Zentrum für Europäische Integrationsforschung
Center for European Integration Studies
Rheinische Friedrich-Wilhelms-Universität Bonn

Working Paper

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B 16
2002

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Abstract

Since 1990, Central and East European economies have experienced increasing integration with the European Union via trade and direct foreign investments. The spatial implications of this process have not been investigated in-depth so far. Have patterns of regional specialization changed over the period 1990-1999? Has a relocation of manufacturing activity taken place? What are the determinants of regional specialization and industrial concentration patterns? This paper identifies and explains the effects of economic integration on patterns of regional specialization and the geographic concentration of manufacturing in Bulgaria, Estonia, Hungary, Romania and Slovenia. Using a specially created data base, we find evidence of regional relocation of industries, leading to higher average regional specialization in Bulgaria and Romania and lower average regional specialization in Estonia. In Hungary and Slovenia the average regional specialization has not changed significantly. Our results indicate that both factor endowments and geographic proximity to European core determine the location of manufacturing in accession countries.

Keywords: Regional specialization, Location of industrial activity, Accession countries

JEL classification: F15, R11, R12

* This research was undertaken with support from the European Community's PHARE ACE Programme 1998. The content of the publication is the sole responsibility of the authors and it in no way represents the views of the Commission or its services. We thank Marius Brülhart, Edgar Morgenroth, Laura Resmini, Christian Volpe Martincus and workshops participants at the Jönköping University and University of Bonn for helpful comments and suggestions.

1 Introduction

The emerging economies in the accession countries will most likely exhibit a high degree of spatial economic dynamics in the years to come, especially if they are increasingly exposed to market forces. The question is whether various regions or industries in these countries have anticipated this transformation, and are already showing the first signs of a shift in their spatial-economic base. Thus, we may wonder whether industries may demonstrate a different pattern of regional localization, or alternatively, whether specific regions are able to attract new industries. This would mean a drastic change in the location patterns of industries, reflected in changes in the spatial concentration of sectors or firms and in the regional concentration of various industries. The available theoretical frameworks on location of industrial activity and regional growth are not always conclusive, nor are individual country reports from the accession countries. Additional empirical research is therefore needed for a better understanding of patterns and changes of regional specialization and geographic concentration of industrial activity in the accession countries.

Have patterns of regional specialization changed over the period of 1990-1999? Has a relocation of manufacturing activity taken place? What are the determinants of regional specialization and industrial concentration patterns?

The aim of this paper is to identify, explain and compare patterns of regional specialization and geographic concentration of manufacturing activity in five accession countries, viz. Bulgaria, Estonia, Hungary, Romania and Slovenia.

This paper is the first to gather evidence about patterns of regional specialization and concentration of manufacturing industrial activity in accession countries. Our research suggests that, in the five accession countries included in this study, the regional relocation of industries has taken place, leading to increasing regional specialization in Bulgaria and Romania and decreasing regional specialization in Estonia. Regional specialization has not changed significantly in Hungary and Slovenia. We find empirical evidence indicating that both factor endowments and geographic proximity to European core 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 regional specialization and geographic 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 geographic concentration of manufacturing in the same countries. Section 6 presents the results of our econometric analysis on determinants of regional specialization and industrial concentration patterns. Section 7 concludes.

2 Analysis Framework

2.1 Theoretical Background

Existing international trade theory about the impact of economic integration on regional specialization and location of industrial activity could be grouped in three strands of literature[1]. While offering different explanations of patterns of specialization, all three theoretical approaches predict increasing specialization as a result of trade liberalization and economic integration. Neo-classical trade theory explains patterns of regional specialization on the basis of differences in productivity (technology) or endowments across 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 regions.

Neo-classical trade theory has explained specialization patterns through differences in relative production costs termed 'comparative advantages' resulting from differences in productivity (technology) (Ricardo, 1817) or endowments (Heckscher, 1919, Ohlin, 1933) between countries and regions. The main features of these models are: perfect competition, homogeneous products and constant returns to scale. The neo-classical theory predicts that trade liberalization and economic integration will result in production re-location and increasing specialization according to comparative advantages. The consequent changes in demands for factors of production will tend to equalize factor prices across countries and regions. The neo-classical trade models can explain a substantial proportion of inter-industry specialization. While relevant, comparative advantage is, however, not sufficient to be the only explanation for specialization. In reality, different production structures are found in regions and countries with similar factor endowments and production technologies. Trade between

industrialized countries consists mainly of differentiated goods, i.e, it is an intra-industry trade.

During the 1980s, new trade theory models were developed to supplement conventional (neo-classical) theories for explaining the phenomenon of 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 models predict that both inter- and intra- industry trade will occur. Firms with increasing returns to scale will tend to concentrate their production in a few locations. Thus large regions or, more generally, regions with good market access will be particularly attractive as production locations and will become net exporters of products produced by these firms. Theory predicts that when trade barriers fall activities with increasing returns will locate in regions with good market access ('the center') moving away from remote regions ('the periphery'). It has been suggested (Krugman and Venables, 1990) that geographical advantage will be greatest at some intermediate trade costs, i.e. the relationship between trade costs and 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 become less important. At this stage factor production costs will motivate firms to move back to peripheral regions.

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 Central and East European countries 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 towards these countries due to factor costs considerations (Hallet, 1998).

The new economic geography models assume that geographical advantage is endogenous and suggest that regional specialization may be the result of the spatial pattern of agglomeration of economic activities (Krugman, 1991a, 1991b). Krugman’s analysis focuses on a model similar to the two sector-two region model of Krugman and Venables (1990), but in this case each sector (agriculture and manufacturing) uses a specific factor of production and only the factor specific to manufacturing (industrial workers) is mobile between regions. The two regions are identical in their initial factor endowments. Relocating firms and workers from one region to the other triggers agglomeration. As a consequence of firm relocation and due to monopolistic

competition, the variety of goods available in the receiving region increases. As labor demand rises in the receiving region, wages increase, which in turn attracts workers to follow the manufacturing firm. Thus this initial relocation will produce cumulative effects, causing both firms and workers to relocate from the 'donor' region to the 'receiving region'. With no barriers to the movement of firms or manufacturing workers (like 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, we are in a situation where manufacturing is evenly split between regions (each region produces for its own local market). If trade costs are sufficiently low, demand linkages outweigh the trade costs of servicing a non-local market. The place where agglomeration happens could be the result of a historical accident: one small change in the share of manufacturing in a region may then set off a chain reaction. This simple model would seem to have dramatic implications for European integration. In this case, regions with an initial scale advantage in particular sectors would see their advantage reinforced in those sectors.

Krugman and Venables (1995) generalize these models as ones where firms have 'supply-side linkages': manufacturing firms benefit from locating in a region where they have access to suppliers providing a range of specialized inputs. In this case, one would expect European integration to simply bring about massive concentration and specialization in sectors where supply-side and demand-side linkages are important. However, the simple agglomeration result seems unrealistic in a European context where inter-EU country mobility is extremely low (Eichengreen, 1993, Obstfeld and Peri, 1998).

The agglomeration effects might still be powerful, as long as there is sufficient labor mobility within EU countries. In this case, we could observe agglomeration effects emerging around border regions similar to those identified by Hanson (1996, 1997a) in the case of the US - Mexican economic integration. Firms moving to border regions could exploit supply-side linkages with firms in neighboring countries attracting the work force in their countries without major increases in labor demand and labor costs.

2.2 Empirical Evidence

Compared to the theoretical literature, empirical analysis of the impact of economic integration on regional specialization and geographic concentration of industries is still at an early stage. The most interesting studies have focused on the United States (US) and the European Union (EU) and have established the following stylized facts:

a) Regional specialization and industrial concentration are higher in the US than in EU (Krugman, 1991a; Midelfart-Knarvik et al, 2000; Aiginger et al, 1999)
b) Production specialization has increased in EU Member States while trade specialization has decreased (Sapir, 1996; Amiti, 1997; Haaland et al, 1999; Midelfart-Knarvik et al, 2000, Brülhart, 1996, 2001)
c) Slow-growing and unskilled labour intensive industries have become more concentrated in the EU (Midelfart-Knarvik et al, 2000
d) Medium and high technology industries have become more dispersed in the EU (Brülhart, 1998, 2001)
e) Industries with large economies of scale have been concentrated close to the European core during the early stages of European integration but have become more dispersed in the 1980s (Brülhart, 1998, Brülhart and Torstensson, 1996,)

A rigorous and complete assessment of the location forces identified by the new trade models is provided in the work of Hanson on US-Mexican integration. He finds support for the hypothesis that agglomeration is associated with increasing returns, and shows that integration with the US has shifted Mexican industry away from Mexico City and towards states with good access to the US market. This is reflected in the falling importance of distance from the capital and the rising importance of distance from the border in explaining interregional wage differentials (Hanson, 1997a, 1997b, 1998). A similar movement towards the border states can be observed in the US. Hanson (1996) finds that integration not only has shifted industry towards border cities both in the US and in Mexico, but also that it has made demand and cost linkages more important determinants of industrial location: employment has grown more in regions that have larger agglomerations of industries with buyer/supplier relationships.

Ellison and Glaeser (1997) analyze the geographic concentration of US manufacturing industries. Using a model that controls for industry characteristics, they find that almost all industries seem to be localized. Many industries are, however, only

slightly concentrated and some of most concentrated industries are related to natural advantages.

With respect to Europe, Brülhart (1996) and Brülhart and Torstensson (1996) study the evolution of industrial specialization patterns in 11 EU countries (all except Luxembourg and the more recent member states of Austria, Finland, and Sweden) between 1980 and 1990. They find support for the U-shaped relationship between the degree of regional integration and spatial agglomeration predicted by the theoretical models when labor mobility is low: activities with larger scale economies were more concentrated in regions close to the geographical core of the EU during the early stages of European integration, while concentration in the core has fallen in the 1980s.

Using production data in current prices for 27 manufacturing industries, Amiti (1997) finds that there was a significant increase of specialization between 1968 and 1990 in Belgium, Denmark, Germany, Greece, Italy, and the Netherlands; no significant change ocurred in Portugal; a significant fall 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 percent for all countries except Italy, compared to 1 percent in the case with 27 manufacturing industries. Other evidence of increasing specialization in EU countries in the 198os and 1990s based on production data is provided by Hine (1990), Greenway and Hine (1991), Aiginger et al. (1999), Midelfart-Knarvik et al. (2000). However analyses based on trade data indicate that EU Member States have a diversified rather than specialized pattern of manufacturing exports (Sapir, 1996; Brülhart, 2001).

In terms of geographic concentration of industries, Amiti (1997) 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 industry centrality indices proposed by Keeble et al. (1986) and find a positive correlation between scale economies and industry bias towards the central 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, more evidently in the Czech Republic and Hungary (Landesmann, 1995, Dobrinsky, 1995). This increase, however, may be associated with the intensification of outward processing traffic. 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 will increase disparities at the European level, by favoring countries near the East-West frontier (Petrakos, 1999). Increasing core-periphery differences in Estonia are documented in Raagmaa (1996). Using the approach of the 'new economic geography', Altomonte and Resmini (1999) have investigated the role of foreign direct investment in shaping regional specialization in accession countries.

Yet to date, there has been no comprehensive study on the impact of economic integration with the European Union on regional specialization and geographic concentration of industrial activity in accession countries.

3 Data and Measurement

In this paper we analyze patterns of regional specialization and concentration of manufacturing and their determinants using regional manufacturing employment data and other variables at the NUTS 3 level for Bulgaria, Estonia, Hungary, Romania and Slovenia. The employment data and the other regional variables are part of a specially created data set named REGSTAT[2]. Apart from employment, other variables at the regional level used in our analysis include geographic and demographic variables, average earnings (wages), Gross Domestic Product (GDP), measures of infrastructure, research and development (R&D) and public expenditure.

The period covered is 1990-1999. In most cases, data have been collected from national statistical offices. In the case of Estonia, employment data at the regional level has been estimated using labor force surveys. In Slovenia, employment data at the regional level has been estimated using the information provided in the balance sheets of companies with more than ten employees.

Regional specialization and geographic concentration of industries are defined in relation to production structures[3]. Regional specialization is defined as the distribution of the shares of an industry i in total manufacturing in a specific region j compared to a benchmark distribution. A region j is considered to be specialized in a specific industry i if this industry has a high share in the manufacturing employment of region j. The manufacturing structure of a region j is 'highly specialized', if a small number of industries have a large combined share in the total manufacturing of region j.

Geographic concentration measures the distribution of the shares of regions in a specific industry i compared to a benchmark distribution. A specific industry i is considered to be 'concentrated', if a large part of production is carried out in a small number of regions.

Specialization and concentration may be assessed using absolute and relative measures. There are several indicators proposed in the existing literature, with each having certain advantages as well as shortcomings. For our analysis we have selected a relative measure (a dissimilarity index derived from the index proposed by Krugman, 1991a). Notations and definitions are given in Box 3.1.

Box 3.1 Indicators of regional specialization and geographic concentration of industries[4]

E = employment

s = shares

i = industry (sector, branch)

j = region

s_{ij}^{S} = the share of employment in industry i in region j in total employment of region j

s_{ij}^{C} = the share of employment in industry i in region j in country employment of industry i

s_i = the share of country employment in industry i in total country employment

s_j = the share of total employment in region j in country employment

$$s_{ij}^{S} = \frac{Eij}{Ej} = \frac{Eij}{\sum_i Eij} \qquad s_{ij}^{C} = \frac{Eij}{Ei} = \frac{Eij}{\sum_j Eij}$$

$$s_i = \frac{Ei}{E} = \frac{\sum_j Eij}{\sum_i \sum_j Eij} \qquad s_j = \frac{Ej}{E} = \frac{\sum_i Eij}{\sum_i \sum_j Eij}$$

The dissimilarity index

Specialization measure

$$SPEC_j = \sum_i \left| s_{ij}^{S} - s_i \right|$$

Concentration measure

$$CONC_i = \sum_j | s_{ij}^{C} - s_j |$$

4 Regional Specialization

How specialized/diversified are regions in accession countries? Have patterns of regional specialization changed in accession countries during the 1990s? What is the relationship between regional specialization and economic performance?

On the basis of the values of specialization indices calculated at NUTS 3 level in Bulgaria, Estonia, Hungary, Romania and Slovenia we first grouped the regions in these countries into highly and low specialized regions. We classified as highly specialized regions the ones in which the specialization index was higher than 0.75 for 60 percent of the period examined while regions in which the specialization index was below 0.35 for 60 percent of the period were classified as low specialized[5]. 14.2 percent of regions fell

in the group of highly specialized regions, while 15.1 percent fell in the group of low specialized ones. A list of regions belonging to these groups may be found in Table 1 (see Appendix).

The common characteristic of highly specialized regions is that GDP per capita was usually above the national average, while wages were around the national average. Unemployment was above the national average and has an upward trend. The number of telephone lines and of cars were below, with the exception of Bulgaria, in which the number of cars were above average and decreasing. The level of specialization of regions belonging to this group ranges between 1.35 and 1.60 of the national average.

In regions with a low level of specialization the GDP per capita seemed to be slightly lower than the national average. The only exceptions were Estonian regions in which GDP per capita seemed to be above the national average. Wages were usually above the national average and increasing, unemployment was usually below, although sometimes increasing. The number of cars and telephone lines were usually above the national average but decreasing, with the exception of Hungarian regions, in which the number of cars and telephones were below the average and converging with that of the rest of the country. The level of specialization of regions belonging to this ranges between 0.60–0.70 of the national average.

Increasing economic integration with the EU and the world economy are likely to result in relocation of industrial activity and changing specialization patterns across regions in accession countries. In order to check whether regional specialization has changed significantly in the countries under analysis, we have estimated the following trend model:

$$SPEC_{jt} = a + b*YEAR_{jt} + e_{jt} \qquad (1)$$

where the dependent variable $SPEC_{jt}$ is regional specialisation measured by means of the dissimilarity index (see Box 3.1) using employment data on manufacturing branches at a regional level. The independent variable YEAR is the year to which the data refers, a and b are the parameters to be estimated, and e_{jt} is the error term.

Since there is substantial heterogeneity among the five countries considered, the trend model has been estimated separately for each country, using regional data at the NUTS 3 level. The results of the OLS estimation with regional fixed effects are shown in Table 2 (see Appendix). The table shows that on average, other things equal, regional specialization in the 1990s has increased in Bulgaria and Romania, and decreased in

Estonia. The estimated coefficient for YEAR is not significantly different from zero for Hungary and Slovenia.

Second, we grouped regions according to their specialization change direction, into three groups: regions experiencing increasing specialization, regions experiencing decreasing specialization, and regions showing no evident increasing or decreasing path. Regions belonging to these groups are listed in the Table 3 (see Appendix).

We found that all regions belonging to the first group – increasing specialization – had a level of specialization that was below the national average[6] at the beginning of the period. The evidence therefore seemed in favor of a convergence in the level of specialization of regions within countries. At the end of the period the average specialization of the regions belonging to this group was slightly higher than the national average in Bulgaria, Hungary and Romania, while it was still below the national average in Estonia and Slovenia. Concerning the other economic indicators, GDP – per capita and per employee – seems to have decreased from slightly above to slightly below the national average in Bulgaria and Hungary, while it remained above the average and still increasing in Estonia. We had insufficient information to analyze the path of the GDP per capita in Romania and Slovenia. The number of cars and of telephone lines per capita may be interpreted as a proxy for the level of wealth. The path of these variables is very similar to the path of GDP per capita: it is decreasing with respect to the national average in Bulgaria and Hungary, while it is increasing in Estonia and Romania. Finally, in Bulgaria, in these regions, wages were above the national average and unemployment was below; none of them seemed to increase or decrease (with respect to the national average). In Hungary, instead, unemployment was above the average and seemed to increase with respect to the national average.

The regions belonging to the second group – decreasing specialization – could be grouped into two sub-groups: in Hungary and Estonia specialization was slightly above the national average at the beginning of the period, and fell below it at the end of the period of observation. The evidence, therefore, seems in favor of a convergence of the level in specialization in Hungarian and Estonian regions. In Bulgaria, Romania and Slovenia, instead, regions experiencing a de-specializing process were already less specialized than the national average. Therefore, the evidence for these countries seems to be in favor of an increasing divergence of the internal level of specialization. Furthermore, regions experiencing decreasing specialization, with the Hungarian regions as the only exception, seemed to experience a decline in GDP per capita with

respect to the national average. Concerning the level of wealth, the number of telephone lines was either stable or decreasing, but always above the national average. The number of cars showed a more heterogeneous pattern: it was stable and above the average in Bulgaria and Hungary, increasing from below the average in Estonia, and decreasing from above the average in Romania. Finally, wages were increasing in Hungary, Romania and Slovenia, while they were stable in Bulgaria and decreasing with respect to the national average in Estonia. Unemployment was more or less stable in all countries with the only exception of Estonia, in which it was decreasing.

The third group of regions – in which specialization was not significantly increasing or decreasing – may be considered a residual group, in which we may observe contradictory paths of the variables of interest. Inside this group we may have regions in which specialization seemed to follow a random path as well as regions in which specialization was clearly increasing in the first period and decreasing in the second period, or vice versa. Due to the limited time period for which data are available, we were not able to better analyze this third 'residual' group. However, we found that, on average, regions belonging to this group were slightly more specialized than the indicator observed at a national level. Concerning the other variables of interest we found no similarity among the five countries.

Finally, the increasing integration of accession countries and the EU may have decreased the importance of internal regions in favor of regions bordering the EU and other accession countries, which were probably favored less in the past. In order to validate this hypothesis, we have tried to compare the behavior of internal regions, regions bordering the EU, regions bordering other accession countries, and regions bordering other extra-EU countries, according to the Eurostat (1999) definition.

Before grouping the regions we divided the value of each variable (cars per capita, wages and so on) by the national average obtaining a number higher than one if the region was above the national average and lower than one if the region was below it. After grouping the regions, we computed the average and standard deviation of the above-mentioned indicators separately for each group. The main advantage of this approach consists of the fact that the national average, which we used as benchmark, remained stable and equal to one across time and countries. The results summarized in Tables 4A-4E (see Appendix) were obtained by comparing the averages computed inside each group with the averages computed at a national level. To get some insights

into the path of each variable, we have reported the value of the indicators at the beginning and at the end of the period.

Table 4A shows that Bulgarian regions bordering the EU and extra-EU countries were the most specialized ones, while internal regions and regions bordering other accession countries were less specialized than the national average. Specialization seemed to increase in all regions, with the exception of regions bordering other accession countries. Concerning the other economic indicators, it appears that internal regions had the worst performance, since they seem to lose their initial advantage in favor of the other groups of regions. Regions bordering the EU, instead, seem to recover after starting from a more disadvantaged position, although at the end of the period they were still below the national average for many indicators. In summary, the evidence is for convergence in GDP per capita, the number of cars and telephone lines per capita, and for divergence in wages and unemployment indicators at a national level.

Table 4B shows the indicators for Estonia. Estonian regions bordering the EU were in a more advantaged position than regions bordering other accession countries at the beginning of the period. GDP per capita, the number of telephone lines per capita, and wages were above the national average for regions bordering the EU; all these indicators were below the national average in regions bordering other accession countries. Although regions bordering the EU are, on average, less specialized than regions bordering other accession countries, the difference between the two groups seemed to decrease. Because of the limited size of the country and its small number of regions, there are no internal regions in Estonia and no borders with extra-EU countries.

Table 4C shows convergence of specialization levels among Romanian regions: there seemed to be convergence among a group of regions, and divergence in the groups of internal regions and regions bordering accession countries. Concerning the other economic indicators, internal regions seem to have performed better than the average at the beginning of the period, although they have lost their initial advantage. Regions bordering extra-EU countries, in contrast, have started from a more disadvantaged position and seem to have improved their position.

Table 4D shows that Hungarian internal regions were less specialized than the national average and seemed to have economic indicators that were better than the national average. On the other hand, regions bordering accession countries were more specialized than the average and seemed to have economic indicators that were worse than the national average.

Table 4E, finally, shows that in Slovenia, regions bordering the EU were on average less specialized than the national average. Furthermore, they had the worst position in terms of wages (lower than the average) and unemployment (higher than the average). Slovenian data showed divergence in all groups and with respect to all variables.

In summary, our findings seem to be in favor of the idea that highly specialized regions have an economic performance that is slightly better than that of low specialized regions. However, although the available data set covers only a limited time period, there seems to be convergence in the levels of regional specialization in Hungary and Estonia. In Bulgaria, Romania and Slovenia, we found only partial convergence since some of the low specialized regions are decreasing their level of specialization and are therefore diverging from the rest of the country. Given the limited availability of observations over time, it is still not clear whether an increase in the level of specialization yields an improvement in the economic performance of regions. Finally, the comparison between regions bordering the EU with regions not bordering the EU seems to confirm the idea of an economic convergence of regions within each country, with Slovenia as the only exception, where the data seem to indicate divergence.

5 Geographic Concentration of Manufacturing

On the basis of the concentration indices calculated for manufacturing branches in Bulgaria, Estonia, Hungary, Romania and Slovenia we have grouped the industries according to the following characteristics: scale economies, technology level, and wages level. The definitions of high-medium-low technology level, and of high-medium-low wage level are based on OECD (1994); the definition of high-medium-low levels of scale economies is based on Pratten (1988). The manufacturing classification is according to the Eurostat NACE Rev1 (2 digit classification) for Estonia, Romania, and Slovenia. Employment data have been collected according to national classifications in Hungary and Bulgaria. For these two latter cases aggregations have been made to bring these classifications as close as possible to the NACE classification.

We found that industries with low economies of scale had a level of concentration which was stable and very close to the national average in Bulgaria and Romania. In Estonia these sectors were less concentrated than the national average, while in Hungary and Slovenia they were slightly more concentrated than the national average. Slovenian

industries belonging to this group were also experiencing a decrease in their level of concentration. The industries with medium economies of scale were below the national average in Bulgaria, Hungary and Slovenia, while they were slightly above the average in Estonia and Romania. In all cases the level of concentration of these industries seemed to be stable or slightly increasing. Finally, the industries with high economies of scale were much more concentrated than average in all countries with Romania as the only exception, where these industries were around the national average. Concentration in these industries seemed to slightly decrease, with the exception of Slovenia, in which it seemed to increase. In Romania all industries seemed to have the same level of concentration (around the national average), while the differences among groups of industries were much more evident for the other countries.

Industries defined as high tech were usually less concentrated than the national average in all countries, although their level of concentration seems to have increased. The industries defined as medium tech seem to be more concentrated than the average and stable or slightly decreasing in Bulgaria, Estonia and Hungary. In Romania and Slovenia these industries were as concentrated as the national average, and their level of concentration was stable (in Romania) or increasing (Slovenia). Finally, the high tech industries were less concentrated than the national average in Bulgaria, Hungary and Slovenia. Their level of concentration seemed to be stable or to be increasing (Bulgaria). In Estonia and Romania these industries were more concentrated than the national average. They seemed to become even more concentrated in Estonia, while their level of concentration seemed to be stable or slightly decreasing in Romania.

Industries with the lowest level of wages were the most dispersed ones. Their level of concentration seemed to be stable or slightly increasing. On the other hand, the industries with the highest level of wages were more concentrated than the national average, and their level of concentration seemed to be stable or slightly decreasing. In conclusion, the evidence seems to be in favor of a convergence of concentration levels. The medium-wage industries had a level of concentration that was not far from the national average. Our results suggest that their concentration has increased in Hungary, decreased in Bulgaria and remained stable in the other countries.

Our analysis has been based on available data for ten years for Bulgaria and Estonia, nine years for Romania, eight for Hungary and only four for Slovenia. We might therefore not be able to capture the impact of regional business cycles on concentration patterns.

At a more aggregate level, increasing economic integration with the EU is expected to change patterns of location and concentration of industrial activity in accession countries. In order to capture whether and to what extent this change has taken place, we have estimated the following model:

$$CONC_{it} = a + YEAR_{it} + e_{it} \quad (2)$$

where the dependent variable $CONC_{it}$ is the level of concentration of manufacturing activity calculated by means of the dissimilarity index using employment data on manufacturing branches at the regional level. The independent variable YEAR is the year to which the data refers, a and b are the parameters to be estimated, and e_{it} is the remaining error term.

The model has been computed separately for each country, using an OLS with industries fixed effects estimation method. The results shown in Table 5 (see Appendix) indicate that concentration did not increase or decrease significantly in these countries, with the exception of Bulgaria, in which concentration seemed to increase.

Since for the majority of sectors there seem to be no significant changes in the level of concentration, the analyses of industries depending on their level of scale economies, level of technology or level of wages did not offer clear results. However, although some small differences between the countries still exist, the data seem to confirm that in all five countries the level of concentration is increasing (and decreasing) in the same type of sectors.

6 Determinants of Regional Specialization and Industrial Concentration Patterns

As pointed out in Midelfart-Knarvik et al., 2000, regional specialization and industrial concentration patterns are determined by the interaction of regional and industry characteristics. The reason for evaluating the interaction between regional and industry characteristics lies in the fact that firms evaluate the same kind of production factors differently (Fujita et al., 1999). Industries will try to locate as close as possible to the place where their most important inputs are available, and will therefore be over represented in that location. Industries for which the same production factor is less important will instead be underrepresented.

To uncover determinants of manufacturing location and explain regional manufacturing production structures differentials in the five accession countries, we estimate a model similar to Midelfart-Knarvik et al. (2000). We analyze changes in regional specialization and industry location by regressing the log share of industry i in region j (s_{ij}^S) on regional and industry characteristics, after controlling for the size of regions by means of the log share of population living in region j (pop_j) and of the log total manufacturing located in region j (man_j), using the following specification:

$$ln\,(s_{ij}^S) = c + a\,ln\,(pop_j) + b\,ln\,(man_j) + S_k\,b\,[k]\,(y[k]_j - g\,[k])\,(z[k]^i - k\,[k]) \qquad (3)$$

where $y[k]_j$ is the level of the k^{th} region characteristic in the j^{th} region and $z[k]^i$ is the level of the k^{th} industry characteristic of industry i. As is clear in (3), the k^{th} region characteristic is matched with the k^{th} industry characteristic. Finally, a, b, $b\,[k]$, $g\,[k]$, and $k\,[k]$ are the coefficients to be estimated. We computed the share of industry i in region j (s_{ij}^S) using employment data.

The first two variables appearing on the right hand side (ln (pop_j) and ln (man_j)) capture regional size effects and are therefore needed to correct for the disparity in the size of regions. The remaining terms should capture the interaction between regional and industry characteristics. Details on the regional and industry characteristics are shown in Table 6 (see Appendix).

The market potential (MP) characteristic – which has been interacted with the level of scale economies (SE) – may be interpreted as an indicator of proximity to markets. We computed two market potential indicators: the first one (MP1) intends to compare regions inside the same country in the context of a closed economy, while with the second indicator (MP2), we try to get some insights into the consequences of the increasing relationship between each country and the EU. It is plausible that the association agreement with the EU has led to a reduction of transport cost into the EU by reducing trade barriers, while transport costs within the country have probably remained unchanged. This had probably led to a comparative advantage for regions bordering the EU with respect to central regions, which had had a comparative advantage before the EU accession agreements. The MP2 variable is used to verify whether increasing integration with the EU has led to a reallocation of activity (industries) from central to regions bordering the EU. We introduced the two market potential variables (MP1 and MP2) in two different models in order to keep the two hypotheses (closed versus open economy) separated.

The labor abundance (LA) and the research and development (RD) characteristics are used to identify the relative regional abundance of these different input factors. The RD characteristic is then alternatively interacted with the technology level (TL) and with the importance of R&D inputs in each industry (RO), while the labor abundance (LA) characteristic is interacted with the importance of labor as a production factor (LI).

The two industry characteristics associated with the R&D regional characteristic – research orientation (RO) and technology level (TL) – may in principle seem very similar. However, the industries listed as RO are not the same industries listed as TL. Furthermore, their significance level did not change when we tried to set one of them aside in our estimations.

After having defined the regional and the industry characteristics, we interacted them as shown in Table 7 (see Appendix).

The interaction variables MP1SE and MP2SE should be interpreted on the basis of the idea that industries with higher economies of scale may tend to concentrate in relatively central locations (Krugman, 1980; Midelfart-Knarvik et al., 2000). Since we expect the central location to be identified as the country capital in the early ‘90s and with the EU market in the most recent years, we expect the MP1SE and MP2SE variables to capture these changes.

The interaction variables RDRO, RDTL and LALI should be interpreted on the basis of the idea that industries that highly value some production factors (R&D for research-oriented firms and firms with a high technology level; labor abundance for labor-intensive firms) tend to locate in areas in which these production factors are abundant.

After this short illustration of the variables introduced in our estimations, we may now briefly discuss some estimation issues. First of all, since the data collected in the different countries are quite heterogeneous, we estimated equation (3) separately for each country using OLS with White’s heteroskedasticity consistent standard errors. The main findings are summarized in Table 8 (see Appendix). More detailed results may be provided on request from the authors.

We estimated our models using yearly data. The first reason for this choice is the limited time period covered by our data set. Secondly, regional differences in business cycles are smaller than differences that may be observed among countries. Finally, this approach may enable us to better identify structural breaks that may occur in our data

set (e.g., we may be better able to distinguish between trends before and after certain EU agreements).

As shown in Table 8, the first two independent variables of the model (ln(pop) and ln(man)), capturing the effect of different sizes of the analyzed regions are higher than zero or are not significant (with the exception of the results for Estonia which are significantly negative) confirming that larger regions have larger shares of industrial activity.

The regional characteristics have, in general, the expected signs. We find that the market potential variables – MP1 and MP2 are positively and significantly related to industry shares (s_{ij}^{S}). Since MP1 and MP2 are decreasing with distance from the core markets we find evidence that industry shares (s_{ij}^{S}) are higher in regions that are located near the core.

The labor abundance (LA) regional characteristic has negative coefficients confirming that labor abundant regions have larger shares of industries. In Estonia, the LA coefficient is however significantly positive while in Romania, the coefficient of LA is negative for the two years when we use MP1 and positive for the one year when we use MP2.

Industry characteristics (see Table 8) have , in general, the expected signs. With the exception of Hungary, industries with economies of scale are positively and significantly correlated with the shares of industries. Research oriented industries seem to be concentrated in Slovenia but dispersed in Bulgaria. The technology level (TL) coefficient is either not significant or positive, although its significance level seems to reduce. Finally, the labor intensity (LI) coefficient is in general not significant.

Concerning the interaction variables, we found that the coefficients of the market potential variables are either positive or not significant. While in Hungary and Romania, both MP1SE and MP2SE seem to be significantly higher than zero, in Bulgaria and Slovenia only MP1SE is significantly positive. In Estonia the only coefficient which seems to be positive is MP2SE. Only in Hungary does the significance level of MP1SE and MP2SE seem to change: both coefficients seem to increase their significance. Theory predicts that market forces induce industries with high returns to scale to locate near the core, and that these forces are stronger with intermediate levels of transport costs. Although, as mentioned above, more research is needed to better identify the variables influencing the market potential of regions, the fact that these forces are not

weakening in the countries and over the period of our analysis supports the idea that the transport costs are still at an intermediate level.

The coefficients of the interaction variables RDRO and RDTL have been estimated only for Bulgaria and Slovenia. While for Bulgaria both coefficients seem to be not significantly different from zero, for Slovenia RDRO becomes significantly positive and RDTL becomes (slightly) significantly negative in the last year (1997). The positive coefficient points out the importance of the supply of researchers in determining the location of research oriented (RDRO) industries, and is more relevant than for high technology (RDTL) industries. Finally, the coefficient of the interaction variable LALI is either zero (Bulgaria) or positive (Hungary, Romania and, to a lesser extent, Estonia). In Hungary and Romania the coefficient was increasing its significance level during the last periods of observation. We may interpret this finding as support for the idea of country specialization in more labor-intensive industries.

Location shifts take place very slowly and a long time series' worth of data is usually necessary in order to appreciate real changes in industrial relocation and regional specialization. Given the 'young' age of the five accession countries and their data sets, more research is still needed to be able to assess the changes in relocation that their 'transition' is implying.

7 Concluding Remarks

Since 1990, Central and East European economies have experienced increasing economic integration with the EU via trade and foreign direct investments. The spatial implications of this process have not been investigated in-depth so far. In this paper, we have analyzed regional specialization and industry concentration patterns in Bulgaria, Estonia, Hungary, Romania and Slovenia.

The main findings suggest that average regional specialization has increased in Bulgaria and Romania, decreased in Estonia and has not significantly changed in Hungary and Slovenia. Our analysis reveals that highly specialized regions seem to perform better than low specialized regions in terms of GDP per capita. Furthermore, although the available data set covers only a limited time period, we found some evidence in favor of – general or partial – convergence in the level of regional

specialization inside almost all countries analyzed. Regions bordering the WEU are found to perform better than the other regions in Bulgaria Estonia and Hungary.

For the majority of industries, there seem to be no significant changes in the level of concentration. Although some small differences between the countries still exist, the data seem to confirm that the level of concentration is increasing (and decreasing) in the same sectors in all five countries analyzed.

Our regression analysis using interacted regional and industry characteristics as independent variables, suggests that industries in accession countries tend to locate where production factors are abundant. Labor intensive industries tend to locate in regions with labor abundance while research oriented industries are concentrated in regions with higher shares of researchers in employment. Larger regions have larger shares of manufacturing activity. Industries with economies of scale are positively and significantly correlated with shares of industries. Finally, geographic proximity to European core matters for location of industries in accession countries.

Notes

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

[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), Amiti (1997), Aiginger et al. (1999), Devereux et al. (1999) and Hallet (2000).

[4] The indicators used in this paper to analyse regional specialization and concentration of industries are defined in a way that is similar to Aiginger et al. (1999). The dissimilarity index is a modified version of the index proposed in Krugman (1991a).

[5] The dissimilarity index used to calculate the specialization level may assume values between zero and two. However, in all regions, with some exception being made for Slovenia, the index is below the value of one. However, we believe that these thresholds, although quite restrictive (the proportion of regions in the two groups is quite low), enable us to find similarity among highly specialised regions on the one side and less specialised regions on the other side.

[6] Since in Bulgaria, Hungary and Romania the economic activity of the country's capital is extremely high with respect to all other regions, in these countries we calculated the national average without the country's capital.

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Appendix

Table 1: Regions with high or low specialization in accession countries

High Specialization				
Bulgaria	**Estonia**	**Hungary**	**Romania**	**Slovenia**
Vidin			Botosani	Pomurska
Pernik			Galati	Koroška
Razgrad			Dambovita	Zasavska
			Ialomita	Spodnejposavska
			Valcea	Notranjsko-kraška
			Caras-Severin	
			Harghita	
Low Specializiation				
Bulgaria	**Estonia**	**Hungary**	**Romania**	**Slovenia**
Veliko Tarnovo	Northern Estonia	Pest	Iasi	Podravska regija
Vtratza		Győr-Moson-Sopron	Mun. Bucuresti	
Montana		Somogy		
Plovdiv		Hajdú-Bihar		
Russe		Jász-Nagykun-Szolnok		
Sofia region				

Table 2: Regional specialization in accession countries, 1990-1999

	Bulgaria	Estonia	Hungary	Romania	Slovenia
Year	0.0068 ***	-0.0073 **	-0.0019	0.0074 ***	-0.0023
	(0.0011)	(0.0033)	(0.0019)	(0.0012)	(0.0061)
Intercept	0.4488 ***	0.4756 ***	0.4638 ***	0.5405 ***	0.7050 ***
	(0.0067)	(0.0202)	(0.0132)	(0.0077)	(0.0462)
Number of observations	280	50	160	369	48
R-sq: within	0.1383	0.1029	0.0074	0.1086	0.0039

* significant at 10%; ** significant at 5%; *** significant at 1%
standard errors in parentheses

Table 3: Regions experiencing increasing or decreasing specialization in accession countries

Increasing Specialization				
Bulgaria	**Estonia**	**Hungary**	**Romania**	**Slovenia**
Veliko Tarnovo	Northern Estonia	Tolna	Vaslui	
Dobrich		Hajdú-Bihar	Constanta	
Kustendil			Galati	
Pazardjik			Vrancea	
Plovdiv			Arges	
Razgrad			Calarasi	
Russe			Teleorman	
Sliven			Dolj	
Smolyan			Olt	
Stara Zagora			Valcea	
			Timis	
			Bihor	
			Salaj	
			Harghita	
			Mures	
Decreasing Specialization				
Bulgaria	**Estonia**	**Hungary**	**Romania**	**Slovenia**
Gabrovo	Central Estonia	Budapest	Iasi	Dolenjska
Pleven	North-Eastern Estonia	Gyõr-Moson-Sopron	Mun. Bucuresti	Gorenjska
		Vas		
		Somogy		
		Nógrád		
		Jász-Nagykun-Szolnok		
		Békés		

Table 4A: Bulgarian regional variables divided by their national average, at the beginning and at the end of the period[a]

	Type of region:	Overall	Borders EU	Borders AC	Internal	Border EX
	Number of regions:	28	3	6	14	5
Dissimilarity Index	Mean	0.982 – 0.989	1.204 – 1.284	0.855 – 0.786	0.929 – 0.940	1.150 – 1.192
over national average	Std. Dev.	0.294 – 0.326	0.042 – 0.215	0.336 – 0.315	0.279 – 0.286	0.285 – 0.345
GDP per capita	Mean	1.027 – 1.001	0.949 – 0.960	0.978 – 1.003	1.041 – 0.985	1.093 – 1.067
over national average	Std. Dev.	0.120 – 0.072	0.078 – 0.012	0.083 – 0.043	0.094 – 0.059	0.208 – 0.117
GDP per worker	Mean	1.001 – 0.997	0.961 – 0.960	0.978 – 1.033	0.999 – 0.964	1.058 – 1.071
over national average	Std. Dev.	0.102 – 0.070	0.096 – 0.060	0.059 – 0.047	0.070 – 0.045	0.198 – 0.092
Cars per capita	Mean	1.031 – 0.999	0.796 – 0.796	0.923 – 0.920	1.099 – 1.051	1.110 – 1.070
over national average	Std. Dev.	0.216 – 0.184	0.116 – 0.037	0.124 – 0.127	0.238 – 0.201	0.149 – 0.144
Telephone lines per capita	Mean	1.029 – 1.010	0.763 – 0.797	1.033 – 0.980	1.132 – 1.089	0.892 – 0.953
over national average	Std. Dev.	0.224 – 0.187	0.248 – 0.223	0.123 – 0.074	0.220 – 0.187	0.130 – 0.172
Wages	Mean	1.019 – 1.010	0.995 – 0.893	0.996 – 0.991	1.023 – 1.024	1.049 – 1.064
over national average	Std. Dev.	0.052 – 0.136	0.016 – 0.034	0.031 – 0.165	0.050 – 0.122	0.080 – 0.163
Unemployment	Mean	0.939 – 1.001	1.321 – 1.023	0.972 – 1.241	0.847 – 0.967	0.927 – 0.838
over national average	Std. Dev.	0.233 – 0.325	0.041 – 0.315	0.119 – 0.179	0.194 – 0.376	0.289 – 0.197

[a]The first figure refers to the first year in which the variable is available, while the second figure refers to the last year in which the variable is available. Since not all variables are available for the same period, not all indicators in Tables 2A, 2B, 2C 2D and 2E refer to the same period. We should therefore use cautions in comparing the first and the last value of the different variables.

EU means European Union
AC means Accession Countries
EX means Extra-European Countries

Table 4B: Estonian regional variables divided by their national average, at the beginning and at the end of the period

	Type of region:	Overall	Borders EU	Borders AC	Internal	Border EX
	Number of regions:	5	3	2	0	0
Dissimilarity Index	Mean	1.000 – 1.000	0.942 – 0.988	1.087 – 1.018		
over national average	Std. Dev.	0.293 – 0.166	0.371 – 0.232	0.204 – 0.043		
GDP per capita	Mean	1.000 – 1.000	1.147 – 1.175	0.779 – 0.738		
over national average	Std. Dev.	0.457 – 0.543	0.578 – 0.686	0.059 – 0.090		
GDP per worker	Mean	1.000 – 1.000	1.101 – 1.122	0.849 – 0.817		
over national average	Std. Dev.	0.341 – 0.436	0.439 – 0.562	0.063 – 0.126		
Cars per capita	Mean	1.000 – 1.000	0.950 – 0.984	1.075 – 1.023		
over national average	Std. Dev.	0.158 – 0.078	0.193 – 0.106	0.081 – 0.018		
Telephone lines per capita	Mean	1.000 – 1.000	1.059 – 1.055	0.911 – 0.917		
over national average	Std. Dev.	0.126 – 0.183	0.112 – 0.233	0.111 – 0.042		
Wages	Mean	1.000 – 1.000	1.080 – 1.063	0.880 – 0.905		
over national average	Std. Dev.	0.165 – 0.217	0.172 – 0.280	0.040 – 0.012		
Unemployment	Mean	1.000 – 1.000	0.942 – 1.054	1.086 – 0.919		
over national average	Std. Dev.	0.356 – 0.269	0.490 – 0.359	0.044 – 0.097		

Table 4C: Romanian regional variables divided by their national average, at the beginning and at the end of the period

	Type of region:	Overall	Borders EU	Borders AC	Internal	Border EX
	Number of regions:	41	0	11	23	7
Dissimilarity Index	Mean	0.993 – 0.987		0.878 – 0.956	1.015 – 0.992	1.099 – 1.018
over national average	Std. Dev.	0.263 – 0.248		0.145 – 0.178	0.259 – 0.272	0.376 – 0.283
Cars per capita	Mean	1.027 – 1.016		1.067 – 1.114	1.098 – 1.055	0.730 – 0.736
over national average	Std. Dev.	0.354 – 0.378		0.272 – 0.489	0.368 – 0.313	0.298 – 0.286
Telephone lines per capita	Mean	1.050 – 1.032		1.031 – 0.961	1.109 – 1.094	0.887 – 0.943
over national average	Std. Dev.	0.408 – 0.329		0.287 – 0.301	0.491 – 0.367	0.210 – 0.206
Wages	Mean	1.001 – 1.011		0.983 – 1.020	1.018 – 1.023	0.974 – 0.956
over national average	Std. Dev.	0.100 – 0.128		0.065 – 0.108	0.112 – 0.142	0.110 – 0.110
Unemployment	Mean	0.987 – 0.986		0.861 – 0.754	0.942 – 1.056	1.333 – 1.123
over national average	Std. Dev.	0.399 – 0.292		0.296 – 0.166	0.420 – 0.287	0.308 – 0.284

Table 4D: Hungarian regional variables divided by their national average, at the beginning and at the end of the period

	Type of region:	Overall	Borders EU	Borders AC	Internal	Border EX
	Number of regions:	20	2	7	8	3
Dissimilarity Index	Mean	0.992 – 0.986	0.920 – 0.774	1.023 – 1.124	0.977 – 0.991	1.008 – 0.795
over national average	Std. Dev.	0.249 – 0.279	0.403 – 0.278	0.240 – 0.138	0.271 – 0.368	0.263 – 0.061
GDP per capita	Mean	1.058 – 1.065	1.248 – 1.453	0.968 – 0.921	1.126 – 1.159	0.962 – 0.890
over national average	Std. Dev.	0.299 – 0.374	0.009 – 0.026	0.149 – 0.164	0.442 – 0.519	0.052 – 0.070
GDP per worker	Mean	1.016 – 0.996	1.029 – 1.089	0.973 – 0.947	1.064 – 1.040	0.981 – 0.933
over national average	Std. Dev.	0.144 – 0.150	0.034 – 0.033	0.071 – 0.051	0.215 – 0.221	0.041 – 0.068
Cars per capita	Mean	1.016 – 1.021	1.071 – 1.130	0.914 – 0.929	1.043 – 1.051	1.145 – 1.084
over national average	Std. Dev.	0.156 – 0.164	0.025 – 0.023	0.166 – 0.154	0.151 – 0.194	0.034 – 0.045
Telephone lines per capita	Mean	1.150 – 1.030	1.350 – 1.098	0.963 – 0.945	1.249 – 1.092	1.187 – 1.019
over national average	Std. Dev.	0.743 – 0.164	0.175 – 0.049	0.352 – 0.123	1.145 – 0.215	0.254 – 0.047
Wages	Mean	1.022 – 1.028	0.990 – 1.078	1.000 – 0.976	1.069 – 1.093	0.968 – 0.944
over national average	Std. Dev.	0.110 – 0.147	0.035 – 0.065	0.050 – 0.061	0.159 – 0.207	0.036 – 0.052
Unemployment	Mean	0.952 – 0.966	0.395 – 0.543	1.055 – 1.155	0.990 – 0.882	0.980 – 1.032
over national average	Std. Dev.	0.527 – 0.346	0.134 – 0.124	0.549 – 0.342	0.618 – 0.351	0.192 – 0.089

Table 4E: Slovenian regional variables divided by their national average, at the beginning and at the end of the period

	Type of region:	Overall	Borders EU	Borders AC	Internal	Border EX
	Number of regions:	12	7	0	1	4
Dissimilarity Index	Mean	0.994 – 1.000	0.882 – 0.890		1.437 – 1.486	1.079 – 1.072
over national average	Std. Dev.	0.368 – 0.409	0.299 – 0.391		---	0.464 – 0.439
Wages	Mean	1.000 – 1.000	0.982 – 0.978		1.033 – 1.003	1.023 – 1.037
over national average	Std. Dev.	0.077 – 0.097	0.038 – 0.064		---	0.130 – 0.152
Unemployment	Mean	1.000 – 1.000	1.009 – 0.990		1.256 – 1.364	0.920 – 0.926
over national average	Std. Dev.	0.274 – 0.304	0.321 – 0.346		---	0.198 – 0.217

Table 5: Geographic concentration of manufacturing in accession countries, 1990-1999

	Bulgaria	Estonia	Hungary	Romania	Slovenia
Year	0.0092 ***	0.0037	-0.0003	0.0015	-0.0011
	(0.0014)	(0.0037)	(0.0275)	(0.0017)	(0.0061)
Intercept	0.4945 ***	0.4481 ***	0.4690 ***	0.6342 ***	0.6367 ***
	(0.0090)	(0.023)	(0.0189)	(0.0111)	(0.0465)
Number of observations	120	130	64	108	48
R-sq: within	0.2773	0.0083	0.0002	0.0077	0.0010

* significant at 10%; ** significant at 5%; *** significant at 1%; standard errors in parentheses

Table 6: Regional and industry characteristics in accession countries

Variable name	Description
	Regional characteristics
Market Potential (MP1)	Average regional wages (deflated at national level) divided by the distances from country capital (in km; to avoid complications the distance of the country capital with itself is supposed to be 1 km)
Market Potential (MP2)	Average wages (deflated at a national level) divided by a proxy of the distance from EU markets (1 if the region borders EU, 2 if the region does not border EU)
R&D (RD)	R&D personnel divided by the number of persons employed for Bulgaria and Hungary; R&D expenditures divided by the value added in manufacturing for Slovenia; no information is available for Estonia and Romania
Labour Abundance (LA)	Sum of employment and unemployment, divided by the population in working age (15-65 years)
	Industry characteristics[a]
Scale economies (SE)	1 = low, 2 = medium, 3 = high (definition by Pratten, 1988)
Research Oriented (RO)	1 = almost none of the industries of the sector is defined as research oriented; 2 = some industries of the sector are defined as research oriented; 3 = almost all industries of the sector are defined as research oriented (definition by OECD, 1994)
Technology Level (TL)	1 = Low technology; 2 = Medium technology; 3 = high technology (definition by OECD, 1994)
Labour Intensity (LI)	Labour Intensity dummy (definition by OECD, 1994)

[a] Since the available classification of industries is quite aggregated we were sometimes forced to 'average' the qualitative characteristics proposed by Pratten (1988) and by the OECD (1994).

Table 7: Interaction variables

	Variable name	Regional characteristic	Industry characteristics
J=1	MP1SE	MP1 Market Potential (distances with country capital)	SE Scale economies
J=2	MP2SE	MP2 Market Potential (distances with EU markets)	SE Scale economies
J=3	RD1RO		RO Research oriented
J=4	RD2TL	RD1 RD2 = RD R&D personnel or expenses	TL Technology level
J=5	LALI	LA labour abundance	LI Labour intensity

Table 8: Summary of the estimations' findings

		Bulgaria		**Estonia**		**Hungary**		**Romania**		**Slovenia**	
	lnpop	0	0	0	P.	P	P	P	0	P	P
	lnman	P	P	N	P+	0	0	P	P	0	0
Regional characteristics	MP1	0	/	N	/	N	/	N	/	N	/
	MP2	/	0	/	N	/	N	/	N	/	0
	RD	0	0	/	/	/	/	/	/	0	0
	LA	0	0	P	P	N	N	N	P	/	/
Industry characteristics	SE	N	0	0	N	P	0	N	N	0	0
	RO	P	P	/	/	/	/	/	/	N	N
	LI	0	0	0	0	0	0	0	0	/	/
	TL	P	P	/	/	/	/	/	/	P	P
Interaction variables	MP1SE	P	/	0	/	P	/	P	/	P	/
	MP2SE	/	0	/	P	/	P	/	P	/	0
	RDRO	0	0	/	/	/	/	/	/	P	P
	LALI	0	0	P	P	P	P	P	P	/	/
	RDTL	0	0	/	/	/	/	/	/	N	N

The first column represents the results for the model using MP1 for market potential and the second column using MP2 for market potential

(P) the estimated coefficient is significantly positive; (N) the estimated coefficient is significantly negative

(/) the variable was not available (or was not used) for the model estimation;

(0) the variable was never significant

(+) the variable was significantly negative in the first period and significantly positive in the last period

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ISSN 1436 - 6053

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