TI 2003-093/3
Tinbergen Institute Discussion Paper

Economic Integration and Manufacturing Location in EU Accession Countries

Simonetta Longhi[1]
Peter Nijkamp[1]
Iulia Traistaru[2]

[1] Department of Spatial Economics, Faculty of Economics and Business Administration, Vrije Universiteit Amsterdam, and Tinbergen Institute, [2] Center for European Integration Studies, University of Bonn.

Tinbergen Institute
The Tinbergen Institute is the institute for economic research of the Erasmus Universiteit Rotterdam, Universiteit van Amsterdam, and Vrije Universiteit Amsterdam.

Tinbergen Institute Amsterdam
Roetersstraat 31
1018 WB Amsterdam
The Netherlands
Tel.: +31(0)20 551 3500
Fax: +31(0)20 551 3555

Tinbergen Institute Rotterdam
Burg. Oudlaan 50
3062 PA Rotterdam
The Netherlands
Tel.: +31(0)10 408 8900
Fax: +31(0)10 408 9031

Please send questions and/or remarks of non-scientific nature to driessen@tinbergen.nl.
Most TI discussion papers can be downloaded at http://www.tinbergen.nl.

Economic Integration and Manufacturing Location in EU Accession Countries

Simonetta Longhi*, Peter Nijkamp**, and Iulia Traistaru***

Abstract

This paper investigates patterns of manufacturing location in the context of increased economic integration in Central and East European countries. Using regional data for the period 1990-1999, we identify and compare patterns and determinants of manufacturing location in five European Union (EU) accession countries: Bulgaria, Estonia, Hungary, Romania and Slovenia. Our research results suggest that, in these countries, regional relocation of industries has taken place, leading in Bulgaria and Romania to increasing regional specialization. However, regional specialization has not changed significantly in Estonia, Hungary and Slovenia. We find empirical evidence indicating that both factor endowments and geographic proximity to large markets determine the location of manufacturing in EU accession countries.

Keywords: Economic integration, manufacturing specialization, geographical concentration of industries, EU accession countries

JEL Classification: F15, R11, R12, P52

* Department of Spatial Economics, Free University Amsterdam.
email <slonghi@feweb.vu.nl>

** Corresponding author at: Department of Spatial Economics, Free University of Amsterdam, De Boelelaan 1105, 1081 HV Amsterdam, Fax: +31 20 444 6004
email <pnijkamp@feweb.vu.nl>

*** Center for European Integration Studies, University of Bonn.
e-mail <traistaru@uni-bonn.de>

1. Introduction

Since 1990, Central and East European countries (CEECs) have experienced increased economic integration with the European Union (EU), which has led to a reallocation of resources across sectors and space. While sectoral shifts in CEECs have frequently been analyzed, so far the spatial implications of increasing economic integration in the EU accession countries have not been investigated in-depth. Important issues are: Where is industrial activity located? How specialized/diversified are regions in accession countries? How concentrated/dispersed are industries? Have patterns of regional specialization and geographical concentration of industries changed over the period 1990-1999? What are the determinants of patterns of industrial location?

This paper investigates all these research questions. We identify and compare patterns and determinants of manufacturing location in five EU accession countries: Bulgaria, Estonia, Hungary, Romania and Slovenia. Our research results suggest that, in these countries, regional relocation of industries has taken place, leading in Bulgaria and Romania to increasing regional specialization. However, regional specialization has not changed significantly in Estonia, Hungary and Slovenia. We find empirical evidence indicating that both factor endowments and geographic proximity to large markets determine the location of manufacturing in accession countries.

The remainder of this paper is organized as follows. Section 2 discusses the theoretical framework and existing empirical evidence on the specialization of countries and regions and the geographical concentration of industries. Section 3 gives an overview of the data set and measures used for our analysis. Section 4 analyses patterns of regional specialization in the five accession countries, while Section 5 discusses the geographical concentration of manufacturing in the same countries. Section 6 presents the results of our econometric analysis on the determinants of the location of manufacturing activity in the five accession countries included in this study. Section 7 concludes.

2. Analytical Framework

2.1. Theoretical Background

The existing literature on international trade theory about the impact of economic integration on the specialization and location of industrial activity can be grouped into three strands.[1] While offering different explanations of patterns of specialization, all three theoretical approaches predict increasing specialization as a result of trade liberalization. Traditional trade theory explains patterns of specialization on the basis of differences in productivity (technology) or endowments across countries and regions, while new trade theory and, more recently, new economic geography models underline increasing returns in production, agglomeration economies and cumulative processes as explanations for the concentration of activities in particular countries and regions.

Traditional trade theory explains specialization patterns through differences in relative production costs. Such cost differences are termed 'comparative advantages' that result from differences in productivity (technology) (Ricardo, 1817) or endowments (Heckscher, 1949; Ohlin, 1933) between countries and regions. The main features of these models are perfect competition, homogeneous products, and constant returns to scale. The traditional trade theory predicts that trade liberalization will result in production relocation and increasing specialization according to comparative advantages. The consequent changes in demand for factors of production will tend to equalize factor prices across countries and regions. A large portion of inter-industry specialization can be explained by neo-classical trade models (see Leamer and Levinsohn, 1995). However, as pointed out by Venables (1998), while relevant, comparative advantage is not sufficient as the sole explanation for specialization. In reality, different production structures are found in regions and countries with similar factor endowments and production technologies. Furthermore, trade between industrialized countries consists mainly of goods in the same product category, i.e. it is intra-industry trade.

During the 1980s, *new trade theory* models were developed, mainly for explaining intra-industry trade (Krugman, 1979, 1980, 1981; Helpman and Krugman, 1985; Krugman and Venables, 1990). The main assumptions in these models are: increasing returns to scale; product differentiation; and imperfect (monopolistic) competition. The new trade theory models focus on the interactions between firms with increasing returns in product markets and explain patterns of specialization and location of industrial activity in terms of the geographical advantage of countries and regions with good market access. When trade barriers fall, activities with increasing returns will tend to locate in countries/regions with good market access ('the center'), and move away from

[1] Recent surveys of theoretical literature include: Amiti (1998); Venables (1998); Brülhart (1998); Aiginger et al. (1999); Hallet (2001); and Puga (2002).

remote countries/regions ('the periphery'). Krugman and Venables (1990) suggest that geographical advantage will be greatest at some intermediate trade cost. This implies that the relationship between trade costs and the location of activity has an inverse U-shape. When trade barriers and transport costs are small enough, the geographical advantage of the regions with good market access becomes less important. At this stage, factor production costs will motivate firms to move back to peripheral regions.

As pointed out by Hallet (1998), the prediction of new trade theory regarding the distribution of economic activity between the core and periphery is relevant in the case of the accession of CEECs to the European Union. The current economic integration situation could be seen as one with 'intermediate trade costs'. Further integration could result in the relocation of manufacturing to these countries due to factor costs considerations.

The *new economic geography* models assume that the geographical advantage of large markets is endogenous, and suggest that specialization patterns may be the result of the spatial agglomeration of economic activities (Krugman, 1991a, 1991b; Krugman and Venables, 1995; Venables, 1996). The main assumptions of these models are: the presence of pecuniary or technological externalities between firms; monopolistic competition; and increasing returns to scale. Krugman's analysis focuses on a two-sector two-region model similar to that of Krugman and Venables (1990). The two regions are identical in terms of initial factor endowments, and the factor specific to manufacturing (industrial workers) is mobile across regions. Relocation of firms and workers from one region to the other triggers agglomeration via the cumulative effects of demand linkages. Assuming no barriers to the movement of firms or manufacturing workers (as in the Krugman, 1991b model), a bleak scenario could be imagined: the manufacturing sector in the 'donor' region would collapse and manufacturing would concentrate in the 'receiving' region. This scenario could develop gradually following the lowering of trade costs. Initially, when trade costs are high, manufacturing is evenly split between the two regions (each region produces for its own local market). If trade costs are sufficiently low, demand linkages bring about the agglomeration of activities. Regions with an initial scale advantage in particular sectors would attract more manufacturing activity and thus reinforce their advantage in those sectors. Krugman and Venables (1995) extend these models to include firms with 'supply-side linkages'. These new economic geography models imply that, in sectors where supply-side and demand-side linkages are important, European integration would bring massive specialization and concentration. However, given the extremely low inter-EU country mobility, this result seems unrealistic (Eichengreen, 1993; Obstfeld and Peri, 1998). However, sufficient labor mobility within EU countries could still result in agglomeration effects emerging around border regions similar to those effects identified by Hanson (1996, 1997a) for the case of US-Mexican economic integration.

2.2. Empirical Evidence

There is a small but growing empirical literature on the impact of economic integration on production specialization and geographic concentration of industries.

In a series of papers, Hanson has looked at the US-Mexican integration and assessed the locational forces identified by the new economic geography models. Hanson (1996) finds that integration with the US has led to a relocation of Mexican industry from Mexico City to states close to the US market. Hanson (1997a, 1997b, 1998) find that in the case of Mexico, interregional wage differentials are increasingly explained by the distance from the border with the US and less by the distance from the capital city.

Using production data in current prices for 27 manufacturing industries, Amiti (1999) finds that there was a significant increase in specialization between 1968 and 1990 in Belgium, Denmark, Germany, Greece, Italy, and the Netherlands; no significant change occurred in Portugal; and a significant decrease in specialization occurred in France, Spain and the UK. There was a significant increase in specialization between 1980 and 1990 in all countries. With more disaggregated data (65 industries), the increase in specialization is more pronounced: the average increase is 2 per cent for all countries except Italy, compared with 1 per cent in the case with 27 manufacturing industries. Other evidence of increasing specialization in EU countries in the 1980s and 1990s based on production data is provided by Hine (1990); Greenway and Hine (1991); Aiginger et al. (1999) and Midelfart-Knarvik et al. (2000). However, analyses based on trade data indicate that EU Member States have a diversified rather than a specialized pattern of manufacturing exports (Sapir, 1996; Brülhart, 2001).

The geographic concentration of US manufacturing industries is analyzed by Ellison and Glaeser (1997). Using a model that controls for industrial characteristics, they find that almost all industries seem to be localized. Many industries are, however, only slightly concentrated, and the locations of some of the most concentrated industries are related to natural advantages.

In the case of Europe, Amiti (1999) finds that 17 out of 27 industries experienced an increase in geographical concentration, with an average increase of 3 per cent per year in leather products, transport equipment and textiles. Only six industries experienced a fall in concentration, with paper and paper products and 'other chemicals' showing particularly marked increases in dispersion. Brülhart and Torstensson (1996) compare industry Gini coefficients with the industry centrality indices proposed by Keeble et al. (1986) and find a positive correlation between scale economies and industry bias towards the central areas of the EU in both 1980 and 1990. Brülhart, 1998 finds that industries, such as chemicals and motor vehicles, that are highly concentrated and located in central EU countries are subject to significant scale economies. Midelfart-Knarvik et al. (2000) find that many industries have experienced significant changes in their location across EU Member States during the period 1970-1997. Slow-growing and unskilled labor-intensive industries have become more concentrated, usually in peripheral low-wage countries. During the same period, a number of medium- and high-technology industries have become more dispersed.

With respect to accession countries, existing evidence based on trade statistics suggests that these countries tend to specialize in labor- and resource-intensive sectors, following an inter-industry trade pattern (Landesmann, 1995). Despite the dominance of the inter-industry (Heckscher-Ohlin) type of trade, intra-industry trade has also increased, particularly in the Czech Republic and Hungary (Landesmann, 1995; Dobrinsky, 1995). This increase may, however, be associated with the intensification of outward processing traffic. Furthermore, it has been claimed that the processes of internationalization and structural change in transition economies tend to favor metropolitan and Western regions, as well as regions with a strong industrial base (Petrakos, 1996). In addition, at a macro-geographical level, the process of transition is expected to increase disparities at the European level, by favoring countries near the East-West frontier (Petrakos, 2000). Increasing core-periphery differences in Estonia are documented in Raagmaa (1996). Using the 'new economic geography' approach, Altomonte and Resmini (1999) have investigated the role of foreign direct investment in shaping regional specialization in accession countries.

Resmini (2002) analyses the determinants of location and growth of manufacturing activities in border regions and finds that regions bordering the EU have been taking advantage of their location since the beginning of the transition process. High wages, a skilled labor force, and a well-developed service sector have all contributed to increasing employment in manufacturing activities relative to national averages. Among these border regions, those regions bordering the EU and countries outside the EU enlargement (non-European Union, non-accession countries) show the highest predicted growth rates.

In this paper, we test the role played by the industrial and regional characteristics which are suggested by international trade theory as determinants of manufacturing location using different model specifications based on the panel properties of our data set.

3. Data Set and Measurement

In this paper, we analyze the determinants of manufacturing location in five EU accession countries –Bulgaria, Estonia, Hungary, Romania and Slovenia – using data at NUTS 3 level, which is part of a specially created data set called REGSTAT[2].

The variables available are: employment; unemployment; average earnings; indicators of research and development (R&D); population; and other geographic and demographic variables. The period covered is 1990-1999, though certain variables are available for a shorter period. In most cases, data were collected from national statistical offices. In the case of Estonia, employment data at the regional level were obtained using labor force surveys. In Slovenia, employment data at the regional level were obtained using the information provided in the balance sheets of companies with more than ten employees.

The classification of manufacturing activities was made according to the Eurostat NACE Rev1 (two-digit classification) for Estonia, Romania, and Slovenia. Employment data were collected according to existing national classifications in Hungary and Bulgaria. For these two cases, we aggregated the data to get them as close as possible to the NACE classification.

In our analysis, we measure regional manufacturing location by means of specialization and concentration indicators computed using employment data at NUTS 3 level. Several absolute and relative measures of specialization and concentration have been proposed in the existing literature[3], each having certain advantages as well as shortcomings. For our analysis we have selected a relative measure: a dissimilarity

[2] This data set has been generated in the framework of the PHARE ACE Project P98-1117-R.

[3] Overviews of different measurements for specialization and geographic concentration of industries include: Ellison and Glaeser (1997); Aiginger et al. (1999); Devereux et al. (1999); and Hallet (2000).

index derived from the index proposed by Krugman, 1991a. Our specialization (*$SPEC_r$*) and concentration (*$CONC_i$*) measures are computed as follows:

$$SPEC_r = \sum_i \left| \frac{E_{ir}}{\sum_i E_{ir}} - \frac{\sum_r E_{ir}}{\sum_i \sum_r E_{ir}} \right| \qquad (1)$$

and

$$CONC_i = \sum_r \left| \frac{E_{ir}}{\sum_r E_{ir}} - \frac{\sum_i E_{ir}}{\sum_i \sum_r E_{ir}} \right|, \qquad (2)$$

where E_{ir} is employment in industry *i* and region *r*. The index ranges from 0 to 2, and increases with increasing specialization or concentration. The index is 0, indicating maximum diversification of regional manufacturing structures or maximum geographical dispersion of manufacturing branches, when region *r* has the same industry structure as the national average ($SPEC_r$), or when the distribution of industry *i* over all regions is the same as the distribution of the whole manufacturing across regions ($CONC_i$). The upper bound is 2 and indicates maximum manufacturing specialization of a region or maximum geographical concentration of an industry. Both measures are computed using regional data, separately for each country.

Changes in patterns of regional specialization and concentration of industry are explored in the next two sections.

4. Regional Specialization

Over the past decade, CEECs have experienced a significant structural adjustment following increased economic integration and the transition to a market economy. There has been a reallocation of resources across sectors and space, resulting in changing patterns of regional specialization. As shown in Figure A1 of the Appendix, during the 1990s average regional specialization increased in Bulgaria and Romania and decreased in Estonia and Hungary. In the case of Slovenia, the trend is unclear due to the short period covered by the available data.

In order to check whether regional specialization has changed significantly in the countries under analysis, we estimate the following trend model:

$$\ln SPEC_{rt} = \alpha_r + \beta \cdot t + \varepsilon_{rt}, \qquad (3)$$

where the dependent variable $\ln SPEC_{rt}$ is the natural logarithm of the specialization index, in region *r* at time *t*, measured by means of the dissimilarity index, as in (1). The independent variable *t* represents the year to which the data refer, rescaled to the interval [1; 10], α and β are the parameters to be estimated, and ε_{rt} is the remaining error term.

Because the dissimilarity index is a relative measure that compares the specialization of region *r* with the average specialization of the country to which the region belongs, we have estimated model (3) separately for each country. The results of the panel estimations with regional fixed effects are shown in the upper part of Table 1. It is worth stressing here that, while Figure A1 shows the average specialization of each country, model (3) analyzes regional differences that cannot easily be derived from Figure A1.

The table shows that, on average, regional specialization in the 1990s increased in Bulgaria and Romania, meaning that the regions within these two countries are becoming more dissimilar if compared with their respective national average. The estimated coefficient for *t* is not significantly different from 0 for Estonia, Hungary and Slovenia.

Table 1: Regional specialization in accession countries, 1990-1999

	Bulgaria	Estonia	Hungary	Romania	Slovenia
	1990-1999	*1990-1999*	*1992-1999*	*1991-1999*	*1994-1998*
t	0.01263***	-0.01177	-0.00639	0.01279***	-0.00700
	(0.00227)	(0.00835)	(0.00424)	(0.00210)	(0.01147)
Nr. of obs.	280	50	160	369	48
	1990-1993		*1992-1993*	*1991-1993*	
t	0.01730**		-0.02746	0.03862***	
	(0.00683)		(0.01966)	(0.00851)	
Nr. of obs.	112		40	123	
	1994-1996		*1994-1996*	*1994-1996*	
t	0.07036***		0.00987	0.02315***	
	(0.01383)		(0.02225)	(0.00804)	
Nr. of obs.	84		40	123	
	1997-1999		*1997-1999*	*1997-1999*	
t	-0.01129		-0.05151***	-0.01139	
	(0.00893)		(0.01707)	(0.00939)	
Nr. of obs.	84		60	123	

Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

Since the time series for Bulgaria, Hungary and Romania cover a relatively long time period, we split the data into three sub-periods, in order to investigate the presence of structural breaks in these time series[4]. The sub-periods are: 1990-1993; 1994-1996; 1997-1999 for Bulgaria; 1991-1993; 1994-1996; 1997-1999 for Romania; and 1992-

1993; 1994-1996; 1997-1999 for Hungary. On the one hand, since we expect regional specialization to change slowly over time, these sub-periods might appear quite short. Furthermore, the number of observations summarized in the regressions might seem quite small in some cases. On the other hand, the estimations presented in the lower part of Table 1 show some interesting results. Bulgaria and Romania have positive significant coefficients, when computed over the whole period. However, specialization increased only in the first two sub-periods, while the coefficient for the last period is insignificant in both countries. These results indicate an increase in regional disparities in the regions within Bulgaria and Romania – compared with their respective national average – at the beginning of the 1990s, followed by a period of stabilization of regional disparities, in terms of industrial location across regions. In Hungary, the coefficient for the first two periods is not significant, while specialization seems to decrease in the period 1997-1999, meaning that the Hungarian regions seem to become more homogeneous in terms of manufacturing employment location.

The increased integration of accession countries with the EU may have decreased the importance of internal regions in favor of regions bordering the EU and other accession countries. Such border regions were probably less favored in the past. In order to identify systematic differences between these types of regions, we have classified them into two groups, according to Eurostat (1999): regions bordering the EU; and regions not bordering the EU. However, different regressions computed separately for each country on the two groups of regions did not show any relevant difference between regions bordering and those not bordering the EU. This result might well be due to the short time periods available for our empirical analysis.

5. Industry Concentration

Besides the regional specialization level, increasing economic integration with the EU is also expected to influence the concentration of industrial activity of accession countries. Figure A2 of the Appendix shows that, over the period 1990-1999, the average concentration of manufacturing has increased in Bulgaria and Romania, decreased in Estonia and Hungary, and remained stable in Slovenia.

In order to check whether patterns of manufacturing concentration have changed significantly in the period under analysis, we estimate the following trend model:

---

[4] We did not split the Estonian data set because of the small number of regions, and consequently the low

$$ln\ CONC_{it} = \alpha_i + \beta \cdot t + \varepsilon_{it}, \quad (4)$$

where the dependent variable $ln\ CONC_{it}$ is the natural logarithm of the concentration of manufacturing activity, in industry i at time t, measured by means of the dissimilarity index, as in (2) using employment data on manufacturing branches at the NUTS 3 regional level. The independent variable t is the year to which the data refer, rescaled to the interval [1; 10], α and β are the parameters to be estimated, and ε_{it} is the remaining error term.

Because the dissimilarity index is a relative measure that compares the concentration of industry i with the average concentration of industries located in the same country, we have estimated model (4) separately for each country. The results of the panel estimations with industry fixed effects are shown in Table 2. It is worth stressing here that, while Figure A2 shows the average specialization of each country, model (4) analyzes regional differences that cannot easily be identified from Figure A2.

Table 2: Geographical concentration of manufacturing in accession countries, 1990-1999

	Bulgaria 1990-1999	Estonia 1990-1999	Hungary 1992-1999	Romania 1991-1999	Slovenia 1995-1998
t	0.01713***	-0.00112	-0.00442	0.00411	0.00069
	(0.00283)	(0.00919)	(0.00531)	(0.00281)	(0.00951)
Nr. of obs.	120	120	64	108	48

Standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%.

The coefficients of Table 2 indicate that, in the period under analysis, concentration of manufacturing did not change significantly in these countries, with the exception of Bulgaria, in which it increased. This analysis has been based on the available data for ten years for Bulgaria and Estonia, nine years for Romania, eight for Hungary, but only four for Slovenia. We might not, therefore, be able to capture the impact of regional business cycles on concentration patterns.

In the next sections, we analyze the determinants of industrial location across the regions of the five accession countries under investigation.

number of degrees of freedom of the sub-period regressions.

6. Determinants of Industry Location

6.1. Model Specification

Our analysis of the determinants of manufacturing location in EU accession countries is based on specific characteristics of industries and regions as suggested by Midelfart-Knarvik et al. (2001). Industries may differ in the way they combine production factors in order to obtain their final output. For example, they may employ different technologies, they may be subject to different levels of scale economies, etc. On the other hand, regions may differ in size, population, factor endowments, geographic position (core or peripheral), and so on. As a consequence, when deciding on their location, industries with different characteristics will evaluate the same regional characteristics differently. Industries that try to locate as close as possible to the place where their most important inputs are available will be overrepresented in those locations where these inputs are abundant, and will therefore be underrepresented in those locations where these inputs are scarce.

This kind of industry behavior is modeled by Midelfart-Knarvik et al. (2001). In this paper, the authors analyze how factor endowments, trade frictions and geographical distribution of demand interact to determine international specialization patterns. The model is based on two strands of the literature: on the one hand, the work on the effect of industrial characteristics on trade (Baldwin, 1971), and, on the other hand, the literature on the effect of country characteristics (endowments, technology, etc) on trade (Leamer, 1984; Harrigan, 1995, 1997; Davis and Weinstein, 1998, 1999). Using simulation techniques, Midelfart-Knarvik et al. (2001) select the following model for estimation:

$$s_{ir} = \alpha + \Sigma_k\, \beta[k]\, (y[k]_r - \gamma[k])\, (z[k]^i - \kappa[k]) + \varepsilon_{ir}, \qquad (5)$$

where (s_{ir}) is the share of industry i in region r, $y[k]_r$ is the level of the k^{th} region characteristic in the r^{th} region, and $z[k]^i$ is the level of the k^{th} industry characteristic of industry i. The coefficients of, $y[k]_r$ and $z[k]^i$ capture the influence of, respectively, regional and industrial characteristics on the location decisions of manufacturing firms. As it is clear in (5), the k^{th} regional characteristic is matched with the k^{th} industry characteristic. The interaction terms enable us to capture the influence of the combination of regional characteristics and industrial characteristics on manufacturing location. Finally, α, $\beta[k]$, $\gamma[k]$, and $\kappa[k]$ are the coefficients to be estimated, while ε_{ir} is the remaining error term.

In this paper, we apply this model separately for each country under analysis in order to identify the determinants of the location of manufacturing. The data that we use to identify regional and industrial characteristics will be explained in more detail in the next section.

6.2. Regional and Industrial Characteristics

On the basis of our data set, we identify a number of regional and industrial characteristics that can be matched in order to test the determinants of manufacturing location. The selected regional and industrial characteristics are listed in the upper part of Table 3.

The market potential (MP) characteristic is an indicator measuring the proximity of each region to the core market, and is computed by dividing average regional earnings by the distance of the region to the most important market. Depending on the degree of openness of the country, we compute the indicator in two different ways. The first market potential indicator (MP1) compares regions inside the same country in the context of a closed economy, where the most important market is usually located in the country's capital. The second indicator (MP2), in the context of the increasing integration between accession countries and European countries, assumes that the largest market for these countries is the EU. MP2 is therefore useful in order to get insights into the consequences of the increasing integration between each country and the EU.

By reducing trade barriers, the Europe Agreements between the EU and accession countries have probably led to a reduction of the cost of trade with the EU, while the costs of trading within the country have probably remained unchanged. We believe that these agreements might have favored regions bordering the EU in comparison with central regions, which, instead, had a favorable position before the EU accession agreements. The variable MP2 can, therefore, be used to verify whether increasing integration with the EU has led to a reallocation of activity (industries) from central regions to regions bordering the EU.

The labor abundance (LA) variable, computed by dividing the sum of the number of people employed and of people unemployed by the working age population, was introduced in the models in order to identify the relative regional abundance of labor. Similarly, the research and development (RD) characteristic, computed on slightly different data for each country, was introduced in the models in order to identify the relative regional abundance of R&D opportunities/spillovers.

Table 3: Regional and industrial characteristics

Variable name	Description
Regional characteristics	
Market Potential (MP1)	Average regional earnings (deflated at national level) divided by the distances to the country capital (in km)
Market Potential (MP2)	Average regional earnings (deflated at a national level) divided by a proxy of the distance to EU markets (1, if the region borders the EU: 2, if the region does not border the EU)
R&D (RD)	R&D personnel divided by the number of persons employed for Bulgaria; R&D expenditures divided by the value added in manufacturing for Slovenia; too many missing values prevent us from using this variable for Estonia, Hungary and Romania
Labor Abundance (LA)	Sum of employment and unemployment, divided by the population of working age (15-65 years)
Industrial characteristics	
Scale Economies (SE)	1 = High; 0 = Low or Medium (on the basis of the definition by Pratten, 1988)
Research-Oriented (RO)	1 = almost all industries of the sector are defined as research-oriented; 0 = only a few of the industries of the sector are defined as research oriented (on the basis of the OECD (1994) definition)
Technology Level (TL)	1 = High technology; 0 = Low or Medium technology (on the basis of the OECD (1994) definition
Labor Intensity (LI)	Labor Intensity dummy (on the basis of the OECD (1994) definition)

The industry characteristics analyzed in our models are all defined as dummies, and are summarized in the bottom part of Table 3. The choice of the relevant industrial characteristics is mainly motivated by the regional characteristics that we were able to evaluate and match with each industrial characteristic. Therefore, the industrial characteristics considered are the following: the level of scale economies (SE); the degree to which each industry might be defined as research-oriented (RO); the technology level (TL); and the intensity to which industries use labor in their production process (LI). While the definition of RO, TL and LI is based on OECD (1994), the definition of SE is based on Pratten (1988).[5]

[5] We analyzed the sensitivity of our results to changes in the industry taxonomies by substituting the OECD, 1994 for the classification WIFO (Peneder, 1999). These different definitions of the LI and TL industrial characteristics did not change our results and conclusions significantly.

After defining regional and industrial characteristics, we define the interacted variables included in equation (5) by matching industrial and regional characteristics, as illustrated in Table 4.

Industries with a high level of scale economies should highly evaluate regions that are located near the core market (Krugman, 1980). For this reason, we made the market potential (MP1 and MP2) characteristics interact with the level of scale economies (SE).

Table 4: Interaction variables

	Variable name	Regional characteristics	Industrial characteristics
K=1	MP1SE	MP1 (Market Potential) (distances from country capital)	SE (Scale Economies)
K=2	MP2SE	MP2 (Market Potential) (distances with EU markets)	SE (Scale Economies)
K=3	RDRO	RD (R&D personnel or expenses)	RO (Research-Oriented)
K=4	RDTL		TL (Technology Level)
K=5	LALI	LA (Labor Abundance)	LI (Labor Intensity)

Firms that are based on a high technology level (TL) or firms that are research-oriented (RO) will highly evaluate regions in which the level of the RD indicator assumes a higher value. We then let the RD characteristic interact with the technology level (TL), and with the importance of R&D inputs in each industry (RO). These two industrial characteristics (TL and RO) may, in principle, seem very similar. However, they comprise different industries, meaning that they are based on different underlying industrial characteristics.

Finally, firms for which labor is a very relevant production factor (LI) will tend to highly evaluate the availability of labor, and will consequently tend to locate in regions with a high abundance of labor (LA)[6].

After this brief illustration of the variables introduced in our estimations, we now turn to a more detailed discussion of estimation issues.

6.3. Estimation Issues

Our dependent variable is the share of employment in industry *i* in region *r* in the country's employment of industry *i*:

[6] In this case we assume a homogeneous pool of workers, and we do not take into account the possibility of a mismatch between skill/education levels required by firms and skill/education levels of the population living in a certain region. Another possible problem with this variable might be that firms that

$$s_{ir} = \frac{E_{ir}}{\sum_r E_{ir}} . \quad (6)$$

The dependent variable is a number ranging from 0 (when no industries of type *i* are located in region *r*) to 1 (when all industries of type *i* are located in region *r*).

In order to remove fluctuations due to the business cycle, Midelfart-Knarvik et al. (2000, 2001) computed 4-year moving averages of their data. Since the length of our time series is extremely short, we decided to estimate the model using data on levels, and to add time dummies in order to capture the effect of year-specific conditions. In order to analyze the sensitivity of our results to this choice, we estimated the model on 3-years-averaged data, and we compared its outcome with the model estimated on level data. Although the R^2 – as expected – drops when we pass from the time-averaged data to the data on levels, the coefficients and standard errors of the two estimations are very similar.

While the explanatory variables of the model are either dummies or real numbers, the dependent variable (s_{ij}) can only have values between 0 and 1[7]. In such a situation, an estimation of equation (5) by means of OLS would lead to biased results. The solution to this problem consists in rescaling either the dependent variable or the independent variables by means of a logistic transformation, in order to make all variables comparable. We rescale our dependent variable in the following way:

$$\bar{s}_{ir} = ln\ (s_{ir} / (1 - s_{ir})). \quad (7)$$

Finally, the dependent variable of (5), which is the share of industry *i* in region *r* belonging to country *c* observed over time, has an implicit multilevel structure. The best option would consist in using estimators able to exploit the multilevel structure of the data, as suggested by Hsiao (2003). Unfortunately, since our data set would be unbalanced, the estimation would become quite complicated. On the other hand, estimation by OLS would lead to consistent, though inefficient, estimators, characterized by standard errors downwardly biased (Hsiao, 2003). We therefore analyze the determinant of interregional industry location separately for each country by estimating equation (5), in which the dependent variable is transformed on the basis of

make intense use of labor might also locate in those areas in which wages are comparatively lower. However, details on wages are already embedded in the two MP variables.

[7] In our data set, the dependent variable is never exactly 1. When it is exactly 0, we substitute for it a very low value (0.00001) to avoid the observation being dropped from the sample.

(7) with a Least Squares Dummy Variable (LSDV) estimator[8]. The results are shown and compared in the next section.

6.4. Estimation Results

We estimated equation (5) – in which the dependent variable is transformed using equation (7) – in order to analyze the determinants of industrial location across regions. Because of data availability and comparability the estimates have been computed separately for each country, and the results are shown in Tables A1 of the Appendix.

In column (1), the model is estimated using a complete set of time dummies, dummies for regions as well as industry dummies. In this case, it is not possible to estimate the coefficients of the industrial characteristics, since these are linear combinations of the industry dummies. In column (2), we therefore substitute the industry dummies with industrial characteristics. By comparing the coefficients of column (1) with the coefficients of column (2) we can assess the predictive power of the industry characteristics against the complete set of industry dummies. The adjusted R^2 and the estimated coefficients remain almost unchanged when we use industrial characteristics instead of industry dummies, while the standard errors slightly increase. Yet, the industrial characteristics estimated are usually not significant.

The regional dummies are likely to pick up a high portion of the variability, thus hiding the importance of the regional characteristics that we have identified in the previous sections. To test this, we reestimated our model excluding the regional dummies. We first note that the adjusted R^2 drops when we delete the regional dummies, even though this means adding degrees of freedom. Furthermore, dropping regional dummies leads to a dramatic change in the estimated coefficients; in some cases – see for example MP2, RD and LA for Bulgaria or MP1 for Estonia and Romania – slopes that were significantly positive become significantly negative, or viceversa.

Since these results suggest the presence of omitted variable bias in the estimations of column (3), we choose the model of column (2) – which allows for region-specific intercepts – as our preferred estimation. Table 5 below summarizes the findings of the estimations of column (2) of country tables shown in the Appendix (see Tables A1_BG, A1_EST, A1_HU, A1_RO, A1_SLO).

The coefficient of Ln(pop) is positive for Bulgaria and Estonia. As expected (recall that the dependent variable is computed using data on employment) in more populated

[8] All estimations are made with Stata 7.

regions of these countries, we generally find a higher concentration of industries, compared with less populated regions. In contrast, for Romania, the slope seems to be negative.

Table 5: Summary of column (2) of Tables A1 of the Annex

	BG	EST	HU	RO	SLO
Ln(pop)	+ + +	+ + +		− −	
MP1		++		-	
MP2	+ + +	−			
RD	− − −	/	/	/	
LA	++			− − −	/
SE					
RO		/	/	/	
LI					/
TL		/	/	/	+ +
MP1SE					
MP2SE					
RDRO		/	/	/	
LALI					/
RDTL		/	/	/	− − −

Detailed results can be found in Tables A1 of the Appendix. The plus sign means that the coefficient is significant and positive at 10% (+), 5% (+ +) or 1% (+ + +). The minus sign means that the coefficient is significant and negative at 10% (–), 5% (– –) or 1% (– – –). / means that the variable was not used in the estimation.

The interpretation of the regional and industrial characteristics has to be made on the basis of their inverted signs, since in equation (5) they have a negative sign. A positive value for the market potential variables MP1 and MP2 is therefore usually associated with lower values of s_{ir}. This result might indicate that industries generally try to locate in those areas where wages, and therefore labor costs, are lower. The denominator of the MP variable is the distance of each region to the country's capital (or to the core market). A positive coefficient of MP might suggest that the lower the distance to the core market, the lower the share of regional employment in industry *i* compared with national employment in industry *i*. On the other hand, this result is also consistent with the assumption that core regions – for example, the country's capital – are usually characterized by comparatively higher wages. These two indicators (MP1 and MP2) do not, however, allow us to disentangle the effect of wages and distances to the 'core market'.

The coefficient of RD appears to be negative for Bulgaria, indicating that firms would tend to locate in those regions where a high number of employees work in R&D.

The coefficient of labor abundance (LA) is positive for Bulgaria and negative for Romania. While in Romania industries seem to locate in regions with a high availability of labor, in Bulgaria industries do not seem to locate in these kinds of regions. Since the LA indicator is computed by dividing the sum of the number of people employed and unemployed by the total population (see Table 3), the positive coefficient for Bulgaria might be due to a high number of unemployed people in those regions where industries tend not to locate. Further research might help to clarify this point.

Turning to the industrial characteristics, note that almost none of them seem to be significant. The positive coefficient of TL for Slovenia suggests that industries with a high technology level tend to be located in regions with lower values of s_{ir} than industries with a low technology level. We might interpret this result as evidence that high technology industries seem to be more dispersed than low technology industries. However, the coefficient of TL is significant only for Slovenia, which is a small country, where distances between regions might be not very relevant[9].

Similar to the variables identifying the industrial characteristics, almost none of the interaction terms is significant. The only exception is the slope of RDTL for Slovenia, which appears to be negative, suggesting that the RD regional characteristic has a lower effect for TL industries. This counterintuitive result might be due to data collection problems: the R&D expenses are imputed to the regions where the headquarters of the firm is located, which does not necessarily coincide with the region where the majority of the workers are located.

In conclusion, our results are consistent with the hypothesis that industrial location decisions are due to specific regional characteristics. On the other hand, there seem to be no striking differences among the location decisions of different kinds of industries. One reason for this result might be due to our crude industry classification, which does not allow us to identify more than ten economic sectors, and might therefore be too aggregated for the purposes of this analysis.

6.5. Changes over time

In order to analyze the presence of structural breaks, and therefore slopes that change over time, in the last columns of Tables A1 of the Appendix, we split our estimations into sub-periods, on the basis of data availability. Estimations for Bulgaria, Hungary and Romania have been split into three sub-periods each covering three years, but it has only been possible to split the estimations for Estonia into two sub-periods, and the Slovenian time series are too short to be split into any sub-periods.

In Bulgaria, the coefficient of MP2 seems to become insignificant in the second period, after having been significantly positive in the first period. In the third period, the coefficient seems to be negative. These results suggest that, in the period 1991-1993, industries were mainly located far away from the EU borders. In contrast, in the period 1994-1996, when costs of trading with EU countries became lower, regions bordering the EU seemed to increase their relative share of employment, first by reaching the average national level (second period), and finally by gaining comparative advantage over other regions (in the last period[10]).

In Hungary, the coefficient of MP1 appears to be negative in the period 1992-1993, positive in the period 1994-1996, and again negative in the period 1997-1999. Even if the meaning of these changes over short periods is not always unambiguous, it is interesting to note that the changes in the slopes of MP2 are opposite to the changes in the slope of MP1. This is consistent with the hypothesis of the existence of some sort of competition between the internal core market, represented by the country's capital, and the international market, represented by the EU. This is not necessarily inconsistent with the results for Romania.

In Romania MP1, is positive in the first period, and negative in the second and third periods. The MP2 indicator seems to be negative only in the second period. Since no Romanian regions border the EU, the regional variation of MP2 is only due to regional wage disparities and does not depend on distances to the EU market.

6.6. Industry-Specific Slopes

The model proposed and estimated by Midelfart-Knarvik et al. (2000, 2001) implicitly assumes a selective interaction between industrial and regional characteristics. Indeed, up to now, we have only evaluated regional characteristics that we could match with industrial characteristics and the interaction terms consistent with the identified match (see Table 4).

---

[9] It might even be argued that industrial location is not a relevant issue in such small countries.

[10] In EU accession countries, no specific regional policy was adopted before the end of the 1990s. In Romania and Bulgaria, specific regional development Acts were passed in 1998 and 1999, respectively (Horváth, 2002). As a consequence, our results concerning the behavior of border regions compared with central regions should not be affected by such regional-specific policies.

As a sensitivity analysis, given the regional and industrial characteristics that we chose in the previous sections, we reestimated our model, adding all sorts of interaction terms by multiplying each regional characteristic with each industry characteristic. The results of these estimations should coincide with the results that we would obtain by estimating the model separately for each industry group (identified by the industrial characteristics: high versus low economies of scale industries, and so on).

The results of these new estimations showed almost no significant slope of the interaction terms, and therefore we do not report the results here. One reason for these non-significant results might be due to the use of data sets that are too small compared with the number of explanatory variables that we tried to estimate.

7. Conclusions

In this paper we have investigated patterns of industrial location across regions – defined at a NUTS 3 level – in the case of five EU accession countries: Bulgaria, Estonia, Hungary, Romania and Slovenia, over the period 1990-1999.

The analysis of regional specialization and concentration of industry patterns shows increasing specialization in Bulgaria and Romania. Specifically, we find that specialization increased in Bulgaria and Romania at the beginning of the 1990s, while in the second part of the decade we find no significant change in this indicator for these countries. On the other hand, for Hungary we see a reverse path: while the beginning of the 1990s are characterized by no significant changes in specialization, in the last period the Hungarian data show a significant decrease of this variable. These results seem to indicate an increase in regional disparities – in terms of the location of manufacturing employment – in the regions within Bulgaria and Romania at the beginning of the 1990s, followed by a stabilization of regional disparities. After a period of stable regional disparities, in the late 1990s the Hungarian regions seem to become more homogeneous.

Concentration of industry, seems stable in the period under analysis in all countries except Bulgaria, in which it seems to increase.

Finally, we explore the determinants of industrial location by applying to our regional data on accession countries the model originally proposed and estimated by Midelfart-Knarvik et al. (2000, 2001) on EU country data. The model aims to evaluate the impact that specific industrial and regional characteristics have on the share of employment of industry *i* located in region *r* in total national employment of industry *i*. Our results seem to be consistent with the hypothesis that the location decisions of industries are due to specific regional characteristics, but there seem to be no striking differences among the location decisions of different kinds of industries.

Acknowledgments

We thank Johannes Stephan, Michael Stierle and the participants at the European Regional Science Association Congress held in Jyväskylä, Finland, 27-31 August 2003, for useful comments on an earlier version of this paper

References

Aiginger, K., Boeheim, M., Gugler, K., Pfaffermayr, M. and Wolfmayr-Schnitzer, Y. (1999) Specialisation and (Geographic) Concentration of European Manufacturing, Enterprise DG Working Paper No 1, Background Paper for the 'The competitiveness of European industry: 1999 Report'.

Altomonte, C. and Resmini, L. (1999) The Geography of Transition: Agglomeration Versus Dispersion of Firms' Activity in the Countries of Central and Eastern Europe, paper presented to the European Workshop on 'Regional Development and Policy in Europe', Center for European Integration Studies, Bonn, 10-11 December.

Amiti, M. (1998) New Trade Theories and Industrial Location in the EU: A Survey of Evidence, *Oxford Review of Economic Policy*, 14, 45-53.

Amiti, M. (1999) Specialisation Patterns in Europe, *Weltwirtschaftliches Archiv*, 134, 573-593.

Baldwin, R. E. (1971) Determinants of the Commodity Structure of US Trade, *American Economic Review*, 61, 126-146.

Bring, J. (1994) How to Standardize Regression Coefficients, *The American Statistician*, 48, 209-213.

Brülhart, M. (1996) Commerce et Spécialisation Géographique dans l'Union Européenne, *Economie Internationale*, 65, 169-202.

Brülhart, M. (1998) Economic Geography, Industry Location and Trade: The Evidence, The World Economy, 21.

Brülhart, M. (2000) Evolving Geographical Concentration of European Manufacturing Industries, Available at: http://www.hec.unil.ch/deep/Textes/00.08.pdf.

Brülhart, M. (2001) Growing Alike or Growing Apart? Industrial Specialisation of EU Countries, in *The Impact of EMU on Europe and the Developing Countries*, ed. by C. Wyplosz. Oxford: Oxford University Press, 169-194.

Brülhart, M. and Torstensson, J. (1996) Regional Integration, Scale Economies and Industry Location, Centre for Economic Policy Research, Discussion Paper No. 1435.

Davis, D. R. and Weinstein, D. E. (1998) Market Access, Economic Geography and Comparative Advantage: An Empirical Assessment, NBER Working Paper no. 6787.

Davis, D. R. and Weinstein, D. E. (1999) Economic Geography and Regional Production Structure: An Empirical Investigation, *European Economic Review*, 43, 379-407.

Devereux, M. P., Griffith, R. and Simpson, H. (1999) The Geographic Distribution of Production Activity in the UK, Institute for Fiscal Studies Working Paper, W99/26.

Dobrinsky, R. (1995) Economic Transformation and the Changing Patterns of European East-West Trade, in *Transforming Economies and European Integration*, ed. by R. Dobrinsky and M. Landesmann. Aldershot: Edward Elgar, 86-115.

Eichengreen, B. (1993) Labour Markets and the European Monetary Unification, in *Policy Issues in the Operation of Currency Unions*, ed. by P. R. Masson and M. P. Taylor: Cambridge University Press.

Ellison, G. and Glaeser, E. (1997) Geographic Concentration in U.S. Manufacturing Industries: A Dartboard Approach, *Journal of Political Economy*, 105, 889-927.

Eurostat (1999) Statistical Regions in the EFTA Countries and the Central European Countries (CEC), European Commission, Eurostat.

Goldberger, A. S. and Manski, C. F. (1995) Review Article: The Bell Curve by Herrnstein and Murray, *Journal of Economic Literature*, 33, 762-776.

Greenway, D. and Hine, R. C. (1991) Intra-Industry Specialisation, Trade Expansion and Adjustment in the European Economic Space, *Journal of Common Market Studies*, 29, 603-622.

Haaland, J. I., Kind, H. J., Knarvik, K. H. and Torstensson, J. (1999) What Determines the Economic Geography of Europe, CEPR Discussion Paper, No. 2072.

Hallet, M. (1998) The Regional Impact of the Single Currency, Paper presented at the 38th Congress of the European Regional Science Association, Vienna.

Hallet, M. (2000) Regional Specialisation and Concentration in the EU, European Communities, Economic Papers No 141.

Hallet, M. (2001) Real Convergence and Catching-up in the EU, Paper presented to the workshop 'Structural Funds and Convergence', The Hague.

Hanson, G. H. (1996) Economic Integration, Intra-Industry Trade, and Frontier Regions, *European Economic Review*, 40, 941-949.

Hanson, G. H. (1997a) Localization Economies, Vertical Organization, and Trade, *American Economic Review*, 87, 1266-1278.

Hanson, G. H. (1997b) Increasing Returns, Trade, and the Regional Structure of Wages, *Economic Journal*, 107, 113-133.

Hanson, G. H. (1998) Market Potential, Increasing Returns, and Geographic Concentration, NBER Working Paper No. 6429.

Harrigan, J. (1995) Factor Endowments and the International Location of Production; Econometric Evidence for the OECD, *Journal of International Economics*, 39, 123-141.

Harrigan, J. (1997) Technology, Factor Supplies and International Specialization; Estimating the Neoclassical Model, *American Economic Review*, 87, 475-494.

Heckman, J. J. (1995) Lessons from the Bell Curve, *The Journal of Political Economy*, 103, 1091-1120.

Heckscher, E. (1949) The Effect of Foreign Trade on Distribution of Income, *Economisk Tidskrift*, 497-512, reprinted in *Readings in the Theory of International Trade*, ed. by H. S. Ellis and L. A. Metzler. Philadelphia: Blakiston, 272-300.

Helpman, E. and Krugman, P. (1985) *Market Structure and Foreign Trade: Increasing Returns, Imperfect Competition and the International Economy*. Brighton: Harvester Wheatsheaf.

Hine, R. C. (1990) Economic Integration and Inter-Industry Specialisation, University of Nottingham, CREDIT Research Paper 89/6.

Horváth, G. (2002) Regional Policy and Development in East Central Europe, in *Cities and Regions in an Enlarging European Union*, ed. by R. Domanski. Warsaw, 107-127.

Hsiao, C. (2003) *Analysis of Panel Data*. Cambridge: Cambridge University Press.

Keeble, D., Offord, J. and Walker, S. (1986) Peripheral Regions in a Community of Twelve Member States, Commission of European Communities.

Krugman, P. (1979) Increasing Returns, Monopolistic Competition and International Trade, *Journal of International Economics*, 9, 469-479.

Krugman, P. (1980) Scale Economies, Product Differentiation, and the Pattern of Trade, *American Economic Review*, 70, 950-959.

Krugman, P. (1981) Intraindustry Specialization and the Gains from Trade, *Journal of Political Economy*, 89, 959-973.

Krugman, P. (1991a) *Geography and Trade*. Cambridge: MIT Press.

Krugman, P. (1991b) Increasing Returns and Economic Geography, *Journal of Political Economy*, 99, 483-499.

Krugman, P. and Venables, A. (1990) Integration and the Competitiveness of Peripheral Industry, in *Unity with Diversity in the European Community*, ed. by C. Bliss and J. Braga de Macedo. Cambridge: Cambridge University Press.

Krugman, P. and Venables, A. (1995) Globalisation and the Inequality of Nations, *The Quarterly Journal of Economics*, 110, 857-880.

Landesmann, M. (1995) The Patterns of East-West European Integration: Catching up or Falling Behind?, in *Transforming Economies and European Integration*, ed. by R. Dobrinsky and M. Landesmann. Aldershot: Edward Elgar, 116-140.

Leamer, E. (1984) *Sources of International Comparative Advantage*. Cambridge MA: MIT Press.

Leamer, E. E. and Levinsohn, J. (1995) International Trade Theory: The Evidence, in *Handbook of International Economics*, ed. by G. M. Grossman and K. Rogoff: Amsterdam, Elsevier-North Holland.

Midelfart-Knarvik, K. H., Overman, H. G. and Venables, A. J. (2000) The Location of European Industry, Economic Papers no. 142 – Report prepared for the Directorate General for Economic and Financial Affairs, European Commission.

Midelfart-Knarvik, K. H., Overman, H. G. and Venables, A. J. (2001) Comparative Advantage and Economic Geography: Estimating the Determinants of Industrial Location in the EU, Available at: http://econ.lse.ac.uk/staff/ajv/mkov.pdf.

Obstfeld, M. and Peri, G. (1998) Asymmetric Shocks: Regional Non-Adjustment and Fiscal Policy, *Economic Policy*, 28, 206-259.

OECD (1994) Manufacturing Performance: A Scoreborard of Indicators, OECD/OCDE.

Ohlin, B. (1933) *Interregional and International Trade*. Cambridge, MA: Harvard University Press.

Peneder, M. (1999) Intangible Investment and Human Resources. The New WIFO Taxonomy of Manufacturing Industries, WIFO Working Paper No. 114.

Petrakos, G. (1996) The Regional Dimension of Transition in Eastern and Central European Countries: An Assessment, *Eastern European Economics*, 34, 5-38.

Petrakos, G. (2000) The Spatial Impact of East-West Integration, in *Integration and Transition in Europe: The Economic Geography of Interaction*, ed. by G. Petrakos, G. Maier and G. Gorzelak. London: Routledge.

Pratten, C. (1988) A Survey of the Economies of Scale, in *Research on the 'Cost of Non-Europe'*, ed. by Commission of the European Communities. Luxembourg.

Puga, D. (2002) European Regional Policies in Light of Recent Location Theories, *Journal of Economic Geography*, 2, 373-406.

Raagmaa, G. (1996) Shifts in Regional Development in Estonia During the Transition, *European Planning Studies*, 4, 683-703.

Resmini, L. (2002) Specialization and Growth Prospects in Border Regions of Accession Countries, Center for European Integration Studies, University of Bonn, ZEI Working Paper B02-17.

Ricardo, D. (1817) *On the Principles of Political Economy and Taxation*. London.

Sapir, A. (1996) The Effects of Europe's Internal Market Programme on Production and Trade: A First Assessment, *Weltwirtschaftliches Archiv*, 132, 457-475.

Venables, A. (1996) Equilibrium Locations of Vertically Linked Industries, *International Economic Review*, 37, 341-359.

Venables, A. (1998) The Assessment: Trade and Location, *The Oxford Review of Economic Policy*, 14, 1-6.

Appendix

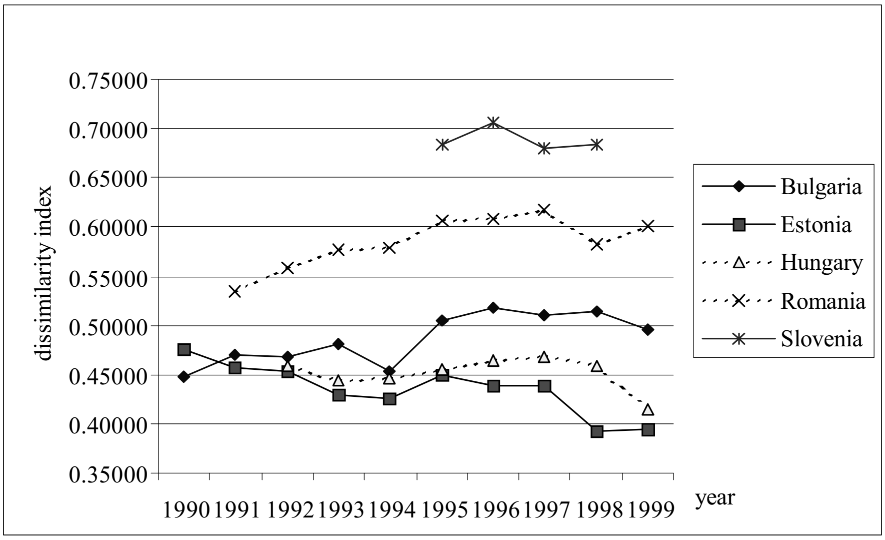

Figure A1: Average regional specialization in accession countries, 1990-1999

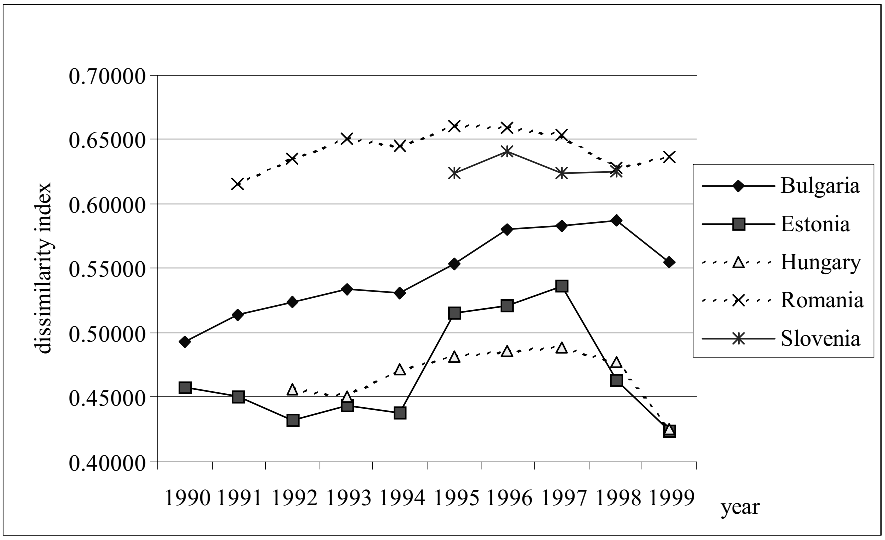

Figure A2: Average industry concentration in accession countries, 1990-1999

Table A1_BG: Estimations for Bulgaria

	(1)	(2)	(3)	(4)	(5)	(6)
	1991-1998	1991-1998	1991-1998	1991-1993	1994-1996	1997-1998
Ln(pop)	10.06743	10.06743	0.15067	14.89118	67.91752	26.66708
	(2.79716)***	(2.81559)***	(0.04266)***	(2.69211)***	(10.7282)***	(8.12697)***
MP1	0.00011	0.00011	0.00006	-0.00055	-0.00066	-0.00028
	(0.00016)	(0.00016)	(0.00006)	(0.00038)	(0.00035)*	(0.00035)
MP2	0.00221	0.00221	-0.00029	0.00338	-0.00065	-0.00147
	(0.00027)***	(0.00027)***	(0.00015)*	(0.00069)***	(0.00075)	(0.00041)***
RD	-21.40928	-21.40928	23.35459	-4.76795	96.27623	-74.97935
	(6.70358)***	(6.54937)***	(3.14011)***	(55.92516)	(50.03644)*	(53.49175)
LA	3.65049	3.65049	-7.89479	1.51811	5.44920	-0.49484
	(1.36001)***	(1.35938)***	(0.79695)***	(1.61362)	(3.22590)*	(3.06976)
SE		0.01316	-0.12408	-0.09757	-0.09264	-0.09264
		(0.16821)	(0.20477)	(0.23400)	(0.29734)	(0.28942)
RO		-0.12524	-0.11810	-0.09728	-0.22222	-0.22222
		(0.13127)	(0.15672)	(0.12747)	(0.20861)	(0.20675)
LI		0.20065	-4.82241	-1.39897	0.87928	0.87928
		(1.01930)	(1.19665)***	(1.05400)	(1.68881)	(1.66216)
TL		-0.18911	-0.20980	-0.11463	-0.21368	-0.21368
		(0.11785)	(0.14218)	(0.09874)	(0.17780)	(0.17492)
MP1SE	0.00000	0.00000	0.00004	-0.00001	-0.00008	-0.00008
	(0.00008)	(0.00008)	(0.00010)	(0.00010)	(0.00016)	(0.00015)
MP2SE	-0.00003	-0.00003	0.00009	0.00003	0.00019	0.00019
	(0.00015)	(0.00015)	(0.00020)	(0.00018)	(0.00042)	(0.00040)
RDRO	6.09353	6.09353	2.96373	6.15954	11.77949	11.77949
	(6.24819)	(6.20965)	(7.46442)	(6.09396)	(11.48654)	(11.36389)
LALI	-0.18600	-0.18600	7.22375	2.08840	-1.09533	-1.09533
	(1.48336)	(1.49975)	(1.76175)***	(1.53958)	(2.49617)	(2.46082)
RDTL	8.79754	8.79754	7.86060	4.79416	15.69244	15.69244
	(6.04574)	(6.02179)	(8.40929)	(6.81007)	(10.83484)	(10.06336)
Time D.	Yes	Yes	Yes	Yes	Yes	Yes
Industry D	Yes	No	No	No	No	No
Regional D	Yes	Yes	No	Yes	Yes	Yes
Nr. of obs.	2628	2628	2628	1008	1296	1296
Adj. R^2	0.91097	0.91042	0.87416	0.95987	0.90108	0.90218

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. All models include time dummies.

Table A1_EST: Estimations for Estonia

	(1)	(2)	(3)	(4)	(5)
	1995-1999	1995-1999	1995-1999	1995-1996	1997-1999
Ln(pop)	52.87995	53.37657	-0.61063	1,112.92447	478.08563
	(29.33419)*	(29.11170)*	(0.10658)***	(700.79374)	(207.74492)**
MP1	2.84693	2.86144	0.18980	243.56958	13.21480
	(1.33421)**	(1.30757)**	(0.06643)***	(172.28364)	(2.87182)***
MP2	-2.70314	-2.71906	0.01794	-72.76785	-16.27579
	(1.46389)*	(1.43927)*	(0.08436)	(46.65987)	(3.50187)***
LA	-0.03944	-0.03921	0.01675	-0.00807	-0.19822
	(0.04020)	(0.03835)	(0.02096)	(0.11348)	(0.14167)
SE		-0.97168	-1.08360	0.03314	-1.61045
		(0.72701)	(0.74527)	(0.56823)	(1.24024)
LI		0.39270	0.17626	0.23728	0.48743
		(0.61566)	(0.64626)	(0.66377)	(0.87485)
MP1SE	-0.07645	-0.07401	-0.08119	-0.03700	-0.09333
	(0.05117)	(0.05149)	(0.05321)	(0.04468)	(0.07435)
MP2SE	0.12392	0.12038	0.13366	0.01718	0.17601
	(0.07693)	(0.07844)	(0.08054)*	(0.06215)	(0.12584)
LALI	-0.00827	-0.00816	-0.00289	-0.00730	-0.00849
	(0.01533)	(0.01498)	(0.01563)	(0.01451)	(0.02330)
Time D.	Yes	Yes	Yes	Yes	Yes
Industry D.	Yes	No	No	No	No
Regional D.	Yes	Yes	No	Yes	Yes
Nr. of Obs.	298	298	298	120	178
Adj. R^2	0.69425	0.69563	0.67469	0.77710	0.72291

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. All models include time dummies.

Table A1_HU: Estimations for Hungary

	(1)	(2)	(3)	(4)	(5)	(6)
	1992-1999	1992-1999	1992-1999	1992-1993	1994-1996	1997-1999
Ln(pop)	-2.30116	-2.30116	-0.43163	-83.40661	-47.64795	-32.91818
	(1.70560)	(1.67620)	(0.03026)***	(10.3854)***	(8.06723)***	(9.53834)***
MP1	0.10818	0.10818	-0.00747	-0.91092	2.75716	-1.00477
	(0.26876)	(0.26965)	(0.04948)	(0.14655)***	(0.77311)***	(0.53917)*
MP2	-0.22925	-0.22925	0.61396	1.29170	-4.16444	2.01565
	(0.52786)	(0.53004)	(0.11540)***	(0.34824)***	(1.60467)***	(1.07856)*
LA	0.00332	0.00332	-0.00712	0.01758	-0.04298	0.07129
	(0.00463)	(0.00464)	(0.00132)***	(0.00389)***	(0.01813)**	(0.02166)***
SE		0.01585	-0.12687	-0.00882	-0.03997	0.07679
		(0.14040)	(0.16421)	(0.11859)	(0.30181)	(0.16875)
LI		-0.01337	-0.31607	0.04334	0.06857	-0.05310
		(0.16757)	(0.20474)	(0.12795)	(0.35157)	(0.24990)
MP1SE	0.01304	0.01304	-0.09253	-0.01849	0.00090	0.04644
	(0.10602)	(0.10591)	(0.13531)	(0.08689)	(0.23608)	(0.15901)
MP2SE	-0.03431	-0.03431	0.19612	0.03509	0.00467	-0.11231
	(0.22878)	(0.22859)	(0.28880)	(0.19331)	(0.53118)	(0.34056)
LALI	-0.00021	-0.00021	0.00305	-0.00044	-0.00174	0.00060
	(0.00178)	(0.00178)	(0.00225)	(0.00115)	(0.00489)	(0.00315)
Time D.	Yes	Yes	Yes	Yes	Yes	Yes
Industry D.	Yes	No	No	No	No	No
Regional D.	Yes	Yes	No	Yes	Yes	Yes
Nr. of Obs.	1280	1280	1280	320	480	480
Adj. R^2	0.93495	0.93475	0.91545	0.98973	0.93331	0.94569

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. All models include time dummies.

Table A1_RO: Estimations for Romania

	(1)	(2)	(3)	(4)	(5)	(6)
	1992-1999	1992-1999	1992-1999	1992-1993	1994-1996	1997-1999
Ln(pop)	-10.29648	-10.29648	-0.22994	63.80534	-100.48185	-14.09355
	(4.70864)**	(4.71562)**	(0.03077)***	(32.19245)**	(18.3020)***	(13.75687)
MP1	-0.00060	-0.00060	0.00101	0.00390	-0.00155	-0.00475
	(0.00033)*	(0.00033)*	(0.00005)***	(0.00099)***	(0.00036)***	(0.00111)***
MP2	0.00028	0.00028	-0.00059	0.00108	-0.00445	0.00107
	(0.00050)	(0.00050)	(0.00025)**	(0.00210)	(0.00085)***	(0.00158)
LA	-7.68305	-7.68305	-10.62227	-16.48873	-2.20501	-46.54410
	(2.32625)***	(2.33059)***	(1.57108)***	(5.84581)***	(4.23283)	(8.73467)***
SE		-0.04862	-1.34631	0.02878	0.37300	-0.17317
		(0.45704)	(0.51159)***	(0.81753)	(0.59841)	(1.16744)
LI		0.15055	-0.11887	0.11591	-0.06977	0.69343
		(0.15938)	(0.17829)	(0.30594)	(0.17805)	(0.37176)*
MP1SE	0.00001	0.00001	-0.00006	0.00011	-0.00002	-0.00001
	(0.00008)	(0.00008)	(0.00009)	(0.00013)	(0.00007)	(0.00015)
MP2SE	0.00004	0.00004	0.00102	-0.00006	-0.00020	0.00011
	(0.00034)	(0.00034)	(0.00038)***	(0.00061)	(0.00042)	(0.00098)
LALI	-2.06212	-2.06212	1.30286	1.71908	0.21152	-11.07071
	(2.30271)	(2.30176)	(2.51331)	(4.16824)	(2.59662)	(5.43807)**
Time D.	Yes	Yes	Yes	Yes	Yes	Yes
Industry D.	Yes	No	No	No	No	No
Regional D	Yes	Yes	No	Yes	Yes	Yes
Nr. of Obs.	4264	4264	4264	1066	1599	1599
Adj. R^2	0.87934	0.87941	0.83571	0.92806	0.90532	0.86789

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. All models include time dummies.

Table A1_SLO: Estimations for Slovenia

	(1)	(2)	(3)
	1994-1998	1994-1998	1994-1998
Ln(pop)	16.56524	16.56524	-1.28108
	(93.09926)	(98.00186)	(0.15634)***
MP1	-0.45578	-0.45578	0.25062
	(0.64659)	(0.56102)	(0.03470)***
MP2	-0.73337	-0.73337	0.11824
	(0.68142)	(0.69677)	(0.06443)*
RD	-4.94621	-4.94621	54.91532
	(19.53011)	(21.07321)	(15.77615)***
SE		-0.77488	-3.46160
		(1.02327)	(1.14271)***
RO		0.93840	0.51638
		(0.57365)	(0.64923)
TL		1.17400	0.28722
		(0.49336)**	(0.51323)
MP1SE	0.05087	0.05087	0.11084
	(0.04735)	(0.04229)	(0.04485)**
MP2SE	-0.03817	-0.03817	0.20931
	(0.08979)	(0.09342)	(0.10458)**
RDRO	2.83992	2.83992	25.41286
	(18.18005)	(18.08719)	(20.97665)
RDTL	-48.73257	-48.73257	-14.58125
	(17.81421)***	(18.64105)***	(20.90060)
Time D.	Yes	Yes	Yes
Industry D.	Yes	No	No
Regional D.	Yes	Yes	No
Nr. of Obs.	504	504	504
Adj. R^2	0.77086	0.75624	0.65762

Robust standard errors in parentheses; * significant at 10%; ** significant at 5%; *** significant at 1%. All models include time dummies.