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Regional specialisation and sectoral concentration: an empirical analysis for the enlarged EU

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Regional specialisation and sectoral concentration: an empirical analysis for the enlarged EU*

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Abstract

Already in the current fifteen Member States of the European Union, differences in national and regional economic specialisation exist. Statistically, the diversity in the EU will increase with the enlargement May 2004. While this is only a statistical artefact, more important is how far enlargement will change regional concentration of sectors and specialisation of regions, both in Central and Eastern Europe as well as in current Member States. This academically interesting question also has political implications, especially for national and European regional policy.
Economic theories are far from being able to explain or even to predict the changing specialisation and concentration patterns. Different models from (new) trade, (new) growth and (new) economic geography come to contradicting conclusions depending on their assumptions, a possible change of parameters in time, mobility patterns, transaction costs and to what extent variables are endogenous. Consequently, empirical work should shed some more light on the European economic landscape.
After an overview of other empirical studies we will present our data base. This allows us i) to investigate nearly the entire area of the enlarged EU at NUTS2 level, ii) with the sectoral breakdown according to the European System of National Accounts (ESA95), reflecting the increased importance of the service sector. Based on these new data we present first results for various indicators on the differences in regional specialisation and sectoral concentration.

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* The opinions expressed in this paper are exclusively that of the authors and do not necessarily reflect those of the *European Commission, DG Economic and Financial Affairs*, by which one of the authors is employed.

Regional specialisation and sectoral concentration: an empirical analysis for the enlarged EU

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1 Introduction

Already in the current fifteen Member States of the European Union, differences in national and regional economic specialisation exist. Statistically, the diversity in the EU will increase with the enlargement May 2004. While this is only a statistical artefact, more interesting is what effect enlargement will have on regional concentration of sectors as well as on specialisation of regions, both in Central and Eastern Europe as well as in current Member States. This academically fascinating question can also have political implications, especially for national and European regional policy.

Economic theories are far from being able to explain or even predict the changing specialisation and concentration patterns. Different models from (new) trade, (new) growth and (new) economic geography come to distinct conclusions, depending on their assumptions, a possible change of parameters in time, mobility patterns, transaction costs and the extent to which variables are endogenous. Consequently, empirical work should shed some more light on the European economic landscape. Therefore, in chapter 2 we provide an overview of the main results of empirical studies.

Recently, new sectoral and regional data became available in Eurostat´s REGIO database for most current EU Member States and now also for candidate countries at NUTS2 level (chapter 3). They are based on the new European System of National Accounts (ESA95), which provides researchers with more details on services whose tradability and shares in GVA have increased.

Based on these new data, chapter 4 presents first results for various indicators on the differences in regional specialisation and sectoral concentration in the current as well as in the new Member States. Section 5 concludes.

2 Literature review

Against the background of increasing integration and globalisation various empirical analyses have emerged in recent years. They try to test theoretical insights and to find

factors responsible for the current specialisation and location patterns in the U.S. and Europe as well as to predict the future evolution of the economic landscape. Studies of the EU show the following features[2]:

Regional aggregation

- A majority of studies analyse national data, i.e. at Member State level.
- Regional studies concentrate on administrative units, based on different NUTS-levels.

Unit for the activity level

- Above all employment data are used.
- Some studies apply production values as gross value added (GVA), gross value of output or investment data (gross fixed capital formation).
- Also trade flows (exports / imports) in order to capture trade specialisation are analysed.

Sectoral aggregation

- Mot of the studies concentrate on the manufacturing sector at different aggregation levels or industry differentiated by the kind of scale economies.

One stylized fact seems to be the very slow change in specialisation and concentration patterns (*Midelfart-Knarvik et al.* 2000, *Hallet* 2000). Most of studies analysing manufacturing calculating different specialisation indicators using production variables or employment find slight increases in country specialisation in the last decades (*Aiginger* / *Davies* (2000), *Amiti* (1997), *Midelfart-Knarvik et al.* (2000), *WIFO* (1999)). However, the years in which this increase could be observed varies between the different studies and, in addition, it depends on the individual country. In contrast export specialisation seems to have decreased (*WIFO* (1999) and *Sapir* (1996)).

In relation to our study, investigations at the regional level are more interesting. Here, overall regional specialisation tends to decrease during recent decades (*OECD* (1999), *Hallet* (2000), *Molle* (1996)). This result seems to be fairly stable although the authors calculate different indicators with employment or production data, include diverse sector mixes. Concerning the development of industries with increasing returns to scale, which play a major role in the models of new economic geography and also in the income perspectives of regions, *Krieger-Boden* (2002) finds support for a movement of

these industries from the core to the periphery in regions of France and Spain leading to a convergence in regional industry shares.

Concentration patterns vary considerably across sectors and aggregation level as predicted by theory. In this context we would like to mention two research papers which focus on the regional level: The agricultural sector is, according to the studies of *Hallet* (2000) and *Brülhart / Träger* (2003), less concentrated than overall production while the manufacturing sector and the service sector tend to be highly concentrated for traded goods (credit and insurance services, other market services). However, interpreting their declining entropy index of "topographic" concentration of manufacturing *Brülhart / Träger* (2003) conclude that production relocates from regions with high employment density to regions with low employment density.

Our study aims at reducing the white areas on the European specialisation and concentration map by analysing developments in the candidate countries. So far *Landesmann* (2003) concentrates on the analysis of national trade structure in manufacturing at 3-digit NACE level and shows that at the beginning of the 1990s these countries mainly specialised according to the prediction of inter-industry trade. Until 2000 the manufacturing structure for some countries changed dramatically in the direction of technology-intensive branches and high-skill-intensive industries, particularly in Hungary, the Czech and Slovak Republics, Estonia and Poland. Bulgaria, Romania and Lithuania are specialised in labour-intensive production structures. *Traistaru et al.* (2002) choose a different approach by analysing specialisation and concentration patterns of manufacturing (2 digit classification) with employment data and other regional variables (GDP, average earnings, infrastructure, R&D, public expenditure) for Bulgaria, Rumania, Estonia, Hungary and Slovenia at NUTS3 level between 1990 and 1999. They describe a rather mixed picture: while they find increasing overall regional specialisation for Bulgaria and Rumania, in Estonia specialisation decreased and no significant changes occurred in Hungary and Slovenia. Concentration of the manufacturing sector did not reveal any significant change although the same industries showed similar evolution paths.

The differences between these studies show very clearly how results on specialisation and concentration are influenced by the regional and sectoral (dis-)aggregation level and the economic variables applied. Consequently, neither theory nor empirical studies give a clear picture of the economic landscape within the enlarged EU, i. e. including (most) candidate countries. In addition, as far as the authors know, at present no

study provides an overall picture of recent developments in the context of EU enlargement. With the following we want to go into this direction.

3 Data

The calculations of our different indicators are mostly based on a data set provided by the regional data base (REGIO) of Eurostat. For the gross domestic product (GDP), the GDP per capita and the gross value added (GVA) of the different regions and sectors we used a new data set compiled according to the European System of National Accounts ESA 95. As this set starts in 1995 only, our investigation is limited to the years 1995 to 2000.

As the data for fishing (B) is for most regions not separately available, we took the aggregate figure for agriculture and fishing (A+B). Consequently, we have 2 sub-sectors (A+B and mining and quarrying (C)) for the primary sector. The breakdown into branches of the secondary sector is rather limited in ESA95 as only 3 sub-sectors are available (i. e. manufacturing (D), electricity, gas, water supply (E), and construction (F)). On the other hand, however, ESA95 reflects the increased importance and tradability of services. The breakdown of the tertiary sector into 10 branches, (i. e. G to P) including retail services, tourism, financial intermediation and real estate as well as public services, is now more detailed than it was before when the data were based on ESA79.[3] The authors are conscious about the limitation of this sectoral breakdown since for example manufacturing is not disaggregated. However, this data set allows for a more comprehensive overview of the overall economic activity of regions instead of focussing on manufacturing, representing just 20% of production in the enlarged EU.

For the time span 1995 to 2000 data on most 15 NACE branches are available at NUTS2 level for 14 of the current Member States as well as for 11 candidate countries. We had to exclude only the United Kingdom and Malta due to missing data. Turkey has not yet been included in the data base. Hence, our data set comprises 201 regions in total, 147 in EU14 and 54 in 11 candidate countries.[4] For Germany we use data provided by Statistisches Landesamt Baden-Württemberg as they are less incomplete than the EUROSTAT database.[5]

For the calculation of the centrality indicator we employed the peripherality index of *Schürmann / Talaat* (2000). This is an index of the potential or gravity-model type where market size / potential and distances in terms of accessibility are taken into

account.[6] High (low) values of the peripherality index indicate a central (peripheral) position of the related region. As the index that is based on the year 2000 is not available for other years, we used it for the complete time span. For Bulgaria we took the index at NUTS0 level due to the fact that the regional definition in *Schürmann / Talaat* (2000) is inconsistent with that of our GVA data set. In addition, where no index was given (French overseas regions (FR9), Ceuta y Melilla (ES62), Canaries islands (ES63), Açores (PT2) and Madeira (PT3)) we assumed a value of 1, i. e. a value slightly below the Greek islands and Cyprus.

This index is unfortunately only available for EU25 and EU15. We used the index for EU15 as proxy for EU14, but the index for the candidate countries can not be calculated as the residual between EU25 and EU15 as it should reflect the distances and relative market potentials within the candidate countries and not relative to current EU Member States.

4 Indicators and results

In the literature various indicators for regional specialisation and sectoral concentration are discussed.[7] The indicators used here rely on the study of *Hallet* (2000). Specialisation should reveal how much the production structure in one *region* differs from the average of a given set of countries. Geographic concentration measures the spatial distribution of economic activities of a given *sector*, also related to a benchmark distribution. A branch is said to be concentrated if it primarily operates in few regions.

For both investigation issues we computed the indicators with different country sets in order to sketch out distinct developments. The first set includes the whole EU area together with the candidate countries (EU25), the second and third set of regions contain the EU14 and the 11 candidate countries respectively. Because of the ongoing process of transition and consequent substantial changes of production structures in candidate countries, we expect more dynamics in these regions. In the following we first describe the indicators before presenting the first results of our calculations.[8]

4.1 Specialisation

For our analysis of regional specialisation we use one of the most commonly applied indicators for regional specialisation, introduced by *Krugman* (1991):

$$(1) \qquad S_i = \frac{1}{2}\sum_{k=1}^{n}\left|z_i^k - \overline{z^k}\right|$$

The index is based on the sectoral share in GVA of branch k in region i (z_i^k). For each branch in a region the absolute values of the differences between region i and the average of all regions ($\overline{z^k}$) are summed. In contrast to *Krugman* we divide the index by 2 so that the index will take the value zero when no specialisation can be observed, i. e. the production structure does not differ from the average of all regions included, and it will take the value 1 if full specialisation exists. To arrive at the index for a set of regions we summed the regional indices weighted by their share in GDP of the corresponding country group.[9]

Although our period of investigation is rather short, we can observe some remarkable patterns. Interestingly, our index levels for the EU14 and EU25 are similar to other studies analysing all sectors in the EU, even though the sectoral breakdown is now completely different (see e. g. *OECD* (1999) and *Hallet* (2000)). However, in contrast to these studies in our calculations we obtained a slight increase in overall regional specialisation within the current EU Member States, both as a subset in all regions as well as in the EU14 alone.

On the contrary, while starting at a higher level and after a peak in 1996 the indices for the candidate countries show a declining trend. Consequently, regional specialisation patterns are converging between the current and candidate Member States. This should mainly be attributable to the catching-up process, especially in service sectors, of the formerly socialist economies. Besides, if this assimilation trend were a stylized fact ahead of deepening integration (accession), this could also be a reason for the rather similar production structure within current EU Member States. Nevertheless, it can not explain why specialisation is slightly increasing in the EU14.

In addition, when analysing the single regional results in the current EU Member States generally speaking we could observe the highest specialisation indices in more peripheral regions, but no clear convergence tendency could be found. In other words, whether specialisation in a region increased or not did not depend on the level in 1995. This is not the case for the candidate countries where an above average level of specialisation in 1995 made a decline more likely.

4.2 Concentration

In order to investigate production location in an enlarged EU we focus on three measures: concentration, income and centrality. For all indices the sectoral results are standardised by division with the respective value of total production, i. e. GDP. Consequently, a sector with an index value of 100 follows the same spatial pattern as GDP in the complete country group. In addition, by this standardisation the impact of business cycles can be reduced.

The *concentration index* V^k describes the spatial distribution of economic activity. It is calculated as the coefficient of variation between the share of region i in the total GVA of branch k (y_i^k):

$$(2) \qquad V^k = \frac{\frac{1}{\overline{y_i^k}} \sqrt{\frac{\sum_{i=1}^{n} \left(y_i^k - \overline{y_i^k}\right)^2}{N}}}{\frac{1}{\overline{y_i}} \sqrt{\frac{\sum_{i=1}^{n} \left(y_i - \overline{y_i}\right)^2}{N}}}$$

The *income index* W^k shows whether the production of a sector takes place in regions with high or low GDP per capita. Therefore y_i^k is multiplied with the relation between the GDP per capita in PPP in region i and the average of all regions (w_i). The results of branch k are summed for all regions:

$$(3) \qquad W^k = \frac{\sum_{i=1}^{n} \left(y_i^k w_i\right)}{\sum_{i=1}^{n} \left(y_i w_i\right)}$$

Finally, the *centrality measure* M^k reveals if production is concentrated in the centre or periphery. To obtain this index, y_i^k is multiplied by the peripherality index before summing the regional results.

$$(4) \qquad M^k = \frac{\sum_{i=1}^{n} \left(y_i^k p_i\right)}{\sum_{i=1}^{n} \left(y_i p_i\right)}$$

where:

k	Branch (k = 1, …, 15)
i	Regions i = (1, …, n); n = 201 for EU25, n = 147 for EU14 and n = 54 for CAN11
y_i^k	Share of branch k in GVA of region i
y_i	Share of total production (GDP) in region i to total GDP in all regions
p_i	Peripherality index in region i
w_i	GDP per capita in PPP of region i relative to the sum of all regions
N	Total number of regions

We calculated the first two indices within different country groups, i. e. EU25, EU14 and the 11 candidate countries. As mentioned above, the peripherality index is only available for the first two groups, so we could analyse the centre / periphery pattern of concentration only inside the EU25 and EU14.

In order to identify patterns of concentration we apply the following classification: if a sector shows indicator values below 95.0 the branch is considered to be less centralised / concentrated in terms of space or income than the average production while values higher than 105.0 indicate higher spatial concentration and centralisation patterns than average economic activity for the reference group of regions.

In the following we will present some first results by sector and by indicator in relation to the country grouping for the year 2000. However, some facts appear quite obvious regarding all indices, sectors and country groups: Concentration patterns change only very slowly or even remain stable over the short observation period. If one can observe major movements in the indicators it is in the 11 candidate countries.

Sectoral analysis

The primary sector in our data set, consisting of agriculture and mining, displays very distinct patterns of concentration. As is intuitively clear, both branches depend on natural resources and are traditionally located in regions with lower income, while arable land is more evenly distributed than raw materials like coal and ore. Consequently, agriculture and fishing (A+B) displays the lowest values in every indicator for every country group which means that this sector is the most spatially dispersed one and particularly important in peripheral regions and regions with low income per capita. In contrast, mining and quarrying is highly concentrated but income measures and centrality indices are below average.

In the secondary sector the concentration index for manufacturing show particularly high values in the EU25 and EU14 while it is the second lowest in candidate countries. The opposite is true for the other two sub-sectors, E (electricity, gas and water supply) and F (construction), which are above average in the candidate countries and low in EU25 and EU14. In the latter the centrality index is also rather low for construction (F).

Generally speaking, services tend to be highly concentrated, particularly in candidate countries where they also tend to be based in regions with high income. Especially the financial intermediation sector (J), but also real estate businesses (K) show very high concentration values through all indicators and country groups, which implies the presence of these concentrated sectors in central and in wealthier regions, particularly in capital regions. Services that are generally provided by public institutions, i. e. public administration (L), education (M) and health (N), have below average concentration indices in the EU14 and in some candidate countries. Within the service sectors hotels and restaurants are the only activity with a below average centrality index. Hence, they seem to be more important in remote, tourism areas.

Concentration index

For all three country groups, sectors depending on regionally concentrated production factors like natural and human resources display high concentration values as e. g. the service sector with financial intermediation (J), real estate, renting and business activities (K) as well as mining and quarrying (C).

In EU25 the construction (F), electricity, gas and water supply (E) sectors are at the lower end following agriculture. Aside from the above mentioned sectors, high concentration can also be observed in manufacturing (D). When analysing EU14 this pattern does not change a lot although the index values of the service sector are slightly higher in EU25. Looking at the candidate countries some major changes can be detected. After a sharp decline from 1995 to 2000, manufacturing (D) and public administration / defence (L) are far more dispersed than in the EU while in contrast sectors E and F are more concentrated. The same applies for most services.

Income measure

For the whole area mining and quarrying as well as the sector A+B show low indicator values which implies that the primary sector is located in regions with lower income. In

EU25 values above 105.0 are only achieved in the financial intermediation branch. Only construction activities are located in low income regions of both EU14 and EU25. All other sectors are more or less in line with overall GDP development. In the candidate countries five of ten service sectors display high values of the income indicator, thus some service branches tend to concentrate in regions with higher income potential. For financial intermediation the value is particularly high and strongly increasing.

Centrality index

Again, similar patterns apply for values within the EU25 and EU14, even if in most service sectors the index values are slightly higher in the EU25 than in the EU14 while the opposite is the case in the primary and secondary sector. Agriculture and also mining and quarrying (C), construction (F) as well as hotels and restaurants (H) are more likely to be found in peripheral regions while financial intermediation (J) and real estate businesses (K) concentrate in the centre. This outcome replicates to some extent similar results of the centrality measure obtained by *Hallet* (2000). According to our analysis this tendency has strengthened with taking the 11 candidate countries into account.

5 Conclusions

This analysis contributes to the current discussion on regional specialisation and sectoral concentration by applying a new data set with a more detailed sectoral breakdown for services and covering most regions of the current EU Member States and candidate countries.

We could show that - generally speaking - for the current Member States differences from studies using other sectoral breakdowns are rather minor. But in the opposite to these studies we could detect a slight increase in regional specialisation for our observation period. As it is not clear if this development continues, it is worth looking at a longer time period in the future. Agriculture and fishing tend to be dispersed and located in peripheral and in poorer regions. On the contrary, various services seem to be concentrated in central and wealthier regions. In addition, peripheral regions tend to be more specialised. Overall, for the EU14 we could not observe strong movements of the indices as changes in economic structures need time and our investigation period is short.

In contrast, in candidate countries considerable shifts of most indicators showed up. This should be due to the ongoing transition process to market economies during the time period under investigation. Despite a converging trend in regional specialisation and various similarities with the current Member States, some major differences still persist. Among these are the extraordinarily high concentration indices of most private services as well as of mining and quarrying.

However, further research needs to be done. As for the moment we are presenting only first findings, this is particularly true for a more in-depth look at the details of our results. Also, as within this short investigation period structural change cannot be identified conclusively, our calculations should be redone when longer time series are available. Furthermore, computing clustering indices, analysing regional linkages, as well as a comparison with measures based on employment data could shed some more light on specialisation and concentration in Europe.

Appendix

Tab. A1: Sectors according to NACE

	Sector
A_B	Agriculture, hunting, forestry and fishing
C	Mining and quarrying
D	Manufacturing
E	Electricity, gas and water supply
F	Construction
G	Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
H	Hotels and restaurants
I	Transport, storage and communication
J	Financial intermediation
K	Real estate, renting and business activities
L	Public administration and defence; compulsory social security
M	Education
N	Health and social work
O	Other community, social, personal service activities
P	Private households with employed persons

Tab. A2: Regional division

Member State / Candidate Country	NUTS-level	Number of Regions
Austria	2	9
Belgium	2	11
Bulgaria	2	6
Cyprus	0	1
Czech Republic	2	8
Denmark	0	1
Estonia	0	1
Finland	2	6
France[10]	2	23
Germany	1	16
Greece	2	13
Hungary	2	7
Ireland	2	2
Italy	2	20
Latvia	0	1
Lithuania	0	1
Luxembourg	0	1
Netherlands	2	12
Poland	2	16
Portugal	2	7
Romania	2	8
Slovak Republic	2	4
Slovenia	0	1
Spain	2	18
Sweden	2	8

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[2] Following the classification of *Hallet* (2000).

[3] For a list of the NACE sectors see table A1 in the appendix.

[4] For a list of the NUTS regions see table A2 in the appendix.

[5] However, the disaggregation among the sectors M to P is still not available in the case of Germany. We estimated the missing data according to the average sectoral weight of the sectors in the rest of the countries included. The data of sectors C and E in Ceuta y Melilla and for sector P in the Netherlands we estimated according to the average weight of these regions in GVA in all sectors. As the regional differentiation between the French overseas departments is not available, we took them at NUTS1 level. Generally, when only single years for a specific region were missing the gaps were filled as follows: If data were missing at the beginning or end of the period we applied the average growth rate in the corresponding sector in all other regions for the missing year while when data in the middle of the period were missing, we made a linear interpolation of the data for the specific region.

[6] Among the various available indices we have chosen the one based on GDP in PPP and lorry indicators.

[7] For a survey see for example *Amiti* (1997) or *WIFO* (1999).

[8] Final and detailed results can be made available on request.

[9] The results for the subgroups EU14 / EU25 and CAN11 / EU25 are calculated as follows: The sectoral shares were compared to the average of EU25, but the weighting is based on the share in GDP of the region i in the corresponding subgroup, i. e. EU14 and CAN11 respectively.

[10] The overseas departments we have taken as one region on NUTS1 level.