Integration, Regional Specialization and Growth Differentials in EU Acceding Countries: Evidence from Hungary*

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Abstract

This paper investigates the impact of market integration on regional production structures and regional growth differentials in Hungary over the period 1994-2000. Our analysis indicates a relocation of manufacturing towards border regions, in particular towards regions bordering the European Union. On average, regional manufacturing specialization increased. We find a positive relationship between knowledge spillovers proxyed with a measure of foreign direct investment intensity and regional growth as well as between regional manufacturing specialization and regional growth. The change in regional specialization is also positively related to regional growth. Our empirical results show that on average, other things equal, high growth rates are associated with high initial levels of GDP per capita. This finding shows up even when controlling for regional economic structures, change in manufacturing specialization, the degree of openness and geographical proximity to western markets. Our research suggests that in the first stage of market integration divergence forces tend to prevail leading to relative winners and losers across space.

Key words: Economic integration, Location of economic activity, Regional growth

JEL Classification: F15, R11, R12

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1 Introduction

Since 1990, Central and East European countries (CEECs) have experienced increased economic integration with the European Union (EU), via trade and foreign direct investment (FDI), which has led to a reallocation of resources across sectors and space. While sectoral shifts in CEECs have frequently been analyzed (see for example, *Landesmann / Stehrer* (2002)), the spatial implications of increasing economic integration in the EU accession countries have not been investigated in-depth. Has a relocation of economic activity taken place? Have patterns of regional specialization and industrial concentration changed during the 1990s? How does regional specialization relate to economic growth? Will the costs and benefits of EU membership be evenly distributed across space? Will economic integration foster a convergence of economic structures and income per capita?

The results of a recent research project[1] indicate that increasing economic integration with the EU has resulted in relocation of manufacturing activity and changing patterns of regional manufacturing specialization in EU accession countries. While patterns of manufacturing relocation and regional specialization are country specific, *Traistaru / Nijkamp / Longhi* (2002) find that factor endowments and geographical proximity to industry centers (capital regions) and EU markets explain the economic geography of manufacturing in these countries.

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

As pointed out in *European Commission* (2001a), over the past decade the real convergence process in the ten CEE candidate countries have been slow with levels of GDP per capita compared to the EU average (in PPS) ranging in 2000 from below 30

[1] "European integration, regional specialization and location of industrial activity in accession countries", undertaken with financial support from the European Community's PHARE ACE Programem 1998. The results are presented in *Traistaru / Nijkamp / Resmini* (2003). The countries included in this study are Bulgaria, Estonia, Hungary , Romania and Slovenia

percent in Bulgaria and Romania to 69 percent in Slovenia. While the majority of the ten CEE candidate countries converged toward the EU average, Bulgaria, the Czech Republic and Romania experienced a decline of their GDP per capita relative to the EU-15 average in 2000 compared to 1996. The real GDP per capita growth rates in the period 1996-2000 ranged from –1.6 percent in Romania to 5.2 percent in Poland.

At the regional level, GDP per capita disparities are even larger. The Second Progress Report on Economic and Social Cohesion of the European Commission (*European Commission* (2003)) shows that, in 2000 the GDP per capita in NUTS 2 regions was below 30 percent of EU average in the majority of regions in Bulgaria and Romania, and several regions in Poland. The GDP per capita was above the EU average only in the capital region of Prague and around 98 percent in the capital region of Bratislava.

In addition, several recent studies (*Petrakos* (1996, 2000); *Raagmaa* (1996); *Fazekas*, (1996, 2000) *Nemes-Nagy* (1994, 2000); *Petrakos / Economou* (2002); *Minasian / Totev* (1996)) indicate that over the past decade regional disparities within CEE countries increased. Growing evidence (*Petrakos* (2000), *Petrakos / Totev* (2000); *Resmini* (2002)) shows two types of winners among the regions in CEE countries - metropolitan and urban areas and regions close to EU markets, and two types of losers - rural areas and old (declining) industrial areas.

This paper builds on the results of a previous research on the impact of economic integration on the location of manufacturing in five EU accession countries[2] discussed in *Traistaru / Nijkamp / Longhi* (2002). We further investigate here the role of knowledge spillovers and regional manufacturing specialization on regional growth and patterns of disparities in regional income per capita in Hungary.

We proceed in two steps. We first analyze determinants of regional growth in Hungary over the period 1994-2000. We focus on the effect of knowledge spillovers - proxyed with a measure of regional foreign direct investment intensity - and regional manufacturing specialization controlling for regional economic structures, the degree of openness and geographical proximity to EU markets. Second, we test whether regional income per capita in Hungary has converged or diverged.

The choice of the period to be analyzed is based on the availability of regional GDP data. Although the seven year period is short for assessing the adjustment process

[2] Bulgaria, Estonia, Hungary, Romania and Slovenia

due to trade liberalization, we believe that a number of trends related to the spatial impact of the economic openness after the entering into force of the Europe Agreement in 1994 could be captured. This period has also the advantage of avoiding the volatility of the initial transition years.

The data show that in Hungary regions bordering the EU had the highest manufacturing specialization levels and regions bordering other accession countries the lowest. Regional average manufacturing specialization increased over the period 1994-2000 by 6.5 percent. Interior regions and regions bordering countries outside the EU enlargement had the highest increase in regional specialization. The level of manufacturing specialization remained constant in regions bordering the EU and decreased in regions bordering other accession countries. Regional differentials in GDP per capita increased over the period. Regions bordering the EU had the highest levels of GDP per capita compared to the national average while regions bordering other accession countries and regions bordering countries outside the EU enlargement had the lowest levels. Our econometric analysis indicates a positive relationship between knowledge spillovers and regional growth as well as between regional manufacturing specialization and regional growth. The convergence tests suggest a tendency for absolute and conditional divergence of the real regional GDP per capita.

The remainder of this paper is organized as follows. Section 2 discusses the theoretical framework and testable hypotheses derived from it. We discuss then in section 3 our data and measurement issues. Section 4 analyses summary statistics related to regional specialization and regional GDP per capita in NUTS 3 regions in Hungary over the period 1994-2000. Section 5 discusses estimation issues and the results of our empirical analysis. Finally, section 6 concludes.

2 Theoretical framework

The effect of openness to trade and foreign direct investment on economic growth and patterns of inequalities among participating countries and regions is still a matter of controversy among economists[3]. Until the end of 1980s, the debate on the linkage between openness and growth was dominated by neo-classical trade and growth theories, based on perfect competition and constant returns to scale, predicting that

[3] For surveys of this literature and detailed discussions of reasons for disagreements see *Rodriguez and Rodrik* (2001) and *Baldwin* (2003).

economic integration leads to convergence of income per capita and growth rates among the participating countries and regions. More recent models from the endogenous growth theory and new economic geography, based on imperfect competition and increasing returns to scale, argue that the reduction of trade barriers could foster divergence forces and predict that increasing disparities within and across countries might be the likely outcome of integration. However, the exact outcome of increased openness on growth and disparities depends on the degree of integration, and the extent of technology spillovers.

The traditional trade models explain trade patterns and specialization 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. Free trade is predicted to increase the efficiency of resources allocation, competition, and thus result in higher growth and income per capita. While these models are comparative - static and thus they do not say anything about the contribution of integration to a higher long-run growth rate, they predict that factor prices will be equalized and income per capita will converge in the long term.

Growth models in the neo-classical framework pioneered by the seminal paper of *Solow* (1956) focus on capital accumulation as the driving force for growth and predict convergence of income per capita across countries and regions in the long run. This prediction is derived from two basic assumptions: a) diminishing returns to capital and b) free availability of technological progress to all economies. The first assumption implies that poor economies will have higher returns to capital and will therefore accumulate capital and grow faster than the rich economies generating thus convergence of income per capita across countries and/or regions. Economic integration, in particular the free movement of capital, can reinforce this convergence process because the capital is likely to flow in from richer areas (*European Commission* (2001b)). The second assumption implies that technology can improve and diffuse at no cost in the integrated area and thus contribute to a process of convergence.

The neo-classical growth models have come increasingly at pain to explain the reality in particular, the fact that rich countries have grown richer and poor countries have grown but have not caught up with the rich countries. The assumption of diminishing returns to capital implies that, for a given level of technology, there is a limit beyond which accumulation of capital per worker is no longer profitable. Thus, beyond this limit there is no incentive for further capital accumulation per worker and consequently no growth. The only source of long run growth is the exogenous technological advance (*Fagerberg* (2003)). The new growth models (*Romer* (1986, 1990), *Lucas* (1988), *Grossman / Helpman* (1991), *Rivera-Batiz / Romer* (1991), *Aghion / Howitt* (1992)) overcome this shortcoming by explaining technological progress as an endogenous phenomenon and allowing for imperfect competition and increasing returns to scale. In this framework, accumulation of factors such as localized collective learning, accumulation of skills and technological innovation prevent returns to investment from diminishing.

The more recent new economic geography models suggest that specialization patterns may be the result of the spatial agglomeration of economic activities (*Krugman* (1991a, 1991b), *Krugman / Venables* (1995), *Venables* (1996), *Fujita / Krugman / Venables* (1999)). The main assumptions of these models are the presence of pecuniary or technological externalities between firms, monopolistic competition and increasing returns to scale. These new economic geography models imply that the reduction in transport costs associated with increased integration lead to increased specialization and divergence of industrial structures and generate regional differentials in growth and factor accumulation. In these models, greater capital and labour mobility can increase regional economic fluctuations and produce long-run divergent economic growth over time. The main driving mechanism for regional divergence is increasing regional specialization, making regions more vulnerable to random demand shifts and shocks. Factor movements tend to accentuate rather than compensate for the effects of these random shocks leading to regional economic divergence. In this context initial differentials matter: regions with an initial higher advantage will see their leading position reinforced. When transport cost become very low, factor costs considerations are likely to prevail and some firms will move from the core to periphery. Thus, the relationship between trade costs and agglomeration takes an inverted -U shape, agglomeration in the core regions being the greatest at intermediate levels of trade costs.

A number of recent contributions bring together elements from endogenous growth and new economic geography models and investigate the relationship between location of economic activity and growth. (*Martin / Ottaviano* (1999, 2001), *Baldwin / Forslid* (2000), *Baldwin / Martin / Ottaviano* (2001), *Fujita / Thisse* (2002a, 2002b), *Baldwin / Forslid / Martin / Ottaviano / Robert-Nicoud* (2003)). The results of these studies underline that falling trade costs foster a core-periphery pattern of economic activity and that agglomeration and growth reinforce each other leading to increased regional disparities.

The theoretical models reviewed above make different predictions with respect to the impact of economic integration on regional growth differentials. Neo-classical trade and growth models point to increasing specialization, factor price equalization and convergence of income per capita in the long term in the integrating countries and regions. New growth models and new economic geography models emphasize endogenous processes of factor accumulation, increasing returns to scale, and agglomeration economies that can foster divergence patterns in the context of economic integration. Understanding the nature of the relationship between openness and growth is therefore an empirical question. As pointed out by *Solow* (2000) and *Srinivasan / Bhagwati* (2001) the best approach in this respect is to look at country experiences.

In this paper, we look at the case of Hungary during a period of increased openness, 1994-2000 and focus on the role of knowledge spillovers – proxyed with a measure for regional FDI intensity - and regional manufacturing specialization as driving forces for regional growth differentials.

3 Data and measurement

We use a unique data set REGSTAT[4] containing, regional indicators at the NUTS 3 level over the period 1990-2000. For the purpose of our analysis, we use the following regional data for 20 NUTS 3 regions in Hungary over the period 1994 - 2000[5]: sectoral employment (in agriculture, industry and services), regional manufacturing employment (disaggregated on eight branches[6]), population data, Gross Domestic Product (GDP), and the number of firms with foreign capital participation.

In order to capture the role of geography in explaining patterns of disparities and convergence in regional growth, we use a taxonomy of regions proposed by *Resmini* (2002) which takes into account the geographical position of regions. Thus, we group

4 REGSTAT data set was generated in the framework of the project P98-1117-R undertaken with financial support from the European Community's PHARE ACE Programme. The data set includes regional indicators at NUTS 2 and NUTS 3 levels for Bulgaria, Estonia, Hungary, Romania and Slovenia

5 We decide to focus on this period which coincides with increased market integration with the EU via the Europe Agreement, entered into force in 1994.

6 The manufacturing branches are: food, beverages, and tobacco; textiles, apparel and leather; wood, paper and printing; chemicals; no-metallic mineral products; metallurgy and metal products; machinery and equipment; other manufacturing.

the regions in four categories: BEU- regions bordering the EU (Austria), BAC - regions bordering other accession countries (Romania, Slovakia, Slovenia), BEX – regions bordering countries outside the EU enlargement (, Serbia and Montenegro, Ukraine), and interior regions- INT.

We use a measure of regional FDI intensity (the number of firms with foreign capital per 1000 inhabitants) as a proxy for knowledge spillovers. Specialization of regions is defined in relation to production structures. In absolute terms, a region is said to be specialized if a few industries have a high share in the regional manufacturing activity. A region j is specialized in a certain industry i if that industry has a large share in the regional manufacturing activity. Relative measures of specialization compare the distribution of industries shares in regional manufacturing activity with a benchmark, for instance the distribution of industries share at national level[7].

In this paper we use a standard absolute measure of specialization, the Herfindahl index (H_j) defined as follows:

(1) $$H_j = \sum_i (s_{ij})^2$$

s_{ij} is the share of employment in the manufacturing branch i in total manufacturing of region j.

4 Descriptive empirics

4.1 Evidence of increased market integration

In Hungary, during the 1990s, a clear trade re-orientation towards the EU has taken place. The share of exports to the EU in total exports increased from 35 percent in 1990 to 75 percent in 2000 and the share of imports from 37 percent in 1990 to 58 percent in 2000. The bulk of exports consisted of manufactured products representing 91 percent of exports in 2000 (*European Commission* (2001a)).

Over the period analyzed in this paper, 1994-2000, the average degree of openness of regions increased. Tables A1.1 and A1.2 show summary statistics of the share of exports in regional manufacturing output. The average share of exports in regional manufacturing output increased from 28 to 49 percent over the period 1994-2000. The regional differentials with respect to openness increased as shown by the

[7] Details about various specialization measures are given in *Amiti* (1999), *Aiginger, et. al* (1999), *Brülhart* (2001), *Devereux et al*. (1999), *Hallet* (2000), *Traistaru / Iara* (2003)

standard deviation and the coefficient of variation. The minimum share of exports in regional industrial output increased from 13 percent to 26 percent while the maximum increased from 53 percent to 83 percent. Regions bordering EU had the highest openness over the analyzed period, where exports amounted to 83 percent in 2000. The share of exports in manufacturing output was around 45 percent in the other three groups of regions.

Additional evidence of market integration comes from data on FDI, in particular EU FDI outflows. In Hungary, FDI inflows originating from the EU increased from 839 million ECU in 1994 (1146 million USD total inflows) to 1537 million EURO in 1998 (2036 million USD total inflows) (*Resmini / Traistaru* (2003)). As shown in Table A1.3, the average regional FDI intensity proxyed with the number of firms with foreign capital per 1000 inhabitants at NUTS3 regional level increased over the period from 1.18 to 1.83 and so did regional differentials. Table A1.4 indicate that regions bordering the EU (Austria) had the highest FDI intensity and regions bordering other accession countries (Romania, Slovakia, Slovenia), the lowest.

4.2 Regional structural change and manufacturing specialization

Table A1.5 shows a clear pattern of relocation of manufacturing to border regions, in particular to regions bordering the European Union. Regions bordering the EU (BEU) have increased their employment shares in particular in capital - intensive industries (by 5.5 percent in the case of fuel, chemicals, rubber, plastics; by 2.6 percent in the case of metallurgy, machinery, equipment, motor vehicles), resource-intensive industries (by 4.3 percent in the case of furniture and other manufacturing, by 3.3 percent in the case of wood and paper products) and labour - intensive industries (by 2.4 percent in the case of textiles, clothing, leather). Regions bordering accession countries have gained employment in resource-intensive industries (by 4 percent in the case of wood and paper products) while regions bordering countries outside the EU enlargement have increased their shares in capital - intensive industries (by 6 percent in the case of metallurgy, machinery, equipment, motor vehicles) and resource-intensive products (by 4 percent in the case of non-metallic mineral products).

Tables A1.6-A1.8 show summary statistics of regional manufacturing specialization in Hungary over the period 1994-2000. The average manufacturing specialization of regions measured with the Herfindahl index increased by 6.5 percent over the period 1994-2000. Regions bordering the EU had the highest specialization level compared to the national average over the period 1994-1999, while in 2000, the highest specialization level was in the group of regions bordering countries outside the EU enlargement. Interior regions and regions bordering countries outside the EU enlargement had the highest increase in regional manufacturing (on average by over 15 percent). The level of manufacturing specialization remained constant in regions bordering the EU and decreased in regions bordering other accession countries. Regional differentials with respect to manufacturing specialization increased as shown by the standard deviation and the ratio between the highest and lowest specialization indices. While the lowest level of specialization has not changed, the highest level of specialization increased from 0.28 to 0.38.

Tables A1.9– A1.10 show summary statistics for regional differentials of real regional GDP in Hungary in the period 1994-2000. Regional differentials increased as indicated by the increasing values of the standard deviation, the max/min ratio and the coefficient of variation. While the lowest regional GDP per capita changed little, the highest regional GDP per capita increased by 33 per cent from 1994 to 2000. The ratio between the highest and the lowest regional GDP per capita increased from 2.9 to 3.8 over the period 1994-2000. Regional disparities are present even when the capital region is excluded. In this latter case the level of the highest GDP per capita was in 2000 by 52 percent higher compared with 1994. The ratio between the highest and lowest regional GDP per capita increased from 1.7 to 2.5.

The regions bordering the EU (Austria) had the highest differential with respect to the real GDP per capita compared with the national average. These regions have increased their differential relative to the national average from 19 percent in 1994 to 45 percent above the national GDP per capita in 2000.

These data suggest that in Hungary, over the period 1994-2000, high FDI intensity and high manufacturing specialization were associated with better than average economic performance. Over the same period, average manufacturing specialization increased by 6.5 percent. Regional differentials in the GDP per capita among the regions in Hungary in the period 1994-2000 increased. The differentials appear to be driven by the regions with higher levels of income. The regions bordering EU had the highest GDP per capita and the highest levels of FDI intensity and manufacturing specialization.

5 Empirical results

5.1 Knowledge spillovers and manufacturing specialization effects on regional growth

In order to capture the impact of knowledge spillover effects and of regional manufacturing specialization on regional growth we estimate the following panel model:

$$(2)\ \ln\left(\frac{GDPCAP_{j,t+1}}{GDPCAP_{j,t}}\right) = a + b\ln FDI_{j,t} + c\ln SPEC_{j,t} + dAGRIC_{j,t} + eSERV_{j,t} + fOPEN_{j,t} + gBORDEU + \varepsilon_{j,t,t+1}$$

j refers to regions and t to years.

$$\varepsilon_{j,t,t+1} = \omega_j + \nu_t + \eta_{j,t,t+1}$$

where ω_j is a fixed effect for region j, ν_t is a fixed effect for year t and $\eta_{j,t,t+1}$ is an independently and identically distributed random variable with mean zero and variance σ^2.

The dependent variable is the annual growth rate of regional real GDP per capita in Hungary in the period 1994-2000. The independent variables are one year-lagged values. The knowledge spillover effects are proxyed with a measure of regional FDI intensity (the number of firms with foreign capital per 1000 inhabitant in the region).The Herfindahl index (SPEC), captures the effect of regional manufacturing specialization on regional growth. The share of employment in agriculture in total regional employment (AGRIC), the share of employment in services in total regional employment (SERV), and the share of export in regional industrial output (OPEN) are control variables. In addition, we introduce a dummy variable for regions bordering EU, (BORDEU) with the aim to control for time invariant factors specific to these regions that matter for growth (such as possibilities for cross-border commuting).

Table A2.1 shows simple correlations between the variables. The correlation coefficients indicate that multicollinearity is not a problem. We estimate the model with pooled OLS, introducing gradually our control variables. We then control for unobserved time specific region-invariant effects, and for time-invariant regional fixed effects. In order to correct for potential heteroscedasticity we estimate White-corrected standard errors.

The estimation results are presented in Table A2.2. Column (1) shows the results of the estimation including as control variables the shares of regional employment in agriculture (AGRIC) and services (SERV), respectively. We find that FDI intensity and regional manufacturing specialization are positively and significantly associated with regional growth. On average and other things equal, a 100 percent increase (a doubling) of the regional FDI intensity is associated with an increase by 1.8 percent of the real regional GDP per capita growth rate. A similar increase in the Herfindahl index is associated with an increase of the real regional GDP per capita growth rate by 5.5 percent. Columns (2) and (3) show the estimated results when the measure of regional openness (OPEN) and subsequently the dummy for regions bordering the EU (BORDEU) are added. The knowledge spillover effects are still present. The elasticity of real regional GDP per capita with respect to FDI intensity is around 1.6. In this case, the effect of regional manufacturing specialization is not significantly different from zero. Also, the coefficients of the additional control variables (OPEN and BORDEU) are not significantly different from zero. The adjusted R^2 in the cases of the last two estimated models are lower compared to the adjusted R^2 obtained for the first estimated model. The results shown in Columns (1-3) indicate also that regions with high shares of employment in agriculture and services are declining.

Column (4) shows the results of the panel model including unobserved time-specific region-invariant characteristics. The value of the F-test for the joint significance of the time dummies allows us to reject the null hypothesis of zero coefficients for the time dummies. The results obtained in this case support the positive and significant effects of the knowledge spillovers and regional manufacturing specialization. The elasticity of real regional GDP per capita growth rate with respect to the FDI intensity measure is 1.7 and with respect to regional manufacturing specialization, around 5 percent, results similar to those obtained in the previous estimations. The last two columns in Table A2.2 show the results of the estimations when unobserved region-specific time-invariant characteristics are controlled for. In both cases the values of the F-test for joint significance of regional dummies do not allow the rejection of the hypothesis that the coefficients of regional dummies are jointly zero. The values of adjusted R^2 are lower in comparison with those obtained when controlling for time-specific region-invariant effects, suggesting a weaker explanatory power in the two last cases.

5.2 Testing for regional convergence

We first estimate the following standard convergence cross-section model:

$$(3)\ \frac{1}{T}\ln\left(\frac{GDPCAP_{j,t+T}}{GDPCAP_{j,t}}\right) = a + b\ln GDPCAP_{j,t} + \varepsilon_{j,t,t+T}$$

t = initial year

T = the number of years in the time interval

j = refers to region j

$\varepsilon_{j,t,t+T}$ = the error term

The model described by (3) is a standard model testing for absolute convergence[8]. The dependent variable is the average annual growth rate of real regional GDP per capita. The independent variable is the initial level of regional real GDP per capita. The estimation results are shown in Column (1) in Table A2.4. The positive and significant coefficient for the initial level of the real regional GDP per capita indicates an absolute regional divergence in the case of Hungary in the analyzed period. The higher the initial regional real GDP per capita the higher the regional growth rate. In other words, rich regions in Hungary grew faster in the period 1994-2000 than poor regions. On average, other things being equal, a 100 percent increase in initial level of regional GDP per capita is associated with 5.5 percent increase in the average annual growth rate of the real regional GDP per capita.

We test further for conditional convergence. We investigate the effect of regional manufacturing specialization change on regional growth and control for regional economic structure, openness and the effect of being a region bordering the EU. We cannot investigate in the cross –section model the knowledge spillover effects because our measure for regional FDI intensity is highly correlated with the initial level of the regional GDP per capita (see Table A2.3). We estimate the following model:

8 *Barro / Sala i Martin* (1995) suggest that regions are more likely to exhibit unconditional convergence because of similarity of preferences and structural characteristics.

$$(4)\ \frac{1}{T}\ln\left(\frac{GDPCAP_{j,t+T}}{GDPCAP_{j,t}}\right) = a + b\ln GDPCAP_{j,t} + c\frac{1}{T}\ln\left(\frac{SPEC_{j,t+T}}{SPEC_{j,t}}\right) + dAGRIC_{j,t} + eSERV_{j,t} + $$
$$+ fOPEN_{j,t} + gBORDEU + \varepsilon_{j,t,t+T}$$

The estimation results are shown in columns 2-5 in Table A2.4. The pattern of regional divergence is still present. We find a positive relationship between regional manufacturing change and regional growth, indicating that, on average and other things equal, increasing regional manufacturing specialization may be associated with higher growth rates. Because the increased specialization is taking place in interior regions, which are middle income regions, it offsets the divergence of the high income regions, but it exacerbates that of the low income regions. The coefficient of the regional manufacturing specialization change is significant at the 1 percent level in all estimations suggesting a robust result. A 1 percent increase in the regional manufacturing specialization results in an increase of around 0.3 percent in the average annual regional growth rate both when all regions are included and in the case of the estimations without the capital region. On average, and other things equal, being a region bordering the EU is associated with a higher average annual growth rate of real GDP per capita by 3 per cent higher in comparison with the rest of the regions. The higher the share of employment in agriculture and services, respectively, the lower the regional growth. The corresponding coefficients are negative and significant.

6 Conclusions

This paper investigated the impact of market integration on regional production structures and regional growth differentials in Hungary over the period 1994-2000.

We find evidence indicating increased economic integration after 1994 as shown by increased shares of exports in regional industrial output and an increased number of firms with foreign participation related to the regions' population size. Regions bordering the EU and interior regions have the highest manufacturing specialization levels and regions bordering other accession countries the lowest. Our analysis indicates a relocation of manufacturing towards border regions, in particular towards regions bordering the EU. On average, regional manufacturing specialization increased over the period 1994-2000 by 6.5 percent. Interior regions and regions bordering countries outside the EU enlargement had the highest increase in regional specialization, regions bordering other accession countries experienced a decrease in manufacturing specialization, while manufacturing specialization remained constant in regions bordering the EU. Regional differentials in GDP per capita increased over the analyzed period. Regions bordering the EU had the highest levels of GDP per capita compared to the national average while regions bordering other accession countries and regions bordering countries outside the EU enlargement had the lowest levels of GDP per capita relative to the national average.

Our econometric analysis indicates a positive relationship between knowledge spillovers proxyed with a measure for regional FDI intensity and regional growth as well as between regional manufacturing specialization and regional growth. The change in regional specialization is also positively related to regional growth. When testing for regional convergence we find that on average, other things being equal, high growth rates are associated with high initial levels of GDP per capita. This finding shows up even when controlling for regional economic structures, changing manufacturing specialization, the degree of openness and geographical proximity to western markets. Our results suggest that during an early stage of market integration divergence forces tend to prevail leading to relative winners and losers across space.

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Appendix

A1. Summary statistics

Tab. A1.1: The share of exports in regional industrial output, Hungary, 1994-2000

	1994	1995	1996	1997	1998	1999	2000
Mean	0.28	0.33	0.36	0.41	0.44	0.46	0.49
Std. Deviation	0.09	0.12	0.13	0.15	0.17	0.2	0.18
Minimum	0.13	0.13	0.17	0.18	0.23	0.23	0.26
Maximum	0.53	0.72	0.74	0.75	0.79	0.83	0.83
Max/min	3.98	5.39	4.23	4.11	3.36	3.54	3.18
Coeff. of var.	0.34	0.37	0.38	0.37	0.38	0.42	0.36

Source: Own calculations based on the REGSTAT data set

Tab. A1.2: Average share of exports in regional industrial output, for border and non-border regions Hungary 1994-2000

	1994	1995	1996	1997	1998	1999	2000
BEU	0.44	0.59	0.63	0.70	0.78	0.83	0.83
BAC	0.27	0.31	0.32	0.35	0.37	0.37	0.44
BEX	0.24	0.31	0.35	0.42	0.49	0.54	0.45
INT	0.25	0.29	0.33	0.39	0.41	0.43	0.46

Source: Own calculations based on the REGSTAT data set

Tab. A1.3: FDI intensity at regional level, Hungary, 1994-2000

	1994	1995	1996	1997	1998	1999	2000
Mean	1.18	1.28	1.35	1.41	1.43	1.75	1.83
Std. Deviation	0.99	1.12	1.20	1.26	1.31	1.50	1.65
Minimum	0.36	0.37	0.38	0.44	0.46	0.49	0.51
Maximum	4.81	5.42	5.82	6.10	6.33	7.10	8.00
Max/min	13.26	14.46	15.17	13.93	13.89	14.55	15.68
Coeff. of var.	0.84	0.88	0.89	0.89	0.91	0.86	0.90

Source: Own calculations based on the REGSTAT data set

Tab. A1.4: Average FDI intensity at regional level for border and non-border regions, Hungary 1994-2000

Region type	1994	1995	1996	1997	1998	1999	2000
BEU	1.94	2.15	2.29	2.39	2.41	2.73	2.75
BAC	0.77	0.81	0.85	0.89	0.91	1.24	1.30
BEX	1.16	1.23	1.33	1.32	1.30	1.73	1.67
INT	1.43	1.59	1.68	1.77	1.80	2.06	2.24

Source: Own calculations based on the REGSTAT data set

Tab. A1.5: Structural changes in regional manufacturing employment in different types of regions, 1994-2000, Hungary

Region type	BEU	BAC	BEX	INT
Food, beverages, tobacco	0.28	2.84	2.58	-5.70
Textiles, clothing and leather	2.38	-3.50	0.58	0.54
Wood and paper products	3.31	4.01	2.66	-9.98
Fuel, chemicals, rubber, plastics	5.55	2.39	-1.83	-6.11
Non-metallic mineral products	0.16	-4.63	4.00	0.47
Metallurgy, machinery, equipment, motor vehicles	2.58	-3.07	5.99	-5.50
Furniture and other manufacturing	4.27	-6.37	-2.50	4.60

Source: Own calculations based on the REGSTAT data set

Tab. A1.6: Average manufacturing specialization of regions (Herfindahl index), for border and non-border regions, Hungary, 1994-2000

Region type	1994	1995	1996	1997	1998	1999	2000	Change (%) 1994-2000
BEU	0.2414	0.2358	0.2393	0.2386	0.2466	0.2372	0.2418	0.17
BAC	0.1944	0.1894	0.1879	0.1912	0.2001	0.1890	0.1874	-3.60
BEX	0.2133	0.2170	0.2167	0.2207	0.2180	0.2094	0.2456	15.14
INT	0.2066	0.2080	0.2176	0.2321	0.2374	0.2305	0.2387	15.54
Average	0.2062	0.2047	0.2078	0.2147	0.2205	0.2114	0.2195	6.45

Source: Own calculations based on the REGSTAT data set

Tab. A1.7: Manufacturing specialization of regions (Herfindahl index), Hungary,1994-2000

	1994	1995	1996	1997	1998	1999	2000
Mean	0.2062	0.2047	0.2078	0.2147	0.2205	0.2114	0.2195
Std. Deviation	0.0299	0.0284	0.0352	0.0435	0.0398	0.0437	0.0614
Minimum	0.1502	0.1509	0.1534	0.1541	0.15	0.1464	0.1463
Maximum	0.2781	0.2714	0.2928	0.3342	0.3029	0.3271	0.3768
Max/min	1.85	1.8	1.91	2.17	2.02	2.23	2.57
Coeff. of var.	0.15	0.14	0.17	0.2	0.18	0.21	0.28

Source: Own calculations based on the REGSTAT data set

Tab. A1.8: Manufacturing specialization of regions (Herfindahl index) relative to the national average, for border and non-border regions, Hungary, 1994-2000

Region type	1994	1995	1996	1997	1998	1999	2000
BEU	117	115	115	111	112	112	110
BAC	94	93	90	89	91	89	85
BEX	103	106	104	103	99	99	112
INT	100	102	105	108	108	109	109
Total	100	100	100	100	100	100	100

Source: Own calculations based on the REGSTAT data set

Tab. A1.9: Regional GDP per capita, Hungary, 1994-2000

in 1000 HUF, real GDP (1995=100)

	1994	1995	1996	1997	1998	1999	2000
Mean	477	481	478	499	521	529	550
Std. Deviation	132	139	148	165	178	195	219
Minimum	337	326	313	304	337	331	343
Maximum	965	987	1010	1070	1108	1174	1288
Max/min	2.87	3.03	3.23	3.52	3.29	3.54	3.76
Coeff. of var.	0.28	0.29	0.31	0.33	0.34	0.37	0.40

Source: Own calculations based on the REGSTAT data set

Tab. A1.10: Regional GDP per capita relative to the national average, for border and non-border regions, Hungary, 1994-2000

Region type	1994	1995	1996	1997	1998	1999	2000
BEU	119	123	126	129	136	144	145
BAC	90	89	88	86	85	83	81
BEX	90	89	87	86	84	83	81
INT	111	111	112	114	114	115	117
Total	100	100	100	100	100	100	100

Source: Own calculations based on the REGSTAT data set

A2. Estimation Results

Tab. A2.1: Correlations among the variables (panel models)

$Y = \ln (GDPCAP_{i,\,t+1}/GDPCAP_{i,t})$

	Y	lnSPEC	AGRIC	SERV	lnFDI	OPEN	BORDEU
Y	1.0000						
lnSPEC	0.1302	1.0000					
AGRIC	-0.2982	0.4015	1.0000				
SERV	-0.0888	-0.3693	-0.4839	1.0000			
lnFDI	0.3596	-0.0700	-0.3526	0.2113	1.0000		
OPEN	0.3189	0.3739	-0.0409	-0.3771	0.2384	1.0000	

Tab. A2.2: Regional manufacturing specialization and growth (panel models)

Dependent variable: Annual growth rate of regional real GDP per capita, Hungary, 1994-2000

	(1)	(2)	(3)	(4)	(5)	(6)
LnFDI	0.0177*** (0.0054)	0.0165*** (0.0055)	0.0163*** (0.0057)	0.0165*** (0.0048)	0.0386 (0.0210)	0.0036 (0.0284)
LnSPEC	0.0548** (0.0277)	0.0477 (0.0289)	0.0475 (0.0304)	0.0474* (0.0263)	0.0798 (0.0592)	0.0767 (0.0550)
AGRIC	-0.5239*** (0.1324)	-0.4920*** (0.1298)	-0.4911*** (0.1353)	-0.4686*** (0.1219)	-1.2243** (0.5847	-0.5511 (0.6574)
SERV	-0.1402*** (0.0477)	-0.1212** (0.0473)	-0.1199** (0.0544)	-0.1287*** (0.0441)	0.0000 (0.1397)	-0.0411 (0.1121)
OPEN		0.0215 (0.0257)	0.0204 (0.0290)	0.0122 (0.0258)	-0.0507 (0.0755)	-0.0827 (0.0708)
BORDEU			0.0014 (0.0182)			
Time fixed effects	No	No	No	Yes	No	Yes
Regional fixed effects	No	No	No	No	Yes	Yes
Constant	0.2233*** (0.0629)	0.1913*** (0.0684)	0.1906** (0.0740)			
R^2	0.2787	0.2828	0.2829	0.4425	0.3511	0.5046
adj. R^2	0.2536	0.2514	0.2448	0.3913	0.1872	0.3450
N	120	120	120	120	120	120
F				F(6,109) =7.98***	F(19,95) = 0.69	F(5,90) =6.40*** F(19,90) =0.78

Estimations with White-corrected standard errors
*, **, *** significant at 10%, 5%, 1% levels; robust standard errors in parentheses

Tab. A2.3: Correlations among the variables (cross-section models)

Y = 1/T ln ($GDPCAP_{i,t+T}/GDPCAP_{i,t}$) SPECG = 1/T ln ($SPEC_{i,t}$+T/$SPEC_{i,t}$)

	Y	lnGDPCAP	lnFDI	SPECG	AGRIC	SERV	OPEN
Y	1.0000						
lnGDPCAP	0.5380	1.0000					
lnFDI	0.6168	0.8055	1.000				
SPECG	0.3501	0.0366	0.0450	1.0000			
AGRIC	-0.3634	-0.2440	-0.2427	0.2257	1.0000		
SERV	-0.0631	0.3911	0.3084	-0.1535	-0.5640	1.0000	
OPEN	0.3088	0.1016	0.0549	-0.0038	0.0147	-0.1719	1.0000

Tab. A2.4: Testing for regional convergence (cross-section models)

Dependent variable: Average annual growth rate of regional real GDP per capita, Hungary, 1994-2000

	(1)	(2)	(3)	(4)
LnGDPCAP	0.0538*** (0.0146)	0.0569*** (0.0134)	0.0415*** (0.0099)	0.0410*** (0.0111)
SPECG		0.2551*** (0.0515)	0.2841*** (0.0577)	0.2856*** (0.0629)
AGRIC		-0.3964*** (0.0726)	-0.3842*** (0.0720)	-0.3856*** (0.0757)
SERV		-0.1733*** (0.0439)	-0.1274*** (0.0412)	-0.1272** (0.0453)
OPEN		0.040 (0.0234)		-0.0117 (0.0330)
BORDEU			0.0288*** (0.0093)	0.0311** (0.0123)
Constant	-0.3108*** 0.0879	-0.2144** (0.0735)	-0.1369** (0.0557)	-0.1306* (0.0624)
R^2	0.2894	0.7548	0.8413	0.8427
adj. R^2	0.2499	0.6673	0.7846	0.7702
N	20	20	20	20

Estimations with White-corrected standard errors
*, **, *** significant at 10%, 5%, 1% levels; robust standard errors in parentheses