5. Regional Specialization of the 20 Hungarian Regions

This research analyses industry agglomerations and regional development in Hungary in the context of European integration from 1992 to 2008. The previous Chapter 4 has analysed agglomeration of the manufacturing industries in Hungary. In this chapter, the focus shall be on regional development, more precisely on regional specialization with respect to manufacturing industries of the 20 planning-statistical regions in Hungary (the Nuts-3 level).

For clarification, the difference between agglomeration and specialization shall be recalled here.

<table>
<thead>
<tr>
<th>Concentration</th>
<th>looks at the industry, a sector of manufacturing, at the degree of its agglomeration or dispersion in space.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Specialization</td>
<td>looks at the region, at the structure of sectoral employment, whether only a few sectors are dominant, or whether a region is highly diversified.</td>
</tr>
</tbody>
</table>

With respect to specialization, this research looks at the hypothesis whether regional specialization in Hungary has increased or declined in the course of European integration under the Europe agreement, or whether there were both trends and at which stages of the integration process. It also verifies whether there may have been a turning point in the development up to which there was an increase and after which there was a decline. This would be the prediction made by theories of the NEG (e.g. Venables 1996; Krugman & Venables 1996; Puga (1999); Overman et al. 2008). The analysis shall also find out whether such a peak point was reached prior to full EU-membership of Hungary.

Here again, the speciality of my research is that it looks at regions and their degree of industrial specialization and not at countries, as most other of the few existing studies on Central and Eastern Europe do.

5.1 Review of previous empirical studies on specialization

The degree of regional specialization in Hungary under the Europe agreement and since full EU membership, namely from 1992 to 2008, can best be measured using an index as a tool for calculations which is applied to the actual data.
Previous empirical studies apply various specialization indices. These have been reviewed in an effort to single out the most suitable index for this study.

In an analysis of country specialization in 10 countries of the EU-15, Amiti (1999) applied a Gini index to Eurostat production and employment data of 65 manufacturing industries for the years 1968, 1970, 1980, 1982, 1988 and 1990. Specialization at the country level was found to have fallen in some countries between 1968 and 1990, but all countries in the sample recorded an increase between 1980 and 1990. Increasing specialization was observed in both “richer core” EU countries as well as in “poorer” Southern EU countries.

A potential problem with using the Gini coefficient as a measure of specialization is that it places relatively strong values on changes in the middle parts of the distribution, i.e. industries that are closest to the sample average will get the most weight in the Gini coefficient for the country - or in my case - the region. Thus, this index was not judged as best measure for my purpose.

In a study on intra-industry specialization and trade in the European Economic Space, Greenaway & Hine (1991) used the so-called Finger-Kreinin (F-K) index to measure country specialization in 28 manufacturing industries with production and export data. They found evidence of increasing specialization in the early 1980s. The F-K index is a relative measure of specialization which compares one country’s distribution of production shares to another. However, this measure of specialization is unsatisfactory when the mean of the sample and the country specialization move in different directions, as it overestimates the result when this is due to large variations in small countries’ production shares. For these reasons, this index has also been ruled out for the purpose of my study.

In an analysis of the effects of the European Single market programme, Sapir (1996) used the Herfindahl index to measure country specialization based on export data of 100 manufacturing industries. He concluded that specialization remained constant in Germany, Italy and the UK over the period 1977 to 1992, and increased in France since 1986. The inference made in that study from export data to production could be put in question, as in practice exports may change due to domestic consumption and without any changes in production.

The Herfindahl index in the form of an absolute specialization measure was used by Majoli (2003) to analyse regional specialization in Hungary in the period 1992 to 1999. That index ranged between zero and one, where one indicates complete specialization. Calculating country-wide averages, he found that the Herfindahl
remained virtually constant at 0.17 during the 1990s which was evaluated as being “relatively low”. He further found that the three most specialised regions were regions in the Western part of the country in 1999, the end-year of that study. As the Herfindahl index tends to overestimate the shares of the largest countries (or regions), however, it is not chosen as the best index for the purpose of my study.

In a paper by Aiginger & Davies (2004) the aim of which was mainly methodological, the authors used an adjusted entropy index as a measure of country specialization. They based their methodological analysis on nominal value added data for 14 EU countries for 99 3-digit industries and the years 1985 to 1998. In their results, they only showed average specialization for the group of 14 countries. They found that average specialization increased, which they interpreted in that specialization had increased in most countries. Overall, even taking their methodological considerations into account, this measure does not appear suitable for my analysis.

In a book edited by Traistaru et al. (2003), a group of authors apply a so-called dissimilarity index based on Krugman to a (private) data base for country studies of Bulgaria, Estonia, Hungary, Romania and Slovenia. That dissimilarity index was calculated for regions of those countries based on manufacturing employment and total employment data from 1990 until 1999 only. Taking the average specialization for each country, that study found that average specialization levels in Bulgaria, Estonia and Hungary were in a lower group, and that they were rising in Hungary up to 1997/98, while average regional specialization in Romania was at a higher level, and that of Slovenia, shown for only four years, was comparatively highest.

Mafioli (2003) calculated relative specialization of regions using a Balassa-type index based on the same data set as Traistaru et al. (2003) for the period 1992 to 1999. By means of that relative specialization measure, he found out that the regional specialization pattern for the manufacture of mineral products differed significantly from the national pattern in Hungary during the 1990s.

Given this overview and the advantages and disadvantages of each index, the Krugman specialization index has been chosen for this study as the most suitable index for measuring regional specialization in Hungary. The details will be explained in the next section.
5.2 The Krugman specialization index

The Krugman specialization index is a relative measure of regional specialization and was introduced in international economics by Krugman (1991a), comparing the industrial structure of the USA and Europe. In its original set-up, the index summed up the absolute difference of the industrial structures of the two respective regions. The index is zero if the two regions have the same industrial structures. Its maximum value is 2 which is reached if the two regions do not have any common industries at all.

The Krugman specialization index has also been selected here for the purpose of consistency with Chapter 4 which worked with the Krugman concentration index, and Chapter 6 will use both the specialization and concentration indices for econometric analysis. Moreover, the Krugman specialization index is a tool in line with the predictions made by the theories of Krugman regarding the development of regional specialization in the course of integration (Krugman & Venables 1996; Venables 1996). Finally, the Krugman specialization index provides a conservative estimate of actual developments - the equivalent has been shown for the Krugman concentration index in the comparison of indices in section 4.9. Thus, the results obtained here for regional specialization in Hungary will be a good basis for the validity of this research.

5.2.1 Formula of the Krugman specialization index

The formula of the Krugman specialization index used here is the following:

\[ \text{SPEC}_j = \sum_{i=1}^{N} |s_{ij} - x_i| \]

where the index \( i \) refers to the industry sector (8 manufacturing sectors), \( j \) to regions (20 Nuts-3 regions). The term in the absolute value brackets is the difference of the share of industry \( i \)'s employment in region \( j \) in total manufacturing employment of region \( j \) minus the share of industry \( i \)'s employment in Hungarian manufacturing employment; the specialization of region \( j \) takes the sum of this term over all 8 industries \( i \).135

135 The notation of this formula according to Traistaru et al. (2002a), but is applied here to 20 Hungarian regions and to manufacturing employment only. Those authors applied the index to a (private) database for 5 Central and East European countries with output and total employment data for the years 1990-1999 (even though the initial years 1990, 1991 and to some extent 1992 can be regarded as distorted by the end of communist regimes data collection).
This index shall be calculated based on regional employment data for manufacturing employment by subsectors, i.e. for the 8 manufacturing industries and each of the 20 regions (data as provided by HCSO). These data have also been the basis of the previous calculations of concentration developments presented in Chapter 4. The index takes the value 0 if a region j has an industrial structure identical to the rest of Hungary, and takes a maximum value of 2 if it has no industries in common with the rest of Hungary.

### 5.3 Results for regional specialization in Hungary

The results of the calculations of the Krugman specialization index for the 20 Nuts-3 regions in Hungary based on detailed employment figures of the 8 manufacturing industry sectors are complex. To facilitate the analysis, various aspects and results have been selected and will be discussed with the help of figures and graphical illustrations.

#### 5.3.1 Regional specialization

In this first section, the results of the calculations of the Krugman specialization index shall be presented for the period 1992 to 2008. As 20 lines for all 20 regions would have led to a confusing graph, 7 typical regions have been selected for the purpose of presentation.

*Figure 39* shows the development of regional specialization for 7 typical regions. At a first glance, a double hub can be seen: the first hub in the lines is around the year 1998 or 1999, while a second hub is visible in the latter years since EU accession. All of these regions show a rise in specialization up to a peak in 1999: For some regions, this started from 1993 onwards, for others like Tolna and Csongrád one or two years later. After the 1999 peak, specialization declined, for some regions with an intermediate point around the years 2000 and 2001 until a down-point in the year 2004 (2005 for Zala region) which is lower than the start level.

Interestingly, regional specialization started to rise again since 2004 or 2005, coinciding with the EU accession of Hungary on 1\(^{st}\) of May 2004. The second peak formed around the years 2006 and 2007. Since then, for Baranya and Zala regions a diversification set in again, depicted in falling specialization lines in Figure 39. The regions with the highest specialization in this set are Fejér and Tolna, while Csongrád region is about in a middle position with respect to specialization levels.
Figure 39: Regional specialization in Hungary from 1992 to 2008, Krugman specialization index based on employment data, selected regions

Source: Own calculations; own graphical illustration.
Source of data: HCSO, Regional Statistical Yearbook of Hungary, subsequent years, Budapest.

Figure 40 shows a trend diagram for the 20 Hungarian Nuts-3 regions based on the values of the Krugman specialization index for the years 1992, 1995, 1999, 2005 and 2008. The value for the year 1992 was set equal to 100 to make developments comparable. The thin line pointing to the top of the bars for most regions shows the value for the peak year 1999. The bar shows the trend in specialization over the period.

The majority of regions - 12 out of 20 - experienced an overall decline in regional specialization levels over the period up to 2008. That decline ranged from a value of 32 the start level (set = 100) for Baranya, 64 for Pest and between 71 and 77 for 6 other regions. Eight regions show an overall increase in specialization levels compared to 1992. Szabolcs-Szatmar-Bereg, the Eastern-most region bordering Ukraine, increased to 145. The specialization level of Csongrád region increased to 154 and of Hajdú-Bihar even to 205 of the start level. Both of these regions are located in the Great Plain area at the border with Romania. Hajdú-Bihar is one of the least developed regions of Hungary. These border regions have suffered from a loss of jobs in particular in the logistics, textile and shoemaking industry. Many firms of these industries delocated to Romania in the early years of the current
decade due to the minimum wage level in Romania which is only half that of the minimum wage in Hungary.\textsuperscript{136}

**Figure 40: Trend in regional specialization of the 20 regions, Krugman specialization index based on employment data, 1992=100, for selected years**

The thin line shows the 1999-peak levels in specialization compared to the start year. The majority of regions show an increase in specialization levels to around 125\% of their start level. Exceptions with much higher increases were Zala Hajdú-Bihar, and Tolna regions.

### 5.3.2 Analysis of the turning point in regional specialization

In this section, the development of regional specialization with respect to the year of the highest specialization as measured by the Krugman specialization index, the year 1999, shall be analysed. This peak year was the turning point for most regions during the observation period of this study; i.e. up to 1999, regional

\textsuperscript{136} This information was obtained by interview from Hungarian experts during the 4-day BRIT 6 border regions conference which took place in Hungarian border regions in October 2003, in which the author Cordula Wandel participated.
specialization levels rose and fell thereafter up to 2004, the date of Hungary’s accession to the EU.

These results clearly indicate that the provisions of the Europe agreement had a profound effect on regional structures in Hungary. This pre-accession policy, intended by the EU mainly as a trade policy measure, induced a profound restructuring of manufacturing industries which changed the location of agglomerations over the country and had deep effects on regional income and employment as well as on the development of regional disparities. The turning point around 1999 coincided with the largest inflow of FDI to Hungary in the year 2000.

**Figure 41:** Percentage change in regional specialization, 1999/1992; Krugman specialization index based on employment data

![Graph showing percentage change in regional specialization](image)

Source: Own calculations; own graphical illustration.
Source of data: HCSO, Regional Statistical Yearbook of Hungary, subsequent years, Budapest.

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137 The Europe agreement was also seen to some extent as a political insurance to Hungary of the EU’s willingness to consider full membership as the ultimate goal.
Figure 41 shows the relative increases in specialization for the 20 regions in the year 1999 as compared to the start year 1992. The values for the year 1992 were set equal to 100 as to make relative increases in 1999 comparable. Overall, the relative increases in regional specialization in 1999 over 1992 were much stronger than the relative decreases. Increases outweighed decreases not only by the number of regions, 12 of them, but also by magnitude, and this by far. Thus, there was an overall trend of a strong increase in regional specialization of the 20 Hungarian Nuts-3 regions in the year 1999 as compared to the start of the period. This is broadly in line with the predictions made for increasing economic integration by Puga (1999), Venables (1996) and Krugman & Venables (1996), namely that regional specialization would first increase to a certain point, then decrease as trade costs fall even further.

The strongest increase in specialization - to a value of 150 of the start level - took place in Zala, a Western region at the border of Slovenia (54.1 km) and Croatia (42.0 km). Further strong relative increases took place in Hajdú-Bihar, to a value of 122, in Tolna, a Western internal region, and in Csongrád, a region with borders to Serbia (60.5 km) and Romania (40.5 km). 8 regions had modest increases in specialization levels. Some regions also showed decreases in specialization in 1999, i.e. against the general trend. These were Baranya, a region bordering with Croatia, by -32%, and Nógrád, a Northern region, by -19%. 6 regions had very slight decreases in specialization relative to the start year.

For Budapest, there was a slight decrease in specialization, by 13.2%. As this capital region has a strong agglomeration of all 8 manufacturing sectors (see analysis of CR3 in section 4.4.2 and 4.4.3 of Chapter 4), relative increases or decreases in specialization can occur without there being a major change in the industrial set-up. Total manufacturing employment in Budapest was 168,500 in the year 1999, the highest of all regions or a share of 22.6% of the total for Hungary. The capital also had the most inhabitants of all 20 Nuts-3 regions, about 1.8 million of the 10.0 million in Hungary. In the next section, the results shall be analysed by groups of regions.

5.4 Analysis of the results by groups of regions

Regarding the development of regional specialization, it would in particular be interesting to see whether there may have been a difference in the development of specialization regarding internal regions located near the capital Budapest, on the

138 Values for the length of borders were provided by the Hungarian expert for Schengen implementation in Hungary, Prof. Dr. habil Janos Sallai, Colonel, Budapest. His information is gratefully acknowledged.
one hand, and border regions, on the other hand. Further, it would be interesting to look at regions located near the gravitation centre of Hungarian external trade, i.e. in the Western part near the EU market, versus those regions located further away in the Eastern part of the country. Finally, it shall be analysed whether the neighbouring country group made a difference with respect to regional specialization. Here in particular, a distinction shall be made regarding regions bordering the EU (BEU), regions bordering other CEECs (BCE), and regions bordering external countries (BEX). 139

5.4.1 Specialization of Western regions versus Eastern regions

In his article on the development of Hungarian regions in the 1990s, László Faragó (1999) 140 described territorial development axes in Hungary. During the communist era, the axis went from the North-East - with heavy industry and mining - to the South-West, crossing through the capital area. Since the 1990s, the new development axis in Hungary is a North-South axis crossing through Budapest which divides the country in a growing Western half and a declining Eastern part. This axis starts in the North-Centre, passing along Pest and Budapest regions, Bács-Kiskun and in the South along Csongrád region’s border. According to this line, 13 regions are in the Western part and 7 of the 20 Nuts-3 planning-statistical regions are in the Eastern part of Hungary.

In the analysis of Figure 42, this regional division has been applied to my data set. The expected outcome would be lower specialization levels for Western regions than for Eastern regions. The reasons for this are a thinner industrial base and less population in the Eastern part than in the West, which has more manufacturing jobs in absolute terms, a broader industrial structure and more agglomeration centres than in the Eastern part.

**Figure 42** shows the actual values of the Krugman specialization index calculated with manufacturing employment data for the period 1993 to 2008. 141 Unlike what

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139 For the purpose of classification of regions in this Chapter 5, the largest time span of the reference period has been taken as basis and the classification held constant even beyond EU accession, i.e. for BEU the EU-15 and for BCE the accession candidate countries. This makes also some economic sense, as existing business ties between companies of neighbouring countries probably continued for some time beyond EU membership.


141 The values for each group of regions have been calculated as simple averages of the regions in that category. Calculations per group with the values weighted by each region’s population have also been tried. As those results were only marginally different from the
was expected, the two groups - Western and Eastern regions - are rather similar with respect to their levels of specialization. The average specialization of Western regions was only slightly lower than that of Eastern regions. As a reminder, the formula of the specialization index does not take account of the quantity of industry located in a certain area, but rather of the shares of each sector contributing to overall manufacturing employment there. This result can be interpreted in the way that despite the thinner industrial base in the Eastern part of the country, there seems to be a certain mix of sectors as in the West of Hungary.

**Figure 42: Regional specialization levels for Western and Eastern regions, Krugman specialization index based on employment data, 1993 to 2008**

As to the pattern of specialization during proceeding integration, the lines exhibit a double hub structure. Both Western and Eastern regions show first an increase in specialization levels up to a point, in 1999, then a decrease until 2004 or 2005, to levels below the start level. For the latter years of the period, i.e. since the EU accession of Hungary, a second rise in specialization has been observed, although ones presented here, however, it has been decided to stick with the simple average for clarity.
the peak level is lower than in 1999. For the Western regions, specialization started to decline again from 2007 onwards, while specialization for Eastern regions was still on the rise in 2008. This is broadly in line with the predictions made for increasing economic integration by Puga (1999), Venables (1996) and Krugman & Venables (1996), namely that regional specialization would first increase to a certain point, then decrease as trade costs fall even further.

5.4.2 Analysis of internal regions versus border regions

In this section, it shall be analysed whether there was a difference in the development regarding regional specialization for internal regions versus border regions. 7 of the 20 Hungarian regions are located in the middle of Hungary, thus are internal regions, bordering with other Hungarian regions only. One of the 7 internal regions is the metropolitan region of Budapest, which has been taken out of the group and called “INT w/out Budapest” to abstract from the capital region effects. 13 regions are border regions (the latter group and subgroups shall

Figure 43: Regional specialization for internal regions versus border regions, Krugman specialization index for the years 1992 to 2008

Source: Own calculations; own graphical illustration.
Source of data: HCSO, Regional Statistical Yearbook of Hungary, subsequent years, Budapest.

Pest region has also been counted into this group, as its overwhelming nature is characterised by its borders with other Hungarian regions, and it only has a very short border with Slovakia; see also map in Chapter 3.
be analysed more in detail in section 5.4.3). The expected outcome would be to find the lowest specialization levels for internal regions including Budapest, as the economic weight of the capital - one fifth of the country’s population and the largest regional shares for the 8 manufacturing sectors in country-wide employment \(^{143}\) - would allow for a good diversification of industry structure.

**Figure 43** shows the development of regional specialization of Hungarian border regions and internal regions according to the Krugman specialization index based on regional sectoral employment data for the years 1992 to 2008. \(^{144}\) Unlike what was expected, border regions show lower specialization levels than internal regions including Budapest. The specialization for internal regions without Budapest is the highest of these groups. This points to a thinner industrial structure in the other internal regions and indicates that they cannot benefit from the capital effect, despite the relatively small size of the country.

Interestingly, here again the pattern of a double hub structure is visible over time, depicted by all three groups of regions: a first hub around the year 1999, and a second smaller hub since 2004 until 2007 when it started falling again up to 2008. The end level was about the same as in 1992, but higher compared to the lowest point in 2004 just before EU membership. This is broadly in line with the predictions made for increasing economic integration by Puga (1999), Venables (1996) and Krugman & Venables (1996), namely that regional specialization would first increase to a certain point, then decrease as trade costs fall even further.

### 5.4.3 Differentiation among different groups of border regions

In this section, a differentiation shall be made among border regions in order to analyse whether there may have been an influence on regional specialization by the nature of the neighbouring country. For the purpose of this analysis, a distinction shall be made in 3 groups:

- regions bordering with the EU (BEU): 2 regions, bordering with Austria \(^{145}\);
- regions bordering with other CEECs, which became member of the EU either in 2004 or 2007 (BCE): 6 regions, bordering with Slovenia, Romania, or Slovakia; and

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143 These data were taken from Chapter 4, section 4.4.3., on the regional structure of the CR3 measure.
144 The values have been calculated by taking the average of the regional specialization of regions contained in each group. Here again, as calculations also made with weights by population resulted only in marginal differences from these values, average data are used here for consistency.
145 Please, see the first footnote of section 5.4 regarding Eastern enlargement of the EU.
regions bordering with external countries, i.e. which did not become member of the EU yet, but might become member at some time in the future (BEX): 5 regions, bordering with Ukraine, Croatia, and Serbia & Montenegro.

In the case where a region had a border with two countries, the length of the longer border measured in kilometers was decisive for the category into which it was put. This was the case for 4 regions: Csongrád (BEX), Szabolcs-Szatmar-Bereg (BEX), Zala (BCE), and Győr-Moson-Sopron (BEU).

**Figure 44: Regional specialization for EU border regions (BEU), for border external countries (BEX) and for border CEECs (BCE), years 1992 to 2008**

Source: Own calculations; own graphical illustration.  
Source of data: HCSO, Regional Statistical Yearbook of Hungary, subsequent years, Budapest.

**Figure 44** depicts graphically the results for the three groups of border regions BEU, BCE and BEX regarding regional specialization for the years 1992 to 2008. The values for each group of border regions have been calculated by taking the average of the Krugman specialization index of the regions in each group. As

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146 The length of borders for those regions with two neighboring countries was provided by a Hungarian expert for Schengen border implementation, Prof. Dr. habil János Sallai, Colonel, Budapest.

147 Serbia 60.5 km, Romania 40.5 km

148 Romania 93.5 km, Ukraine 136.7 km

149 Slovenia 54.1 km, Croatia 42.0 km

150 Austria 156.6 km, Slovakia 81.7 km
calculations weighted by population resulted only in marginal differences from these values, average data are used here for continuity.

The graph in Figure 44 shows that the specialization is lowest for the border regions of the EU (BEU), i.e. these have the most diversified industrial structure. For BEU, specialization first rose slightly to a peak in 1995, then fell until 2005, when it was 36% lower than at the start. A slight rise followed after the EU accession of Hungary, yet specialization decreased even further up to 2008.

For the second group of regions, the regions bordering external countries (BEX), specialization developed almost in parallel to that of BEU, only that the decline until 2004 was more modest than for BEU. Again, there is a second hub in specialization in the post-accession period. Specialization levels for the BEX regions were generally higher than for BEU.

Finally, regional specialization for the last group of border regions, BCE, was highest of all three for most years. There was a clear rise to a peak in 1999, followed by a decline until about 2003. The peak was about 17% higher than the year 1992. Since 2005, a second rise in specialization is shown clearly, yet again to lesser levels than 1999, with a decline towards the end of the period. The peak for the BCE-group in 1999 could be attributed to the following: As Romania is the main neighbouring country in question, and due to the rise in minimum wages in Hungary at the turning of the century, many jobs migrated from the Hungarian border regions to Romanian border regions due to the delocation of firms in certain industries such as transport and logistics, textiles and shoe-making.151

5.5 Analysis of the results in light of NEG theories

In this section, the results obtained for regional specialization by calculating Krugman specialization indices based on sectoral regional employment data shall be evaluated in the light of the predictions made by NEG theories. The authors of NEG models which include statements on regional specialization also make predictions about the development of regional specialization changes in the course of economic integration, and these shall be recalled here.

The NEG model by Livas-Elizondo & Krugman (1996) for regional economic integration in the context of international trade formulated that (irreversible) agglomeration would form within the country consisting of more than one region.

151 This information was obtained by interviews with Hungarian experts during the BRIT 6 border regions conference which took place in Hungarian border regions in October 2003, in which the author Cordula Wandel participated.
Trade liberalisation would tend to break up geographical concentration within the economy, thus enabling agglomeration in either region, or the decentralized equilibrium. This implies that with falling trade costs, regional specialization will first rise, then fall again as geographical concentration of industry is breaking up.

The model by *Puga (1999)*\(^\text{152}\) predicts a low degree of industry agglomeration for the start of integration processes and initially high trade costs, i.e. the dispersion of industry in space, coupled with low levels of regional specialization; with medium trade costs exercising stronger clustering forces, industry agglomeration increases up to a peak; centre-periphery structures prevail, and regional specialization increases to the highest point; in a further stage of integration with low trade costs, some firms relocate to regions with lower wages, dispersion takes place; regional specialization is decreasing.

*Venables (1996)* makes similar predictions about regional specialization in the course of integration. In this model, where labour is assumed immobile and manufacturing firms are in an upstream-downstream relationship, agglomeration forms in the course of economic integration in one region; this region then becomes specialised in manufacturing. The agglomeration coupled with high regional specialization is, however, not sustainable at low levels of trade costs, when the development is reversed again, associated with a decline in regional specialization.

In the model by *Krugman & Venables (1996)*, manufacturing firms are no longer in an upstream-downstream relationship, but their products can either be used as input or for final consumption, and each industry uses inputs from the other sector as well. Labour is assumed internationally immobile, but can move between different sectors. In this set-up, agglomeration will become necessary for trade costs at very low levels, such that each region (country) will lose its presence in one of the industries; thus specialization is increasing to high levels. This outcome is subject to the condition that input-output links and the consequent cost and demand linkages are stronger within each of the industries than between them. If this condition is relaxed, then the outcome is that each location will always have some of each industry, as firms then derive more benefit from proximity to firms in the other industry than their own. Thus each region will be less than completely specialised.

The results of the calculations of regional specialization by means of the Krugman specialization index broadly confirm the predictions made by these NEG models.

\(^{152}\) To recall from Chapter 2, this model without labour migration across regions takes each region's labour endowment as fixed; the requirement that in equilibrium real wages must be equalised across regions is dropped.
(Livas-Elizondo & Krugman (1996), Puga (1999), Venables (1996), Krugman & Venables 1996). For the majority of regions, regional specialization followed the pattern of a double hub structure: first an increase from 1992 to 1999, then a decrease up to 2004, to levels below the start (see Figure 39). A second slighter rise in specialization levels followed the EU accession, with a decline already setting in towards the end of the period. The same development was illustrated by Western regions versus Eastern regions, as depicted in Figure 42. These two groups show a rise in specialization levels to a peak in 1999, followed by a decline, and a second hub from 2004 until 2008.

Further, the specialization pattern in border regions versus internal regions - a double-hub pattern again, as illustrated in Figure 43 - confirmed the theoretical predictions. Finally, the analysis differentiating among groups of border regions according to their neighbouring countries - as in Figure 44 - can be taken as a confirmation of the theoretical models. All of the three groups of border regions, BEU, BEX and BCE, exhibit the double hub structure: a peak in specialization around the year 1999, followed by a decline, and a second hub since the EU accession of Hungary. In my view this is clear proof of the fact that the pre-accession trade policy of the EU, incorporated in the provisions of the Europe agreement, had profound effects on the regional structure regarding specialization and manufacturing agglomerations in Hungary.

5.6 The results on regional specialization in light of previous studies

Country specialization in the EU-15 was analysed by Midelfart-Knarvik et al. (2000) for various industries. The authors found an increase in country specialization either upon EU accession or with a lag of about 6 to 7 years. This research, however, looks at regional specialization - not country specialization - during European integration. Thus, the results cannot be seen in relation to each other.

Few empirical studies exist on regional specialization either in the EU (generally the EU-15) or - even less - in the CEECs. Hallet (2000) analysed regional specialization in the EU-15 over the period 1980 to 1995 based on gross-value-added data of 17 branches for 119 regions using a relative specialization index which takes the respective EU-15 average as a benchmark and divides the resulting sum by one half. He found a moderate decline in specialization for all regions taken together from 1980 to 1995. Specialization levels in the Southern peripheral regions were somewhat higher than in the EU core regions of the so-called “blue banana” in 1995, a fact which he attributed to their smaller economic base.
The paper by Hildebrandt & Wörz (2004) - while being entitled “industrial specialization and concentration in CEECs” - only deals with concentration and developments of individual industries, taking per-country concentration data as basis (see discussion in Chapter 4, section 4.7.4). Specialization is referred to by the authors as “the other side of the coin”, without performing any explicit analysis of it though.

In a study by Traistaru et al. (2003), a group of authors applied a so-called dissimilarity index based on Krugman to a (private) data base used for country studies of Bulgaria, Estonia, Hungary, Romania and Slovenia. The dissimilarity index is calculated there with reference to total employment as a benchmark. In the Hungary chapter by Mafioli (2003), the period examined was 1992-1999, i.e. it ended in 1999, the year which was found to have the highest specialization in my analysis. This means that the more interesting decline in regional specialization in the course of European integration, or the double hub including the rise after EU accession, are not captured by that study. A comparison of their results for selected regions showed for the overlapping period that values obtained by their dissimilarity index - based on total employment figures - tended to be somewhat higher than those of the Krugman specialization index calculated with manufacturing employment data only, and this, however, by varying distances. Neither did their figures exhibit a clear trend or a specialization peak in the course of integration. Thus, it was apparently a wise choice to concentrate on manufacturing employment rather than on overall employment in my study.

5.7 Conclusions regarding regional specialization

The present chapter has analysed the development of regional specialization of the 20 Nuts-3 planning-statistical regions of Hungary in the period 1992 to 2008. Regional specialization was calculated in this chapter using the Krugman specialization index based on regional manufacturing employment data for the 8 industries as provided by the HCSO.

The hypothesis of this research with respect to regional specialization in Hungary was that there was first an increase of specialization up to a peak or turning point, followed by a decline; and that such a turning point was reached prior to full EU-membership of Hungary. This hypothesis was confirmed by the results of the calculations presented in this chapter, the turning point having been around the year 1999. The results added to that, however, in that there was a second wave of rising regional specialization following the EU-accession of Hungary, and that the second turning point for specialization levels was in 2007 to start falling again.
Furthermore, the hypotheses of this research stated that the Europe agreement - consisting mainly of trade provisions - had an impact on industry agglomerations and regional development in Hungary. The empirical results on regional specialization in this chapter are clear proof in my view that the pre-accession trade policy of the EU, incorporated in the provisions of the Europe agreement, had indeed profound effects on the regional structure regarding specialization and manufacturing agglomeration in Hungary.

Furthermore, this chapter made a differentiation between various groups of regions with respect to their specialization levels.\textsuperscript{153} As a first group, a distinction between Western regions and Eastern regions according to the development shed described by Faragó (1999) revealed that specialization levels for Western regions were only slightly lower than for Eastern regions, despite the broader economic base and more numerous manufacturing agglomerations in the West (see section 5.4.1). Both Western and Eastern regions exhibited a double hub pattern in specialization levels, a peak in 1999, followed by a decline, and a second (smaller) rise in the post-accession period.

The next distinction showed that specialization levels for internal regions were generally higher than those of border regions, and for internal regions disregarding the capital region Budapest were highest of this group (see section 5.4.2). The rise in specialization for these groups up to the 1999 turning point took place almost in parallel, as did the decline up to 2004, followed by a second rise in specialization since the EU-accession of Hungary up to 2007 when the trend was reversed again.

Finally, a differentiation between groups of border regions according to their bordering neighbours (see section 5.4.3) showed that regional specialization for regions with a border to the EU-15 was the lowest, that of regions bordering external countries (BEX) was intermediate, and that of regions bordering EU accession states\textsuperscript{154} (BCE) was highest of these three, yet it showed the steepest rise in specialization to a peak and turning point in 1999. This was attributed to delocation developments in certain sectors such as transport and logistics, textiles and shoe-making to border regions in Romania following the rise in the minimum wage level in Hungary at the turn of the century. All three groups of border regions showed a second, yet slighter rise in specialization since 2004 until 2007 when a new decline set in.

\textsuperscript{153} Specialization for each group of regions was calculated taking simple averages for clarity, as a weighting by population – which had also been tried - would result only in marginal differences.

\textsuperscript{154} Most CEECs became EU member jointly with Hungary in 2004, while Romania (together with Bulgaria) acceded to the EU in 2007.
The comparison of the results with NEG theories revealed that the calculations obtained were a broad confirmation of the predictions made. Especially the models by Puga (1999), Venables (1996) and Krugman & Venables (1996) predicted a rise of regional specialization levels, as agglomeration formed or increased in the course of economic integration; then a peak or turning point for regional specialization ensued; finally, with proceeding integration a dispersion set in coupled with a dissolution of centre-periphery structures resulting in lower regional specialization levels. This pattern was observed twice in Hungary during the 1992 to 2008 period, not only for the 20 Nuts-3 regions as a whole, but also for the groups of regions just described in the preceding paragraphs of this section.

A review of other empirical studies on regional specialization showed that the results obtained by my calculations for Hungary’s Nuts-3 regions in the 1992 to 2008 period are most accurate and have not been obtained nor published in any similar way before.

In chapter 6, the development of manufacturing industry concentration in Hungary during European integration as well as the specialization of Hungary’s 20 Nuts-3 regions shall be analysed by means of econometric analysis.