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Conference Paper

European Region Types: A Cluster Analysis of European NUTS 3 Regions

46th Congress of the European Regional Science Association: "Enlargement, Southern Europe and the Mediterranean", August 30th - September 3rd, 2006, Volos, Greece

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EUROPEAN REGION TYPES

A CLUSTERANALYSIS OF EUROPEAN NUTS 3 REGIONS

*Paper to be presented at the 46th congress
of the European Regional Science Association in Volos,
August 30th 2006 to September 3rd 2006.*

Christine M. Aumayr

June 2006

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1 Abstract

The motivation for the present empirical work arose from a practical problem: It did not seem to be justifiable to compare growth and productivity developments of the 6 Styrian NUTS 3 regions to national and European averages without considering differences in region-specific factor endowments and economic structure. In order to find suitable benchmark region-types, a cluster analysis on the level NUTS 3 was conducted among 1.100 European regions, incorporating information on the economic importance of the three main sectors in terms of relative employment and gross value added, as well as spatial information on the density and the accessibility of population. As a result, eleven region-types (three urban and eight non-urban) were identified and their development between 1995 and 2002 was analysed. The paper further finds that growth in Western European regions was higher in the more peripheral areas, whereas in CEEC countries the central regions experienced higher growth.

2 Motivation and Overview

Very often empirical studies on regional development compare the regions of interest to a conglomerate average of other regions such as the average of the EU-15 or the EU-25. Rankings of all kind afterwards hide interesting insights because of their pell-mell character. By benchmarking regions to a certain average, deeper insights on region-specific factor endowments which might influence direction and speed of regional development are lost.

The primer motivation for this work was to obtain groups of regions which are akin in their factor endowment and their spatial characteristics, which can later on be used as benchmark groups for future empirical studies on regional development of certain regions. This is assessed by means of a cluster analysis of approximately 1.100 European NUTS 3 regions.

In this work it is further hypothesized that economic structure together with spatial conditions (such as the accessibility of regions) does matter in explaining differences in the level of GRP per capita and differences in the average growth rate of GRP. This hypothesis is then assessed by specifying different econometric models containing information on group membership, spatial and structural variables.

The scarce availability of data at the NUTS 3 level with only high degrees of sectoral aggregation leaves the typology on a rough level. In order not to blur the sight on NUTS 3 regions, it has been abstained from using more detailed information (such as R&D activity and better indicators on human capital) which would have been available on the level NUTS 2 for the corresponding regions.

3 Related Papers

This work is strongly inspired by Palme (1995a) which is a classification of Austrian districts by means of similar variables as used in the present paper (except the measures on accessibility). This typology of Austrian regions is still being utilized for empirical studies on Austrian regions – as for example in Mayerhofer (2001) which assessed the impacts of the European enlargement on Austrian regions. For Germany Kronthaler (2003) is a related work, clustering German regions by their endowment with factors acting as drivers for growth, such as innovations, public and private capital, human capital, entrepreneurial concentration and initiative. Central result of this paper is the completely different factor endowment of regions in Eastern and Western Germany. This is emphasized by the result that they never belong to the same cluster. Prettenhaler (2003) groups 77 southern and eastern European region based on structural and spatial variables, including an indicator on the degree of regional specialisation. Bauriedl/Winkler (2004) finally groups selected European NUTS 3 regions according to the dimensions: social justice, the protection of natural resources and sustainability of economic activities.

4 Approach

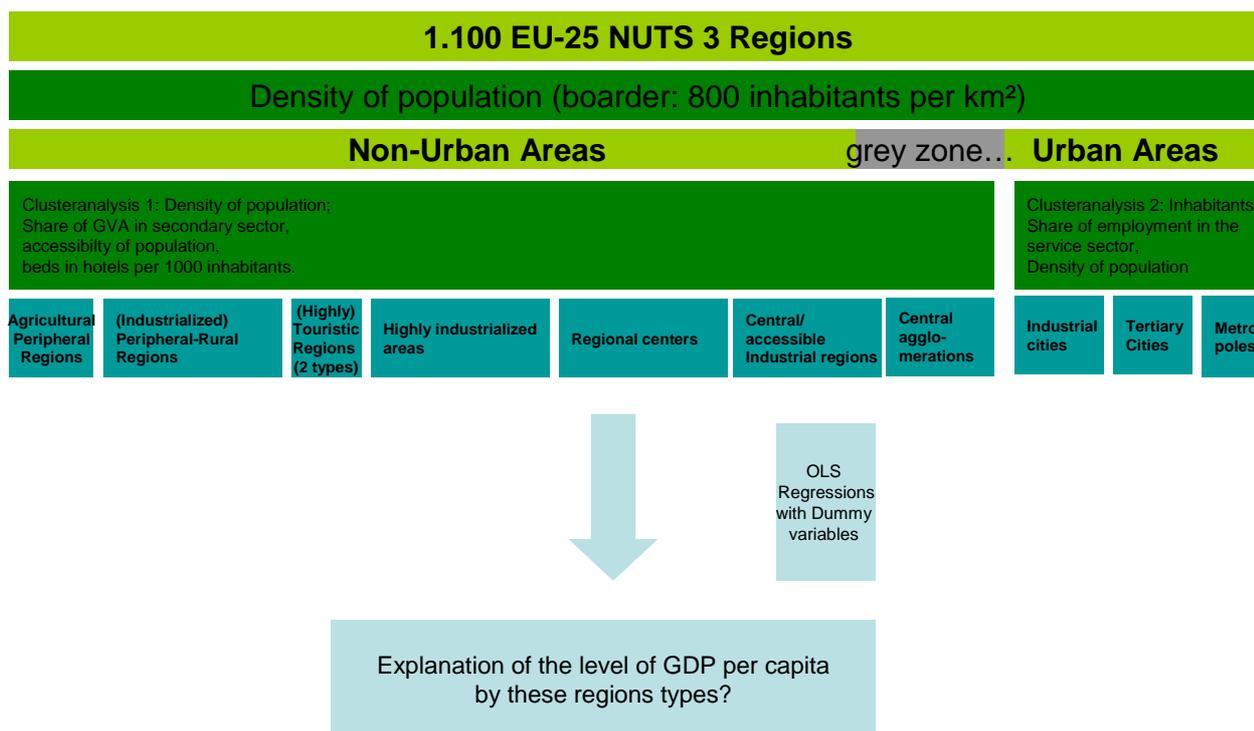
4.1. SEQUENCE OF WORK AND METHODS USED

For the classification part I used the multivariate method of cluster-analysis, in particular the method of “WARD” with the squared Euclidian distance as a measure of distance. The aim of such a cluster analysis is to build groups among a given sample of objects (in this case regions), described by a bundle of variables, which are supposed to be as heterogeneous as possible against each other, but contain members that are as homogenous as possible given the characteristics utilized for classification. Ward’s method in particular is a so called “hierarchical method”, it starts from the finest partition of objects (each object is in the first place a cluster of its own) and then combines objects based on the matrix of distances, without re-grouping. The algorithm Ward uses is to obtain the minimum of variances in between the groups. Variables were standardized in order to avoid weighting.

In fact, two main cluster analyses were conducted among two sets of objects: urban and non-urban areas. A simultaneous treatment of all objects together would not have lead to reasonable results, as there is in fact already an a priori weighting of variables in the notion of what distinguishes urban from non- urban areas: mainly the high density of population. For this reason a first partition of all objects was drawn at a boarder line of 800 inhabitants per km². Around this boarder line, in a grey zone between urban and non-urban areas there are cities which are statistically displayed with some of their surroundings, regions with a high degree of urbanisation (containing several cities) and cities alone which are relatively sparsely populated. Most members of this grey zone are finally to be found either in the group of central agglomerations or in the regional centres with surroundings among the set of non-urban areas.

Given the results of both cluster analysis, I tried to answer the question, how well on the one hand the utilized variables, and how well the groups obtained from the cluster analysis on the other hand could explain differences in gross regional product per capita. On this purpose I estimated various models using OLS using 1) the variables that were used in the second cluster analysis of the non-cities, 2) dummy variables for the region types.

Table 1: Overview of the design of the work



4.2. DATA

The sample of regions is generally all European NUTS 3 regions from the 25 member states, lack of data unfortunately lead to a reduced set of only approximately 1.100 classified regions¹. Data are from the EUROSTAT regional database, except those on accessibility, which I gratefully obtained from the Institute of Spatial Planning, IRPUD at the University of Dortmund². If not otherwise indicated, regional economic data are in nominal terms. For the cluster analysis only data from the year 2002 were utilized.

4.3. VARIABLES

The aim of the cluster analysis was to obtain a set of European region types containing members which are similarly endowed with growth factors such as human and capital in kind, and which resemble each other concerning spatial terms (such as either the existence of own agglomerations or the accessibility of neighbouring agglomerations.) Given the high grade of regional disaggregation – and therefore the low number of variables obtainable at this level, only rough proxies could be used for characterising region types. (Especially economic structure is only available by the highest aggregation into primary, secondary and tertiary sector – indicators for the grade of specialization of a region could therefore not be taken into account.) Variables were only used in relative terms or per capita, in order to account for the different size of the regions. Variables indicating the performance of the regions (such as GDP, unemployment or sectoral labour productivity) have not been included as explaining variables into the clusteranalysis, but were taken into account for descriptive purpose only.

¹ Some countries do have gaps of information on some regions, though only the Dutch regions could not be used for classification because of missing structural data on regional gross value added.

² The data was initially compiled by Schürmann and Talaat for the compilation of an index of peripherality on European regions, an update was made by Christian Lindner, IRPUD within the EU project „SERA – Study on Employment in Rural Areas.“ for the Directorate general of the DG Agri.

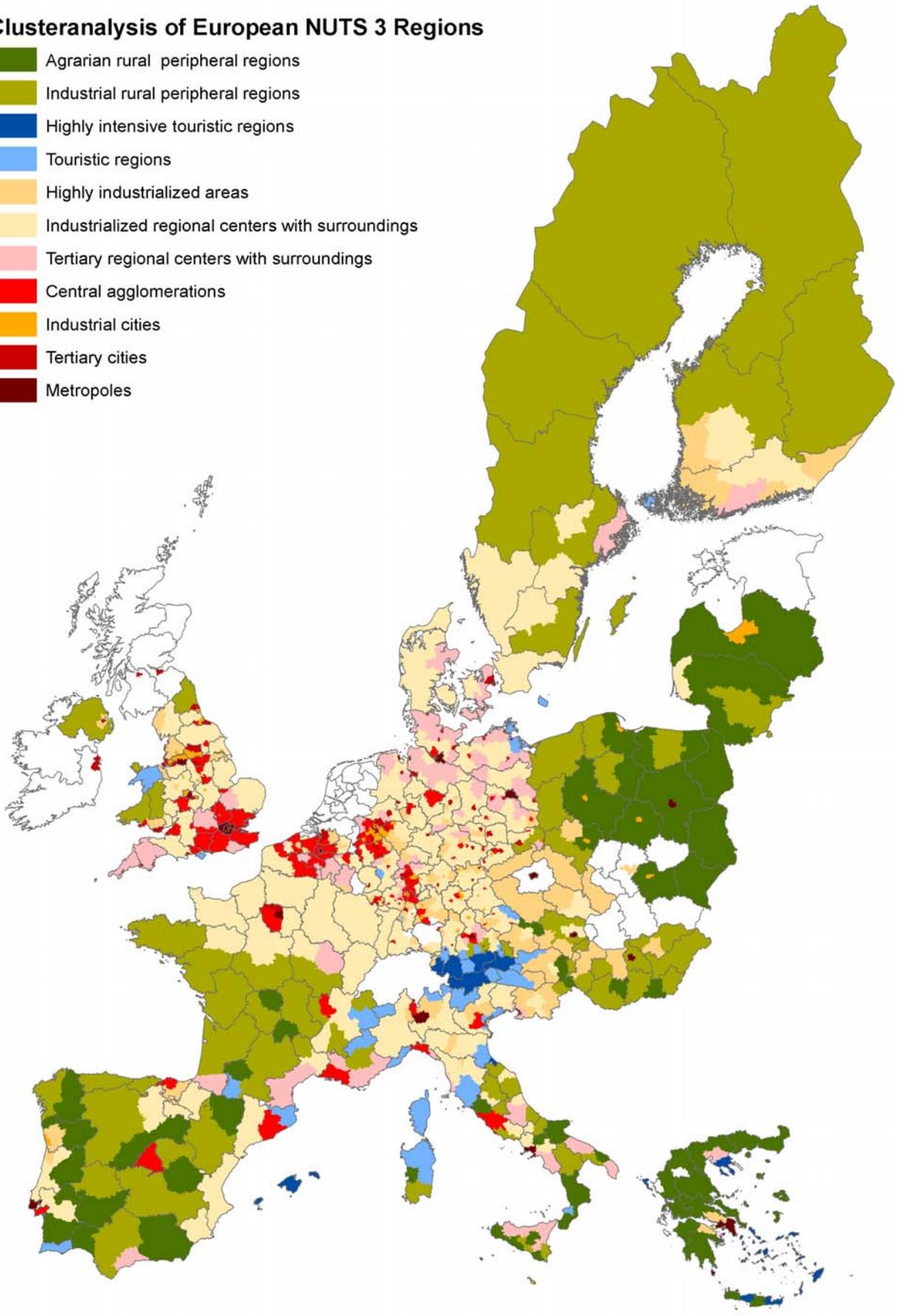
The variables finally utilized are summarized in the following table:

Variable	As a proxy for	Used in Cluster Analysis of
Inhabitants	The total number of inhabitants serves to distinguish metropolitan cities from other cities.	Urban-Areas
Share of employment in the tertiary sector	Is supposed to be the roughest proxy for the endowment of a NUTS 3 (urban) region with human capital and only used in the cluster analysis of urban areas	Urban-Areas
Density of population	This variable measures to a certain degree the existence of densely populated areas in a region and hence the region's opportunity of being able to benefit from positive effects of agglomeration (economies of scale). Agglomerations in big regions with otherwise non- or low densely populated surroundings are of course not detected by this measure. For this reason the analysis was enriched with an accessibility measure.	Urban Areas and Non-Urban Areas
Accessibility of population	This variable represents the amount of people – weighted by their distance from the region of origin that can be accessed in a given time by car. For more information on this data see Schürmann and Talaat (2000), on the compilation of a “European Peripherality Index”.	Non-Urban Areas
Share of gross value added in the secondary sector	The percentage share of GVA is a proxy for the degree of regional endowment with real capital, under the assumption that regions with a high share of GVA in the industrial sector are also endowed with higher real capital stocks. At the same time – given the high negative correlation with the share of GVA in the tertiary sector, this variable at the same time measures the degree of tertiarisation of non-urban-area regions.	Non-Urban Areas
Share of employment in the primary sector	The share of employment in the primary sector serves on the one hand as variable for the detection of rural regions and as an inverse indicator for the endowment of a region with human capital.	Non-Urban Areas
Beds in hotels per 1000 inhabitants	This indicator for tourism is the only sectorally disaggregated one available. It is used for the detection of regions which can said to be specialised in tourism.	Non-Urban Areas

In order to avoid problems with collinearity, Pearson correlation coefficients were calculated between variables that were simultaneously used in one classification. (See Table 10 and Table 11). There appears to be moderate positive correlation between the density and the accessibility of population (of +0.5) and a moderate negative correlation between the share of employment in the primary sector and the density of population (-0.4). Given the low availability of data on that level of aggregation and after numerous alternative trials with multi-stage approaches (pre-partition of objects based on factors subtracted by a main component analysis) which did not lead to more intuitive results, these correlations have been taken into account.

Clusteranalysis of European NUTS 3 Regions

-  Agrarian rural peripheral regions
-  Industrial rural peripheral regions
-  Highly intensive touristic regions
-  Touristic regions
-  Highly industrialized areas
-  Industrialized regional centers with surroundings
-  Tertiary regional centers with surroundings
-  Central agglomerations
-  Industrial cities
-  Tertiary cities
-  Metropolises



5 Results of the cluster analysis

As a result of both cluster analyses, eleven types of regions could be identified. Given the already high standard deviations of the initial group of regions of certain variables (reflecting thus the heterogeneity of Europe's regions) the groups obtained still remain relatively heterogeneous with respect to certain variables. Table 2 shows the mean values (and standard deviations) of characterizing variables for the different types of regions. Nonetheless all types of the regions show improved degrees of homogeneity in all variables which were used for assigning them into a certain cluster, measured in terms of their coefficients of variation (compare table 3).

Peripheral regions

1. **Agricultural rural peripheral regions:** are at the same time sparsely populated and obtain a low degree of accessibility of population. An average share of 26 % of the workforce is employed in the primary sector, which is the highest value among all regions. Per capita GRP is with 9.400 Euro only half of the average region's GRP. Labour productivity is low in all sectors, even so in agriculture which leads to the suspicion of the statistical appearance of otherwise unemployed peasant population in the primary sector. Geographically this type of region is mostly found in Southern (Portugal, Spain, Greece) and Eastern (Poland, Latvia and Lithuania) European regions. In Austria two regions –Mühlviertel and Oststeiermark (Eastern Styria) are members of this cluster³.
2. **Industrialized rural peripheral regions:** Also in this cluster, the share of employment in the primary sector is with 8 % still above average, though significantly lower than in the previous group (with a slightly higher degree of variation). What is characteristic for this type is it's relatively high share of GVA generated in the secondary sector (29 %), accompanied by an equally high share of employment in this sector. Labour productivity of this sector is with 42.700 Euro of GVA per employee relatively high given the peripheral location, but lower than in the other industrialized areas and this value is afflicted with a high degree of variation – so there is both, high and low productive industrialized rural peripheral regions. Gross regional product of this type is at 16.800 Euros per capita still below average. Accessibility of population is comparable to that of region type number one, with an even lower degree of variation. We find these types of regions in the peripheral areas of Europe, in all directions: The northern parts of Finland and Sweden, eastern regions in Poland, Hungary and some Austrian boarder regions, in the South(west) many on the Iberian Peninsula and in southern France, few in Scotland.

³ This membership results from their relatively high shares of employment in the primary sector of over 15 % according to the utilized EUROSTAT data. National statistics on the other hand show much lower shares.

Touristic regions

3. **Highly intensive touristic regions:** are the smallest cluster of regions with only 15 members. On average these regions obtain 192 beds in hotels per 1.000 inhabitants. Geographically they are to be found in Alpine regions (Austria and South Tyrol), on Greek Islands and on the Balearic Islands. What is remarkable is the fact that although accessibility of population (on average, though with a higher degree of variation) is lower than in the peripheral areas, gross regional product is substantially higher and (with a relatively low degree of variation) comparable to the average of all regions. – So in this case specialisation of peripheral regions on tourism, explains higher regional income. Some of these regions show a substantially high productivity in the tertiary sector. Especially the Southern-European regions of this cluster obtain high employment shares in the primary sector. The Austrian members of this cluster exhibit high productivities in the industrial sector⁴.
4. **Touristic regions:** Members of this small 44-regions-cluster possess on average 62 beds in hotels per 1.000 inhabitants, which is significantly lower than in the previous group. A relatively high share of employment of 6 % is found in agriculture, whereas it is the tertiary sector that accounts for 75 % of total GVA and accounts for 71 % of the employed. This however suggests an even higher degree of tertiarisation than on average (including urban areas). What is remarkable is that no regions of countries in transition fall into that cluster.

Regions with high endowment of real capital

5. **Industrial regions:** are characterized by their high shares of GVA in the secondary sector of on average 46 % and by their high shares of employment of 41 % in this sector. Labour productivity in the secondary sector lies on average at about 46.000 which is relatively high, but there is also a high degree of variation in the cluster which means that very low productivity regions (especially those of countries in transition) together with high productivity regions can be found in this cluster. The cluster of industrial regions distinguishes itself from the following cluster especially in terms of accessibility. This cluster is equally staffed with western and eastern European regions.
6. **Industrialized regional centres with surroundings:** show high degrees of accessibility of population (either because of their degree of centrality or because of the existence of important agglomerations close by). Many of those regions are in fact cities which are shown with their surroundings, such that they can't be regarded as "pure" urban areas any more. Other regions of this type are those in Germany and Northern France which are on the one hand quite densely populated but do not show high enough accessibility of population to fall into the group of central agglomerations. Also in this cluster, the secondary sector is important in terms of GVA (33 %) and employment (32 %), but they also obtain in general a relatively high labour productivity in the tertiary sector. Furthermore these regions show the highest labour productivity in the primary sector of all clusters. Compared to industrial areas a much higher degree of people employed and of gross regional product is accessible from these regions. This cluster is prominently staffed with (very small) German regions (187), as well as regions from Northern France and the UK.

⁴ As Palme (1995a) finds: even on a lower level of regional aggregation, this ambiguity (alpine regions with industrialized main valleys and touristic side valleys) remains.

Regions with high endowment of human capital

7. **Tertiary regional centers with surroundings:** hold high capacities of human capital, measured in terms of the degree of tertiarisation of employment and given the high labour productivity in the tertiary sector. Together with the former group, these regions in general also show high labour productivities in agriculture. Like the former group, this cluster is mainly filled with regions from Germany, Belgium, France and the UK.
8. **Central agglomerations:** are regions with a high degree of accessibility of population. Although this group was identified in the analysis of “non-urban areas”, the regions represent a “grey zone” between urban and non-urban areas. Some otherwise metropolitan or great urban areas such as Rome, Madrid or Barcelona which are statistically displayed with their surroundings belong to this group. Also regions containing several urban agglomerations or cities (such as some German “Stadtkreise”) with a relatively low population density are part of this group. “Central” to this group is centrality: the members show the highest degrees of accessibility of population, gross-regional-product and employment amongst all types of regions. The main part of these regions is situated in Germany, Belgium and the UK.

Urban Areas

9. **Industrial cities:** are cities for which the secondary sector is still highly important: More than a third of GVA is based on activity in the secondary sector, and over 30 % of all employed work in the industrial sector. Similarly to the industrial areas, labour productivity in this sector is high on average, but there is a substantial degree of variation among the group members. This type of cities can be found in Germany, as well as in Poland, Latvia, Malta and Portugal.
10. **Tertiary Cities:** In this type of cities tertiarisation is on average almost as advanced as in metropolitan areas. The share of employment in the service sector lies on average at 81 %, labour productivity is high in this sector, but still much lower than in the metropolitan areas. Tertiary cities show the highest labour productivity in the secondary sector (with low variation) giving rise to suspect that this type of cities could better accompany structural change from secondary to tertiary sector with high productive services than could the type of industrial cities (or at least that this type is further advanced in this process). Given the high grade of urbanisation together with the fact that cities are often displayed without their surroundings in Britain and Germany, mainly these regions are to be found in this cluster.
11. **Metropolitan areas:** are densely populated tertiary cities with a high number of inhabitants. 82 % of total GVA is generated in the service sector, only 18 % on average in the secondary sector. The regional product per capita is highest amongst all regions and lies at about 37.000 Euro per inhabitant, though there is a high degree of variation among the group members. Based on the fact that the metropolitan areas are widespread across Europe, sometimes even in rather peripheral areas (such as for example Vienna or Helsinki), and sometimes surrounded by sparsely populated areas, the three measures of accessibility (on population, employment and regional product) are below those of other urban areas.

Table 2: Results of both cluster analysis: Mean Values and standard deviations of the respective types of regions

Variables utilized in the clusteranalysis	Agricultural rural peripheral regions		Industrial rural peripheral regions		Highly intensive touristic regions		Touristic Regions		Highly Industrialized areas		Industrialized regional centers with surroundings	
Population density	66	(44)	78	(57)	95	(125)	110	(92)	226	(164)	142	(71)
Beds in hotels per 1000 habitants	12	(17)	11	(7)	192	(52)	62	(23)	9	(8)	11	(9)
Accessibility of population	12215	(5967)	13707	(4810)	11535	(7212)	19905	(8045)	25636	(10149)	30892	(6570)
Share of gross value added of the secondary sector	25	(9)	29	(4)	20	(12)	22	(7)	46	(7)	33	(5)
Share of Employment in the primary sector	26	(10)	8	(4)	14	(13)	6	(3)	5	(5)	5	(3)
Share of Employment in the tertiary sector	51	(9)	64	(7)	63	(10)	71	(7)	53	(9)	63	(6)
Other variables not used for clustering												
Percentage of Employment in the secondary sector	23	(8)	28	(6)	23	(7)	23	(6)	41	(7)	32	(6)
Gross regional product per capita	9419	(4602)	16847	(6818)	20483	(7389)	21120	(5390)	20115	(9922)	19948	(4927)
Labour productivity primary sector	11684	(8972)	26559	(14879)	22626	(9409)	23602	(10761)	21796	(13266)	29061	(12959)
Labour productivity secondary sector	25900	(14137)	42677	(18059)	40352	(19822)	42931	(10042)	47089	(21606)	46888	(11831)
Labour productivity tertiary sector	31974	(15947)	39206	(13015)	53439	(5439)	46771	(7331)	39489	(14582)	46122	(7728)
Accessibility of Employment	5045	(2645)	5884	(2137)	5072	(3349)	8784	(3556)	11503	(4639)	13879	(2952)
Accessibility of gross regional product	215339	(145778)	290567	(127849)	241583	(180533)	445208	(190429)	593310	(301941)	750511	(184849)
Share of gross value added in the primary sector	10	(5)	5	(3)	7	(6)	3	(2)	3	(2)	3	(2)
Share of gross value added in the tertiary sector	65	(8)	66	(5)	74	(9)	75	(6)	52	(7)	64	(5)
Number of group members	117		150		15		44		112		326	

to be continued on next page...

Variables utilized in the clusteranalysis	Tertiary regional centers with surroundings		Central agglomerations		Industrial cities		Tertiary cities		Metropolises		Total	
	Population density	161	(81)	551	(132)	1879	(836)	1736	(985)	4868	(4023)	490
Beds in hotels per 1000 habitants	13	(9)	7	(6)	6	(4)	12	(20)	12	(12)	15	(26)
Accessibility of population	32932	(10419)	37635	(8596)	35702	(9485)	35145	(9336)	34879	(12862)	na	(11869)
Share of gross value added of the secondary sector	20	(4)	26	(7)	34	(9)	21	(5)	18	(5)	29	(10)
Share of Employment in the primary sector	5	(2)	2	(1)	1	(0)	0	(0)	0	(0)	7	(8)
Share of Employment in the tertiary sector	73	(5)	74	(7)	69	(6)	81	(4)	83	(6)	65	(11)
Other variables not used for clustering												
Percentage of Employment in the secondary sector	22	(4)	24	(7)	30	(6)	18	(4)	17	(5)	28	(9)
Gross regional product per capita	19069	(6040)	25125	(9137)	28422	(13234)	31473	(10632)	37348	(26916)	20624	(10273)
Labour productivity primary sector	29702	(11115)	26264	(11978)	15072	(15474)	16529	(14807)	14285	(14545)	23664	(14251)
Labour productivity secondary sector	43468	(11321)	53733	(13018)	52478	(19289)	54573	(14689)	60087	(23748)	45406	(17140)
Labour productivity tertiary sector	47684	(6930)	49451	(11444)	43865	(12121)	46621	(8451)	53152	(19215)	43702	(12403)
Accessibility of Employment	14582	(4806)	16853	(3716)	16093	(4351)	15784	(4204)	15477	(5813)	5056	(5430)
Accessibility of gross regional product	792891	(294155)	949907	(239064)	889135	(275066)	879768	(246478)	869429	(395776)	215350	na
Share of gross value added in the primary sector	4	(2)	1	(1)	0	(0)	0	(na.)	0	(0)	4	(4)
Share of gross value added in the tertiary sector	76	(4)	73	(7)	66	(9)	79	(7)	82	(5)	67	(10)
Number of group members	92		95		60		87		24		112	

Sources: EUROSTAT (2005), IRPUD (2005), own calculations, JOANNEUM RESEARCH, InTeReg

Table 3: Coefficients of variation with respect to different variables given the results of the cluster analysis

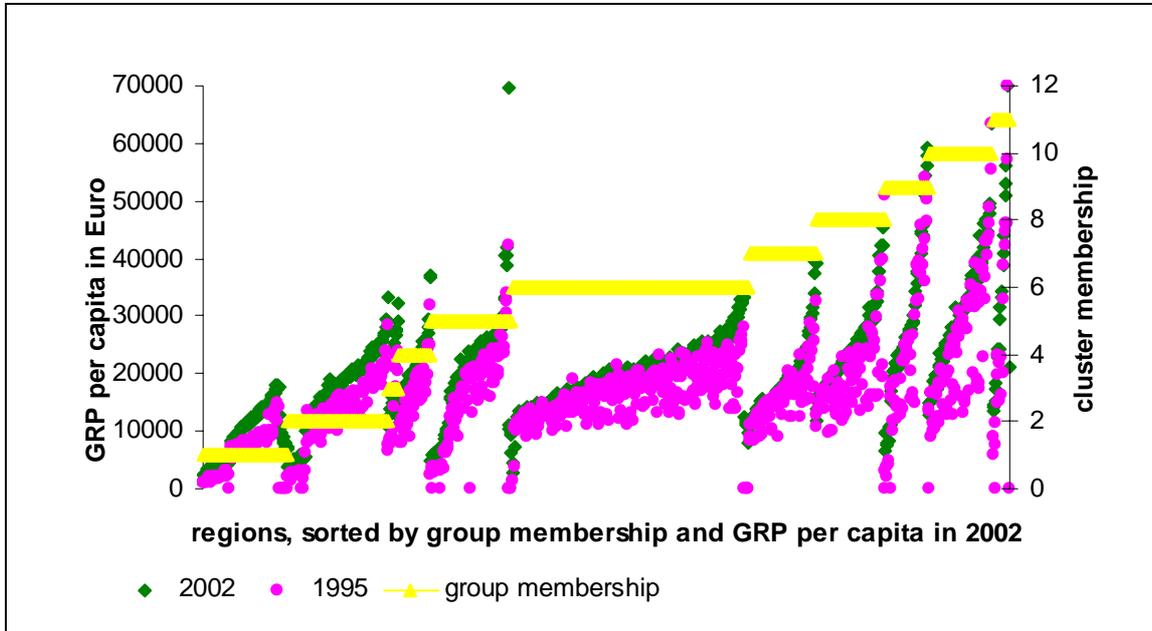
Coefficient of variation (standard deviation/mean *100)	Peripheral areas		Touristic areas		Regional centers			Urban Areas				Total	
	Clusteranalysis	Agrarian rural regions	Industrial rural regions	Highly intensive touristic regions	Touristic Regions	Highly Industrialized areas	Industrialized regional centers with surroundings	Tertiary regional Centers with surroundings	Central agglomerations	Industrial cities	Tertiary cities		Metropolises
Variablen utilized in the clusteranalysis													
Population density Urban and Non-Urban areas		66.7	73.1	131.6	83.6	72.6	50.0	50.3	24.0	44.5	56.7	82.6	223.1
Beds in hotels per 1000 inhabitants Non-Urban areas		141.7	63.6	27.1	37.1	88.9	81.8	69.2	85.7	66.7	166.7	100.0	173.3
Accessibility of population Non-Urban areas		48.8	35.1	62.5	40.4	39.6	21.3	31.6	22.8	26.6	26.6	36.9	na
Share of gross value added of the secondary sector Non-Urban areas		36.0	13.8	60.0	31.8	15.2	15.2	20.0	26.9	26.5	na	27.8	na
Share of Employment in the primary sector Non-Urban areas		38.5	50.0	92.9	50.0	100.0	60.0	40.0	50.0	0.0	0.0	na	114.3
Share of Employment in the tertiary sector Urban areas		17.6	10.9	15.9	9.9	17.0	9.5	6.8	9.5	8.7	4.9	7.2	16.9
Other variables not used for clustering													
Percentage of Employment in the secondary sector		34.8	21.4	30.4	26.1	17.1	18.8	18.2	29.2	20.0	22.2	29.4	32.1
Gross regional product per capita		48.9	40.5	36.1	25.5	49.3	24.7	31.7	36.4	46.6	33.8	72.1	49.8
Labour productivity primary sector		76.8	56.0	41.6	45.6	60.9	44.6	37.4	45.6	102.7	89.6	101.8	60.2
Labour productivity secondary sector		54.6	42.3	49.1	23.4	45.9	25.2	26.0	24.2	36.8	26.9	39.5	37.7
Labour productivity tertiary sector		49.9	33.2	10.2	15.7	36.9	16.8	14.5	23.1	27.6	18.1	36.2	28.4
Accessibility of Employment		52.4	36.3	66.0	40.5	40.3	21.3	33.0	22.0	27.0	26.6	37.6	107.4
Accessibility of gross regional product		67.7	44.0	74.7	42.8	50.9	24.6	37.1	25.2	30.9	28.0	45.5	na
Share of gross value added in the primary sector		50.0	60.0	85.7	66.7	66.7	66.7	50.0	100.0	na	na	na	na
Share of gross value added in the tertiary sector		12.3	7.6	12.2	8.0	13.5	7.8	5.3	9.6	13.6	8.9	6.1	14.9

X Variation coefficient of the respective group higher than in the total of regions.

Lowest variation coefficient amongst all groups.

6 Economic development of the region types

Table 4: Cluster membership and corresponding development of GRP per capita (1995 and 2002)



Source: EUROSTAT (2005), own calculations JOANNEUM RESEARCH, InTeReg

How did the region types develop since the middle of the nineties, and can the groups explain differences in GRP per capita in 2002? Visually (compare Table 4) there seems to be a relation between group membership and GRP per capita: Most of the groups exhibit high ranges of regional product per capita, though, as one can easily examine, there is a rising tendency of GRP per capita in 2002 with rising centrality (as the groups themselves are roughly ordered by their average degree of accessibility of population).

There were slight changes in the ranking between groups based on their average GRP per capita between 1995 and 2002. Touristic and highly touristic regions gained ranks at the expense of the groups of regional centres with surroundings, but given the small size of the former groups one should not put too much weight on that finding. Generally speaking, little has changed in the short period. With the exception of metropolitan areas, growth rates of average GRP per capita were higher in the more peripheral regions, though given their on average by far lower levels of GDP, no significant catching up – especially for the group of poorest regions – took place.

Regarding structural change, growth rates of average regional indicators show the expected pattern of tertiarisation on the European level: Gross value added grew in all groups in all sectors, though at much lower rates in the primary sector, and faster in the service sector than in the secondary sector. Sectoral employment shows negative growth rates in the primary sector, positive rates in the tertiary sector for all types of regions but negative employment growth in the secondary sector only in the more central regions. Especially peripheral and (highly) touristic regions exhibited on average positive growth of employment in the secondary sector (compare Table 13 in the Annex)

Table 5: Development of GRP per capita in market prices (mean value of the respective region types).

Nr.	Type of region	GRP per capita 1995	Rank	GRP per capita 2002	Rank	Change of rank
1	Agricultural rural peripheral regions	6189	11	9419	11	↔
2	Industrial rural peripheral regions	12804	10	16847	10	↔
3	Highly intensive touristic regions	14786	9	20483	6	↑
4	Touristic Regions	16015	6	21120	5	↑
5	Highly industrialized areas	15960	7	20115	7	↔
6	Industrialized regional centers with surroundings	16471	5	19948	8	↓
7	Tertiary regional centers with surroundings	15718	8	19069	9	↓
8	Central agglomerations	19460	4	25125	4	↔
9	Industrial cities	23775	3	28422	3	↔
10	Tertiary cities	24937	2	31473	2	↔
11	Metropolises	26834	1	37348	1	↔
12	Total	16216		20624		

Source: EUROSTAT (2005), own calculations JOANNEUM RESEARCH, InTeReg

In order to assess the question whether and to what extent these region-types do explain differences in the level and growth of GDP, various econometric specifications were made, using 1) dummy variables for the region types and taking into account initial conditions and/or information on CEE membership (model 1) and 2) using those variables as explanatory that were initially utilized in the cluster analysis (model 2) together with information on the initial condition. Both types of models were specified over the whole sample of regions as well as over sub-samples, thereby distinguishing between “CEEC” (new member states except Cyprus and Malta) and “Western European” (remaining regions).

Table 6: Model summary

Nr.	Description	Specification
1	group membership	$GRPp.cap_{2002} = \beta_0 + \beta_1 * GRPp.cap_{1995} + \beta_d * D_d + \beta_{CEE} * D_{CEE}$ where d = 1 to 11 without group 7 and D is a dummy variable for group membership
2	variables	$GRPp.cap_{2002} = \beta_0 + \beta_1 * GRPp.cap_{1995} + \beta_2 * BEDS + \beta_3 * \%GVAC-F + \beta_4 * \%EMPG-P + \beta_5 * \%ACCPOP$

The estimation of model 1 (with the rather intermediary group of “tertiary regional centres with surroundings”) gives significant results of the influence of group membership on the level of GRP, after accounting for differences in the initial conditions. The influence of the initial state of per capita income is higher in CEEC than in the Western European regions, whereas “group effects” (which have to be taken into account simultaneously) are generally lower in CEEC and negative in the more peripheral areas. There is a difference concerning the sign between transition to non-transition regions, in regions with high shares of GVA in the secondary sector (highly industrialized regions and industrialized regional centres with surroundings) indicating that high shares of GVA in the secondary sector in transition countries are the low-productivity obsolete heritage of the communist era, whereas in Western European countries, these high shares might also go together with efficient and wealth creating high productive industries.

Table 7: Results of the parametric specification of model 1, based on group membership

Variable ⁶	Only Western European regions ⁵		Only CEEC regions		All regions (EU-25)	
	Coeff.	Std.Err.	Coeff. ⁷	Std.Err.	Coeff.	Std.Err.
Agricultural rural peripheral regions	731	(574)	-2207 ***	(409)	263	(538)
Industrial rural peripheral regions	1978 ***	(464)	-1916 ***	(406)	1474 ***	(438)
Highly intensive touristic regions	2252 **	(691)			2248 ***	(675)
Touristic Regions	1680 ***	(540)			1618 ***	(528)
Highly industrialized areas	1928 ***	(553)	-1725 ***	(386)	1205 ***	(446)
Industrialized regional centres with surroundings	389	(402)	-1042 ***	(484)	303	(381)
Central agglomerations	2638 ***	(682)			2412 ***	(663)
Industrial cities	2067 ***	(936)	43	(453)	1539 ***	(766)
Tertiary cities	3315 ***	(921)			2843 ***	(859)
Metropolises	9337 ***	(2466)	3982 ***	(576)	8428 ***	(2276)
GRP 1995	0.98 ***	(0.06)	1.23 ***	(0.04)	1.03 ***	(0.045)
const.	3682 ***	(1002)	3623 ***	(437)	2989 ***	(759)
(Reference group: tertiary regional centres with surroundings)						
	R ² =0.795		R ² =0.951		R ² =0.840	

Source: JR-InTeReg

The estimation of model 2 (see Table 8) produces similar results as above in terms of model fit and concerning the influence of the initial state. As suggested by the high positive effects of highly industrialized regions above, there is a positive wealth effect for every additional percentage share of GVA in the secondary sector in the Western European regions, whereas this is not clear for Central and Eastern European countries. Higher (and significant in all regions) is the influence of an additional percentage point of employment in the service sector. Somewhat more ambiguous is the sign of the accessibility indicator: generally, higher accessibility of population is expected to go together with a higher level of GRP, so the negative sign of accessibility over all regions and in the Western European regions is puzzling. However, main parts of the “centrality”-factor should already be incorporated into initial GRP in 1995 which might lead to the suspicion that in the period of concern rather the peripheral regions could grow, and better accessibility was not associated with higher regional growth (also Table 13 might lead to this conclusion). For CEEC regions on the other hand, there is a (small) positive effect of accessibility on GRP, which means in this cross-section specification, that amongst the CEEC regions the more central regions experienced higher growth.

⁵ In order to account for the heteroskedasticity present in the whole sample and in the sample of Western European regions, these equations were modelled, using White heteroskedasticity –consistent standard errors and covariance. For the CEEC the null of no heteroskedasticity was not rejected at the 5 % significance level.

⁶ Significance of the whole block of dummy-variables together was checked with an F-Test (Wald-coefficient-test). The null of zero coefficients could be rejected at the 1 % significance level.

⁷ CEEC regions are not present in all of the groups, therefore no estimation was made on certain coefficients. Group 7 also serves as benchmark in this case. The former Eastern German regions were classified as western European regions.

Table 8: Results of the parametric specification of model 2, based on variables used in cluster analysis

Variable	Western European regions			CEEC			All Regions (EU-25)		
	Coeff.	Std.Err.		Coeff.	Std.Err.		Coeff.	Std.Err.	
GRP 1995	1.02	***	(0.02)	1.3	***	(0.04)	1.04	***	(0.02)
BEDS	0.11	***	(0.02)	0.08	***	(0.03)	0.11	***	(0.01)
% GVA C-F 2002	50	***	(18)	6		(10)	38	***	(16)
% EMP G-P 2002	116	***	(19)	50	**	(10)	110	***	(17)
ACCPOP	-0.05	***	(0.01)	0.02	**	(0.01)	-0.04	***	(0.01)
const.	-4063	***	(1421)	-1553	***	(686)	-3691	***	(1261)
	R ² =0.794			R ² =0.930			R ² =0.838		

Source: JR-InTeReg

7 Literature

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8 Annex

Table 9: List of Abbreviations

Abbreviation	stands for...
GRP	Gross Regional Product
GDP	Gross Domestic Product
GVA	Gross Value Added
PPS	Purchasing Power Standards
GRPp.cap	Gross Regional Product per capita
BEDS	Beds in hotel per 1000 habitants
DENS	Population density
%GVAC-F	Percentage of gross value added in the secondary sector
%EMPG-P	Percentage of employment in the tertiary sector
%EMPA-B	Percentage of employment in the primary sector
ACCPOP	Accessibility of population

Table 10: Pearson's Correlation between the variables used in the cluster analysis of non-urban areas

All data from 2002	Population density	Share of gross value added in the secondary sector	Share of Employment in the tertiary sector	Accessibility of population
Population density	1			
Share of GVA in the secondary sector	,048	1		
Share of Employment in the primary sector	-,423(**)	-,241(**)		
Beds in hotels per 1000 habitants	,026	-,178(**)	,168(**)	1
Accessibility of population	,507(**)	,094(**)	,357(**)	-,156(**)

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

Table 11: Pearson's Correlation between the variables used for the cluster analysis among the urban-areas

All data from 2002	Share of employment in the tertiary sector	Population density	Inhabitants
Share of employment in the tertiary sector	1		
Population density	,363(**)	1	
Inhabitants	,166(*)	,358(**)	1

** Correlation is significant at the 0.01 level (2-tailed). Correlation is significant at the 0.05 level (2-tailed).

Table 12: Pearson's Correlation between the variables used for model 2

	GRP 1995	ACCPop	% EMP G-P	% GVA C-F
GRP 1995				
ACCPop	0.344			
% EMP G-P	0.116	0.160		
% GVA C-F	0.323	0.048	-0.371	
BEDS	0.240	-0.012	0.436	0.135

Table 13: Average annual growth rates of performance- and structural indicators 1995 - 2002

Region Type	Average annual growth rate of				
	Total GRP in mil. Euro	GRP per capita in PPS	GVA, primary sector in mil. Euro	GVA, secondary sector in mil. Euro	GVA, tertiary sector in mil. Euro
Agricultural rural peripheral regions	6,44	4,87	1,42	5,22	6,81
Industrial rural peripheral regions	4,54	4,08	0,39	3,78	5,39
Highly intensive touristic regions	5,52	4,86	2,30	4,47	5,47
Touristic Regions	4,00	3,74	2,11	3,08	4,45
Highly industrialized areas	4,34	4,02	0,32	3,98	4,42
Industrialized regional centres with surroundings	2,91	3,38	0,50	1,86	3,56
Tertiary regional centers with surroundings	2,95	3,19	1,29	0,98	3,39
Central agglomerations	3,47	3,82	-0,01	1,16	4,48
Industrial cities	3,63	3,69	0,47	0,86	3,98
Tertiary cities	3,40	3,67	-1,97	1,08	4,17
Metropolises	5,88	4,44	0,61	4,48	6,74
Total	4,06	3,85	0,48	2,58	4,55
	Employment primary sector	Employment secondary sector	Employment tertiary sector	Unemployment rate⁸	
Agricultural rural peripheral regions	-0,97	1,21	0,95	10,49	
Industrial rural peripheral regions	-2,58	0,74	1,59	9,97	
Highly intensive touristic regions	-1,32	1,46	1,25	1,73	
Touristic Regions	-1,57	0,35	1,44	6,79	
Highly industrialized areas	-2,73	0,00	1,58	6,06	
Industrialized regional centres with surroundings	-2,32	-0,62	1,50	8,06	
Tertiary regional centers with surroundings	-1,80	-0,63	1,44	9,36	
Central agglomerations	-1,70	-1,28	1,82	7,48	
Industrial cities	-0,38	-1,58	1,60	8,30	
Tertiary cities	0,36	-1,97	1,32	8,49	
Metropolises	-3,42	-1,34	1,61	7,99	
Total	-1,92	-0,48	1,52	8,11	

Source: EUROSTAT (2005), own calculations JOANNEUM RESEARCH, InTeReg

⁸ Non-weighted average unemployment rate of the group members.