total Imports



European Union countries



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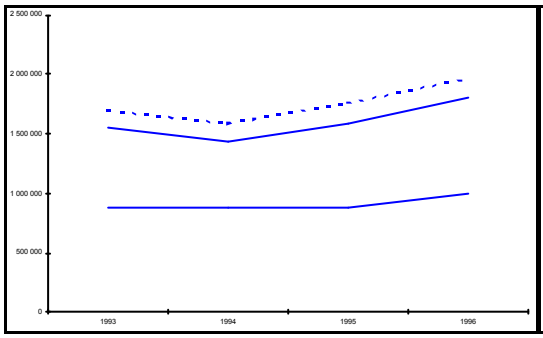

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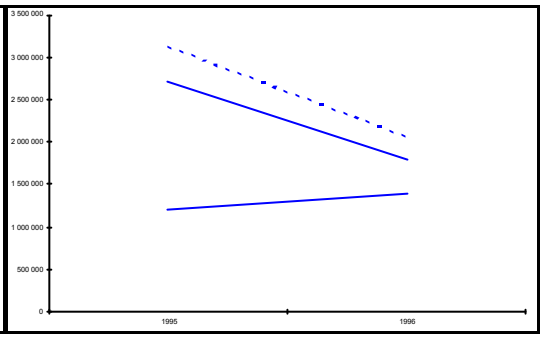


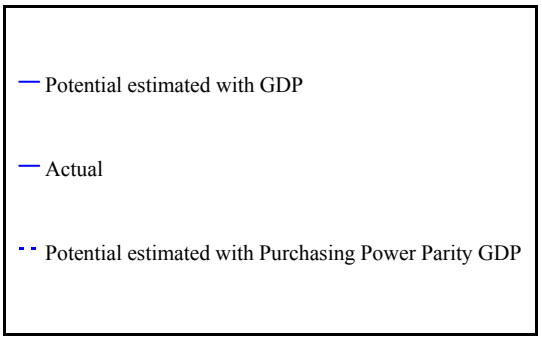
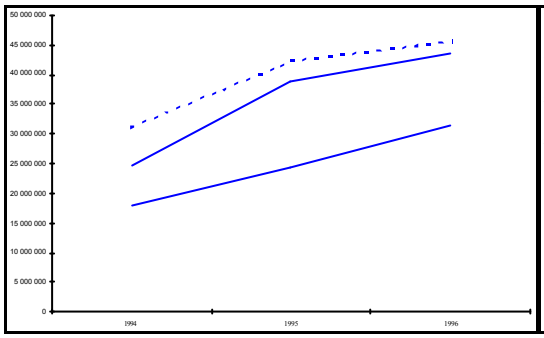


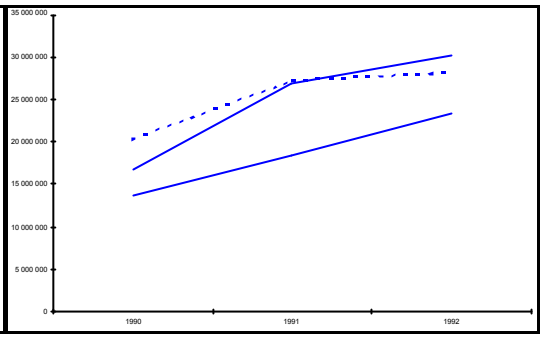
Figure 9.

Evolution of Potential and Actual Imports of Poland, model estimated with Foreign Direct Investment variables

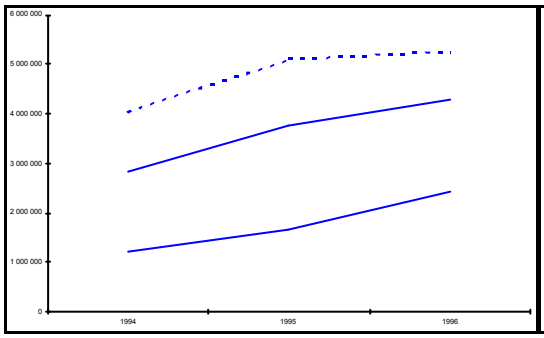
Total Imports



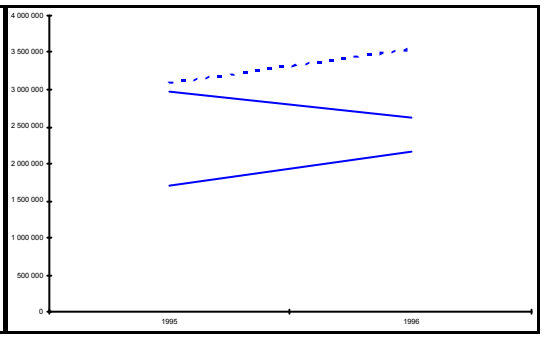
European Union countries



Other Developed countries



CEFTA countries



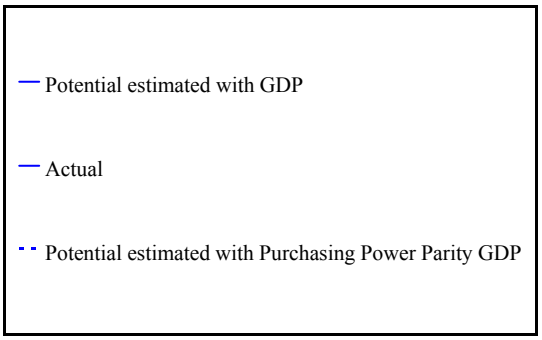
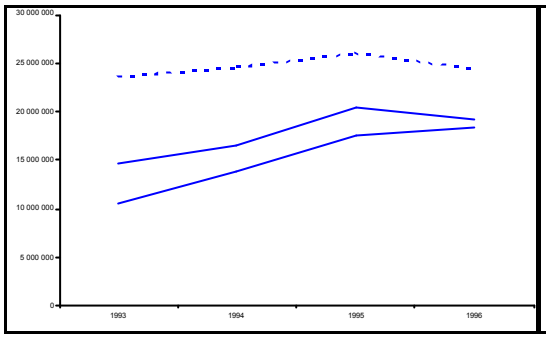


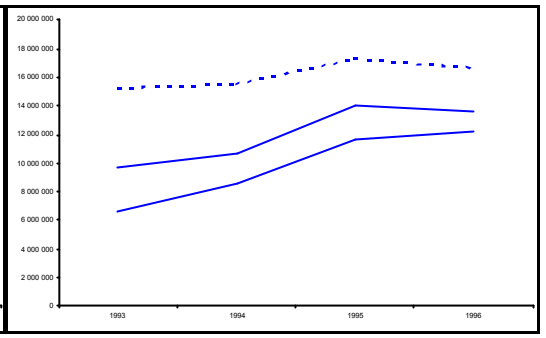
Figure 10.

Evolution of Potential and Actual Exports of Czech Republic, model estimated with Foreign Direct Investment variables

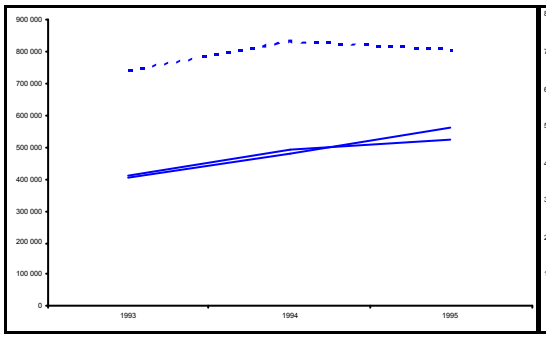
Total Exports



European Union countries



Other Developed countries



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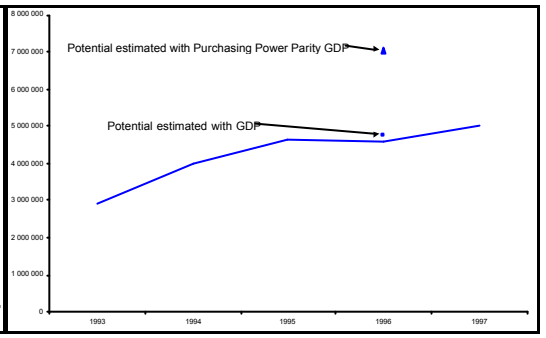


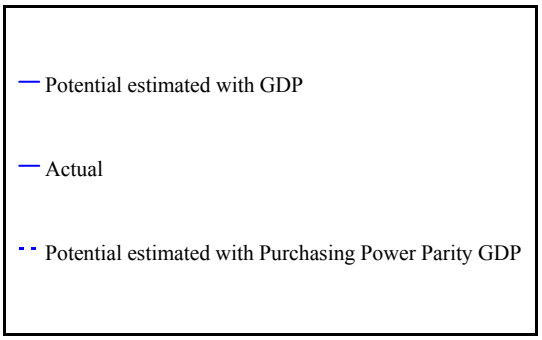
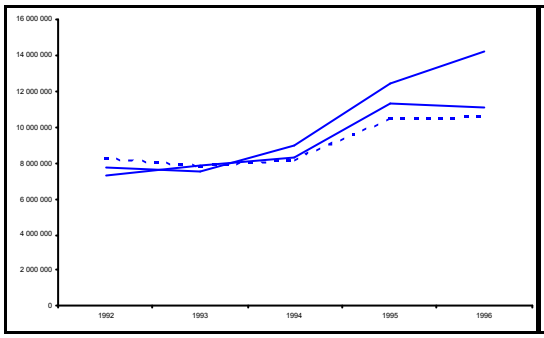


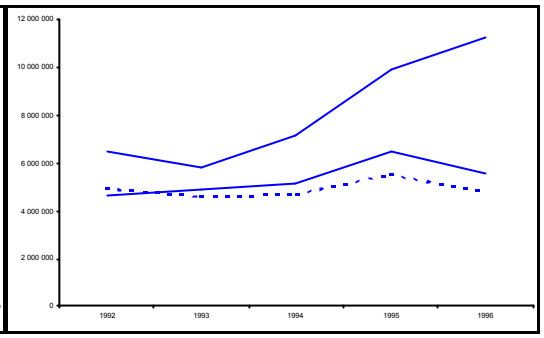
Figure 11.

Evolution of Potential and Actual Exports of Hungary, model estimated with Foreign Direct Investment variables

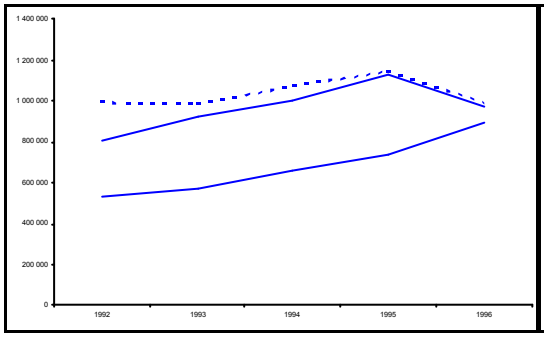
Total Exports



European Union countries



Other Developed countries



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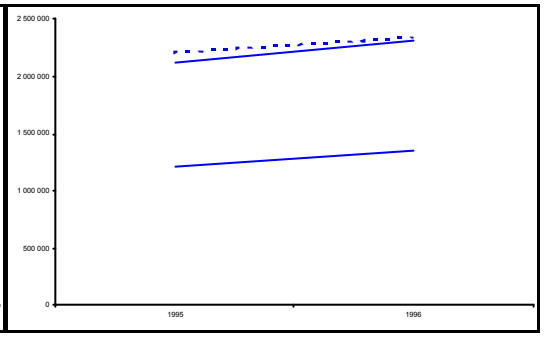


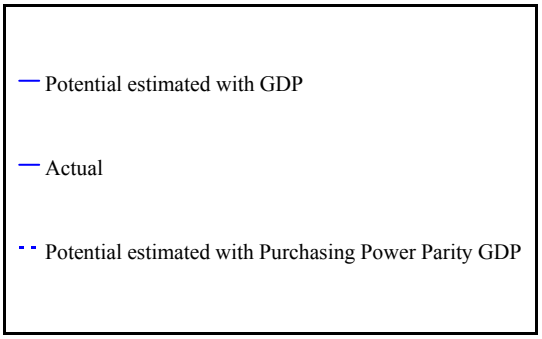
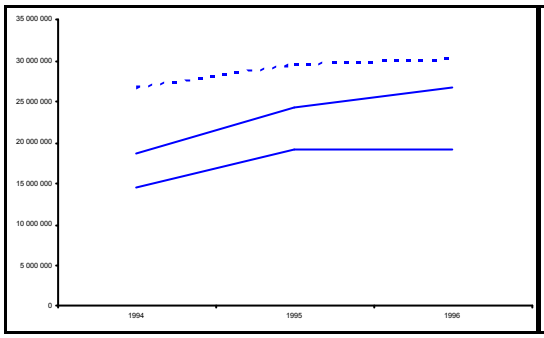


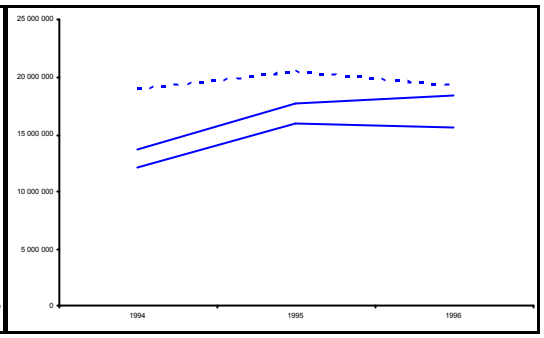
Figure 12.

Evolution of Potential and Actual Exports of Poland, model estimated with Foreign Direct Investment variables

Total Exports



European Union countries



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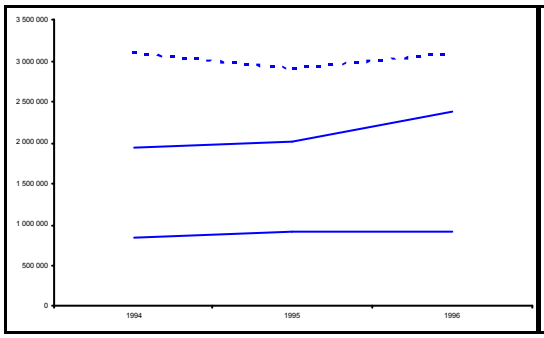

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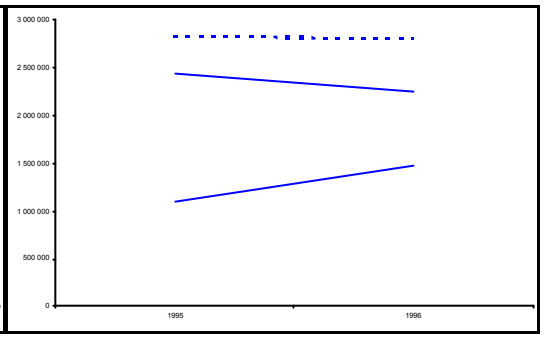

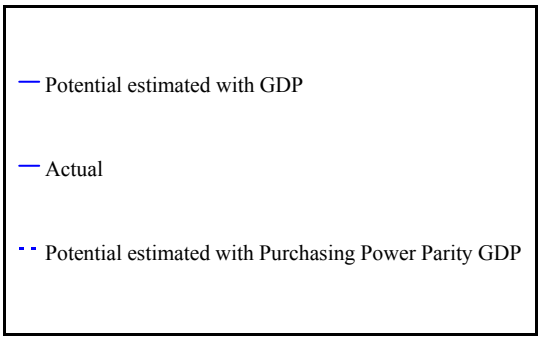

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SÁNDOR VALKOVSZKY – JÁNOS VINCZE: ESTIMATES OF AND PROBLEMS WITH CORE INFLATION IN HUNGARY

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