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Aspatial Peripherality in Europe. Cartographic and statistical analyses

Deliverable 28 of the AsPIRE-Project
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PREFACE

AsPIRE is a European research project funded by the EU Fifth Framework Programme. It is concerned with the changing nature of peripheral disadvantage. Recent decades have witnessed technological advances in transport and communication which have created the potential for gradual but fundamental changes in relationships between accessible “core areas” and the less accessible “periphery”. However, some peripheral regions seem to take advantage of these new opportunities, whilst others, perhaps more accessible in conventional spatial terms, seem to lag behind. AsPIRE seeks to explain these differences in response.

Aspatial Peripherality (AsP) is a term to collectively describe a range of processes which are increasingly emerging to compound or distort the handicaps conventionally associated with remote locations. Thus at a time when physical distance or travel/freight costs are becoming less and less a constraint to economic activity and quality of life, the benefits to peripheral and more accessible regions alike may be masked by the effects of poor utilisation of new information and communications technology, or by inadequate networks linking local business, development agencies and global sources of information or markets. Similarly aspects of social capital, characteristics of regional governance or institutional structures may result in relative isolation from the core regions which are perceived as the motors of economic and social change. On the other hand, peripheral regions in which such essentially non-geographical characteristics exert benign effects are likely to exhibit higher rates of economic growth and better quality of life than would normally be associated with such remote locations.

The research project is structured in such a way that the complex AsP concept is first explored through a number of themes addressing the impact of information technology, business networks, governance, social capital and tourism. After an initial review of the theoretical literature, the themes are brought together for integrated case study work in the six countries represented in the research team (UK, Ireland, Finland, Germany, Spain and Greece). In each of these countries two case study areas have been selected to illustrate different responses to the changing nature of peripherality. Some of the case study areas have been selected because they appear to be performing relatively well despite a peripheral location (in conventional spatial terms). These could be said to exhibit “*low AsP*”. Others seem to be under-performing in relation to their location, and could be described as having “*high AsP*”.

The case studies will provide information on the nature and causes of different regional responses to the changing nature of peripherality which will be drawn together in the latter stages of the project, to form the basis of more appropriate peripherality indicators, best practice guidelines, and policy implications.

I INTRODUCTION

The AsPIRE project has so far accomplished to elaborate the conceptual framework of its major concepts (Work Packages 1-6), conducted 24 regional case studies (WP 7) and is finalising a policy evaluation and compiling best practice examples (WP 8 and 9). The concluding task of the project is to identify and analyse statistical indicators of aspatial peripherality (WP 10). According to the Technical Annex the main *objectives of WP 10* are to

- devise a set of operational indicators of aspatial peripherality and set up a corresponding statistical database for the entire EU at an appropriate level of regional detail (Deliverable 18),
- carry out a statistical and cartographic analysis of the relationship between these aspatial peripherality indicators and economic performance indicators (Deliverable 28) and
- develop an interactive assessment tool through which regional actors are able to assess their region's qualities or weaknesses in regard to aspatial peripherality (Deliverable 29).
- to devise a plan for regular collection and publication of relevant indicators of aspatial peripherality by an appropriate public institution (Deliverable 30).

The present Deliverable 28 is to make use of the database established in D 18 by providing cartographic patterns of aspatial peripherality and a quantitative analysis of the linkages between different factors of aspatial peripherality and key economic indicators.

The *structure of the report* is as follows: Chapter 2 delimitates rural regions, provides the degree of peripherality in conventional terms based on the AsPIRE Baseline Indicator developed in Deliverable 1, presents the economic performance of regions and relates those indicators to the AsPIRE Baseline Indicator in order to assess the potential magnitude of factors of aspatial peripherality in the regions. Chapter 3 presents and discusses for each of the five thematic themes of AsPIRE (ICT, Business networks, governance, social capital, tourism) key aspatial peripherality indicators of the database established in D18. Chapter 4 will relate a selection of aspatial peripherality indicators to the key economic indicators in order to provide a first assessment of the explanatory power of those indictors for regional economic development. Chapter 5 will then assess the combined effect of the aspatial peripherality indicators from all thematic fields by multivariate regression analysis. The report concludes with a summary of the main findings on spatial patterns of aspatial peripherality and its relationship with key economic indicators..

II Rurality, Peripherality and Prosperity – Classification of European Regions

AsPIRE is concerned with the economic performance of rural regions in relation to the geographical position of the regions within Europe. The function of this chapter is to classify the NUTS-3 regions of the fifteen member states of the European Union with respect to rurality, peripherality and economic prosperity in order to provide a base for the further analyses in the report. The degree of regional peripherality in conventional terms is provided in Section 2.1 based on the AsPIRE Baseline Indicator developed in Deliverable 1. Section 2.2 presents the economic performance of regions in terms of GDP per capita. Rural regions are determined in Section 2.3. Finally, Section 2.4 combines the three regional aspects in order to assess the potential magnitude of factors of aspatial peripherality in rural regions.

2.1 Central and Peripheral Regions

A periphery can be defined as a region with low accessibility. However, this is far from being the whole story; peripherality is a contextual category loaded with numerous meanings, and in addition to accessibility, many other criteria are used to delineate centres and peripheries in regional research (see for instance Eskelinen and Snickars, 1995). Notwithstanding this qualification, accessibility is clearly a key criterion of geographical peripherality, and also of major importance in defining economic peripherality, as location (either as a pure geographical factor or in relation to transport networks) is indisputably a conditioning factor for the competitiveness of regions.

The ranking of regions in terms of accessibility depends on the indicator used. The choice of the mode of transport, or a combination of modes is a key issue in this context. In empirical terms, for example it is of interest to what extent accessibility to population *by road* of peripheral regions differs from their accessibility to population *by air.* Most analyses of accessibility have focused on differences between regions with high accessibility, and peripheries have remained an undifferentiated residual. There is a need to pay more attention to the internal differences and distinctive features of peripheral regions in empirical analyses.

The most frequently applied and most extensively tested accessibility indicators are potential indicators. The potential of an area is the total of the destinations in other areas that can be reached from the area discounted by a negative function of the effort to reach them. In the

Study Programme on European Spatial Planning such potential indicators have been proposed as reference indicators for analysing spatial development (Wegener et al., 2000; 2002). Three kinds of potential accessibility indicators were suggested. The first two measure accessibility to population, the last one accessibility to economic activity (expressed by gross domestic product, or GDP). Accessibility to population is an indicator for the size of market areas for suppliers of goods and services; accessibility to GDP an indicator of the size of market areas for suppliers of high-level business services.

However, for the purpose of this study, a single indicator describing peripherality in conventional terms is necessary, i.e. a single value for a region should represent its position. The basic requirements for such an indicator are comprehensiveness, simplicity and explanatory power. Previous work has shown that multimodal potential accessibility indicators, i.e. indicators that aggregate over transport modes, have a much higher explanatory power than accessibility indicators based on a single mode only (Fürst et al., 2000). For that reason, a logsum accessibility potential aggregating over road, rail and air transport has been defined as AsPIRE Baseline Peripherality Indicator (see Deliverable 1, Spiekermann et al., 2002).

The AsPIRE Baseline Peripherality Indicator has been calculated for NUTS-3 regions. The indicator values have been standardised to the European Union's average and have been grouped in five classes: central regions that are clearly above average, intermediate regions that are about average and three classes of peripheral regions.

Figure 2.1 presents the AsPIRE Baseline Peripherality Indicator for the territory of the European Union. Not surprisingly, central regions are located in an arc stretching from Liverpool and London via Paris, Lyon, the Benelux regions, along the Rhine in Germany to Northern Italy. However, also some agglomerations in more remote areas such as Madrid, Barcelona, Dublin, Glasgow, Copenhagen, Rome and Naples are classified as being central or at least intermediate because their international airports improve their accessibility. At the same time, the European periphery already begins in regions that might usually be considered as more central. So, several regions in France, even in northern and eastern parts of the country, or Germany, mostly in the New Länder, are classified as peripheral or even as very peripheral having an accessibility of only about half of the European average. With the few exceptions mentioned above, the regions of Portugal, Spain, Ireland, Scotland and Wales, the Nordic countries, Austria, southern Italy and Greece are very or even extremely peripheral. The example of the Iberian peninsula shows that extremely peripheral regions are not necessarily located at the very edge of Europe, but might also be between large agglomerations.

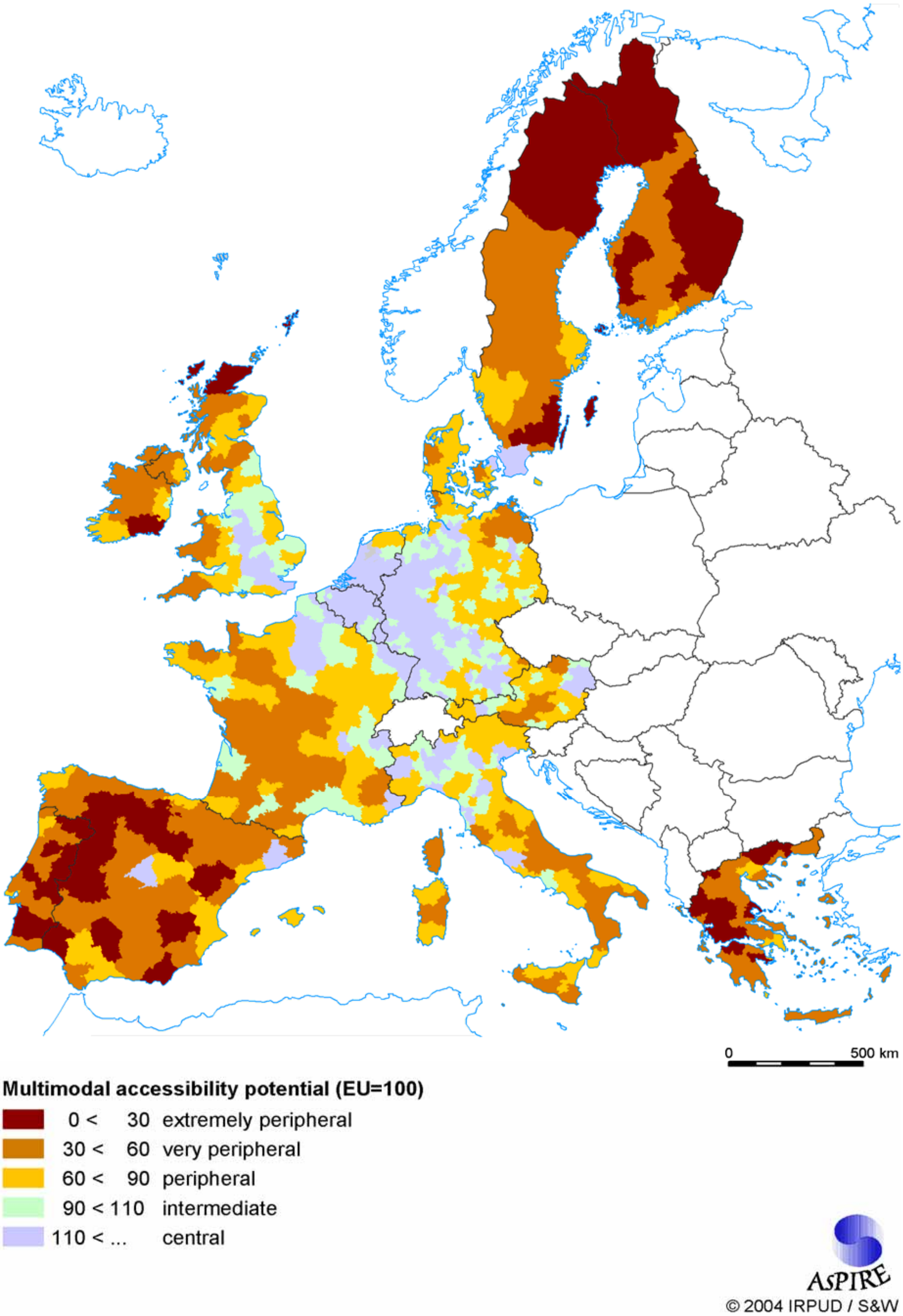

Figure 2.1. AsPIRE Baseline Peripherality Indicator at NUTS-3 level.

2.2 Regional Economic Performance

As reference indicators for the regional economy most often GDP per capita and productivity expressed as GDP per worker are used. Both indicators have advantages and disadvantages. Whereas GDP per capita is predominantly used as proxy for the welfare of a region and is therefore found in many reports addressing spatial disparities in Europe, it has the inherent problem of not properly matching income because of commuting. Productivity might be much better suited when talking about economic potential, at the same time, it must not in any case reflect regional income. Both indicators, GDP per capita and GDP per worker, have been tested for this study (see Deliverable 1, Spiekermann et al., 2002). For this deliverable, GDP per capita has been selected for the further analyses.

Figure 2.2 shows the spatial pattern of GDP per capita in the European Union at NUTS-3 level. The indicator is standardised to the European Union's average. The map repeats the well-known distribution of successful and less successful regions in Europe. The major agglomerations in France, Belgium, the Netherlands Germany, Austria, northern Italy, Denmark, Sweden and Finland have a clearly above-average GDP per capita. Most other parts of these countries are performing about average. However, a substantial number of regions in France, Belgium, the Netherlands, Austria, and in eastern Germany are performing far below EU average.

On the other hand, nearly all regions in Portugal, Spain, southern Italy, and Greece have clearly below average GDP per capita. Lowest values with even less than 60 percent of EU average are located in Portugal, south-western parts of Spain, southern Italy, and in most parts of Greece.

2.3 Rural Regions

The concept of 'rurality' is far from being clearly defined. In some countries, regional units (provinces, counties etc.) are classified as rural in relation to the predominant type of land use or the share or employees working in the agricultural sector; in others, rurality is associated with a set of socio-economic variables such as ratio of active and inactive population, use of public transport or penetration rate of phone contracts (Bengs and Schmidt-Thomé, 2003, part 2, 66ff). According to the OECD (1994), there are also countries where "an official definition of 'rural' does not […] exist" (p. 17, quoted in Shucksmith et al., 2001).

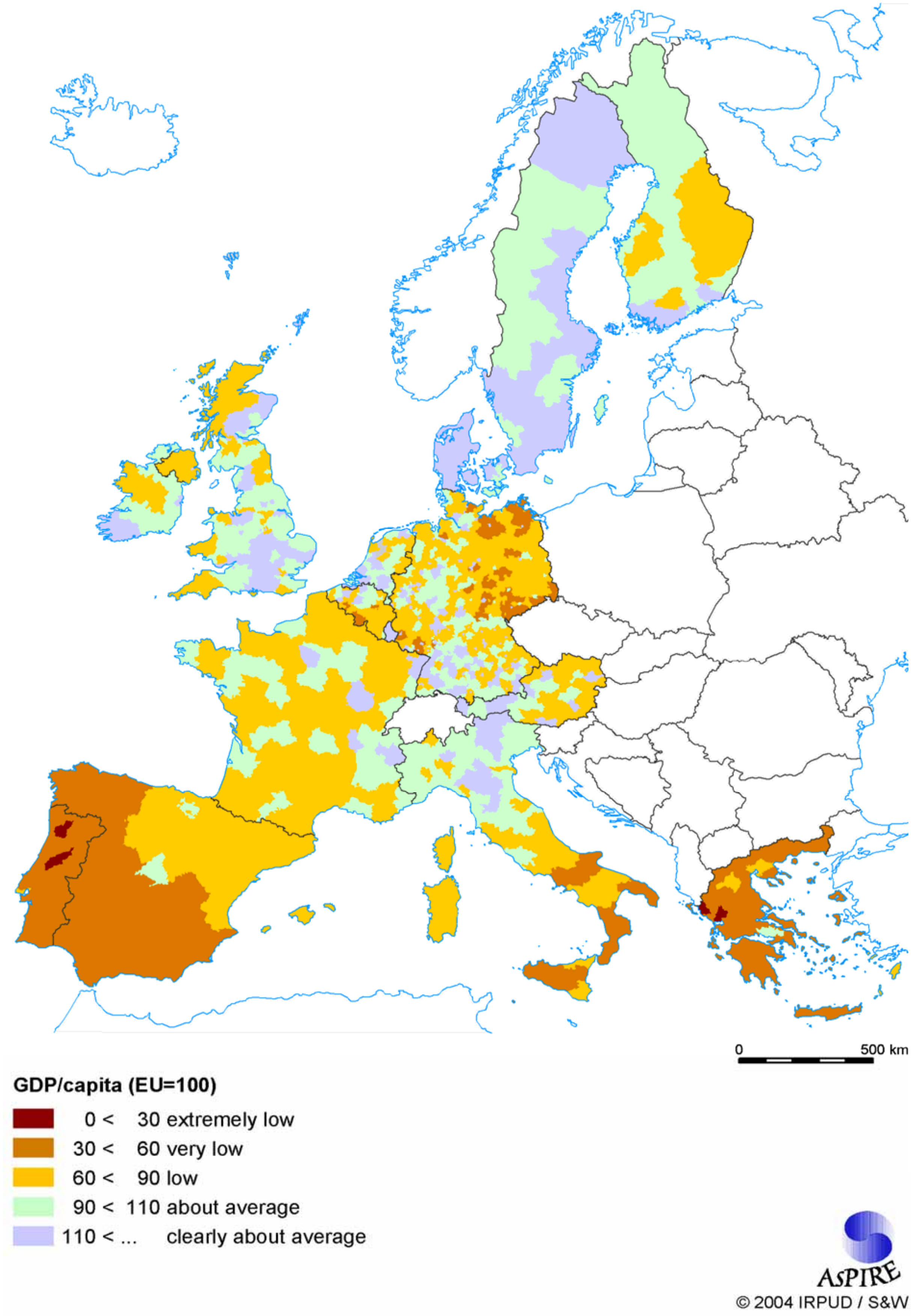

Figure 2.2. Economic performance of NUTS-3 regions of the European Union.

Hence it is not surprising that "several attempts at formulating a single and common international definition of rural areas or rurality have been made, without success, since national conditions and interests are very different" (Shucksmith et al., 2001, 10). There exist, however, some first proposals provided by international organisations and research groups to define features and thresholds of rurality to be used in cross-national comparisons:

- According to a categorisation developed by the OECD, a region can be classified as 'predominantly rural' if more than 50% of its inhabitants live in rural (sparsely populated) municipalities. A rural municipality in turn is characterised by a population density of less than 150 inhabitants per square kilometre (Meyer 1996). This typology was used in ESPON Project 2.1.3, analysing the territorial impact of the EU Common Agricultural Policy and rural development policy (Arkleton Centre, 2003, part 2, 8)
- In contrast, Eurostat defines rural areas as a group of municipalities with a population density of less than 100 inhabitants per square kilometre. In addition, rural areas are marked by a small total number of inhabitants (usually less than 50,000) and are expected not to border a densely populated area (> 500 inhabitants per square kilometre) (Mouqué 2002, 197-198).
- The most recent typology of rural areas in the EU was developed by ESPON Project 1.1.2 on urban-rural relations in Europe. It is based on three types of indicators: land use, population density and "degree of urban integration", derived from a hierarchical ranking of functional urban areas (FUA) developed in ESPON Project 1.1.1. The application of the three indicators leads to a typology of 10 classes, six of which are classified as in some way rural (Bengs and Schmidt-Thomé, 2003, part 2a, 9)

All three definitions include the indicator of population density, though they differ with regard to the proposed threshold of rurality (100 vs. 150 inh./km²), the level of observation (municipalities vs. regions) and the additional indicators considered. For the purpose of the AsPIRE Project, the threshold proposed by the OECD is adopted and rural areas are defined as those NUTS-3 regions with a total population density of less than 150 inhabitants per square kilometre. However, different from the OECD classification, the density is calculated at regional instead of municipal level. In addition, a second criterion is used: Rural areas shall not dispose of a centre of more than 100,000 inhabitants. This incorporates the criticism formulated by Shucksmith et al. (2001) that the sole use of population density in defining rural areas is problematic, "since densities which might be appropriate to England or France (e.g. below 100 or 150 inh./km2 for rural regions) include even most of the larger towns, and even cities, in sparsely populated countries like Finland and Sweden" (Shucksmith et al., 2001, 10) The limit of 100,000 inhabitants corresponds to the one used in the official German classification of rural areas (BfLR, 1997). In order to reflect the case study work of the AsPIRE project, all NUTS-3 regions which contain a case study region (which often cover only a small part of a NUTS-3 region) are classified as being rural for the further analyses.

According to the chosen typology, rural areas comprise 23.2% of the EU population. As expected, the highest share of rural areas is found at the geographic periphery of the European Union, namely in Ireland, Portugal, Spain, Greece and the Scandinavian countries. However, also large sections of the Austrian, the German and the French territory are classified as rural (see Figure 2.3). Especially the German example reveals the problems deriving from the unequal size of the regional units considered: As the German NUTS-3 regions are at average substantially smaller than in any other European country, the share of areas falling beneath the proposed thresholds of rurality is relatively high. In contrast, in countries with generously cut NUTS-3 regions such as Spain, large sections of the territory are not included in the typology of rural areas. Despite these shortcomings it is preferred to stick to one level of the NUTS typology – the NUTS-3 level.

2.4 Location and Regional Economy

How does relative location relate to the regional economy and what is its importance for rural regions? This section presents an analysis of the relationship of geographical position and economic performance, i.e. it demonstrates to what degree location still matters.

Figure 2.4 compares the AsPIRE Baseline Periphery Indicator with GDP per capita for NUTS-3 regions. Each dot on the diagram represents one NUTS-3 region. Looking at the figure, one might ask whether there is a relationship at all. The correlation coefficient r^2 is 0.29 for all regions. If only rural regions (green dots) are considered, the correlation coefficient r^2 is 0.18, i.e. the relationship between location and economic performance is less pronounced for rural regions than for all regions.

The data can be used to show which regions in Europe conform to the traditional hypothesis that more accessible regions are economically more successful and which are not. This can be done by classifying regions by their position in the correlation diagram of accessibility and economic performance (Figure 2.4) , i.e. with respect to their residual or distance from the diagonal.

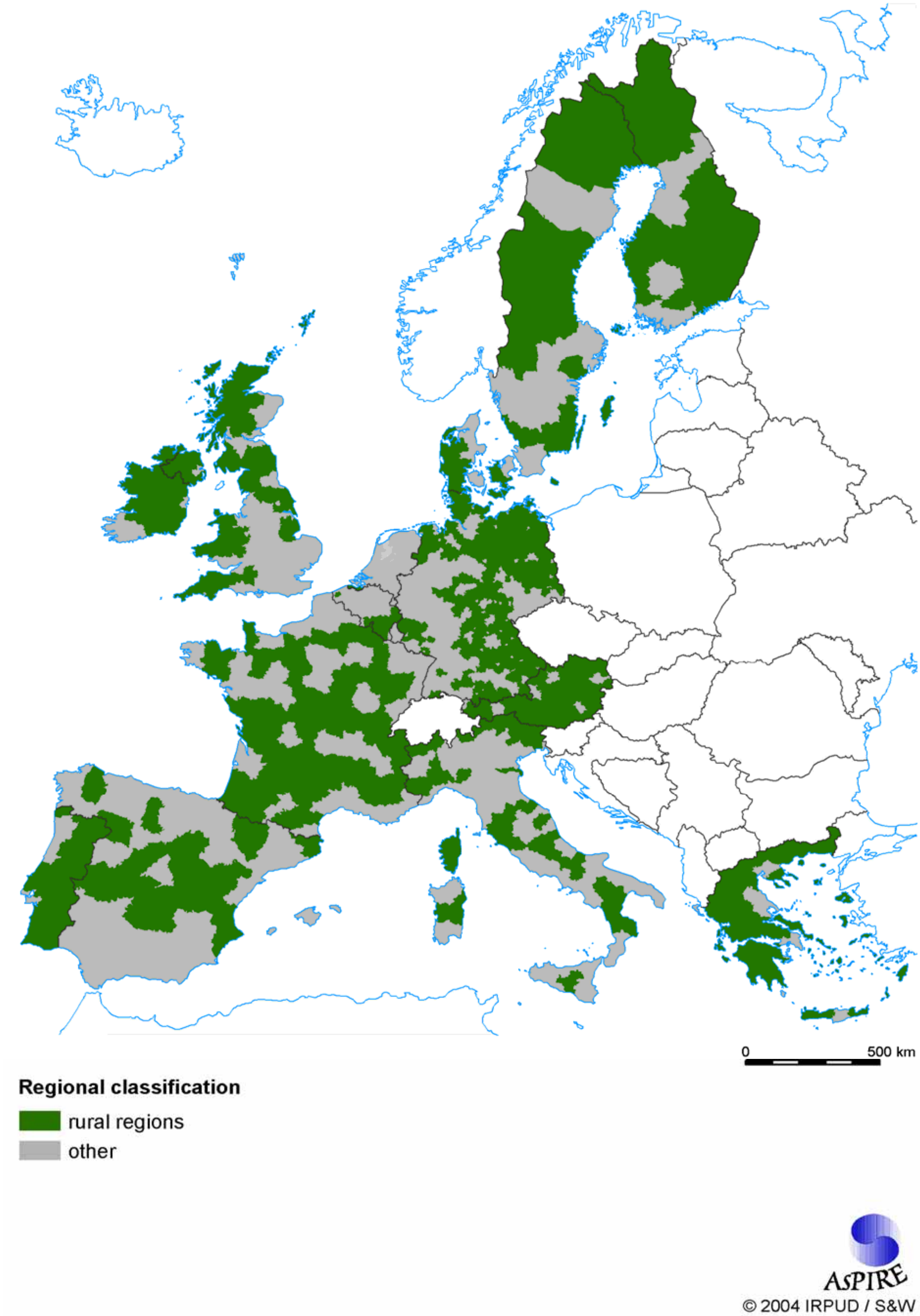

Figure 2.3. AsPIRE delimitation of rural NUTS-3 regions in the European Union.

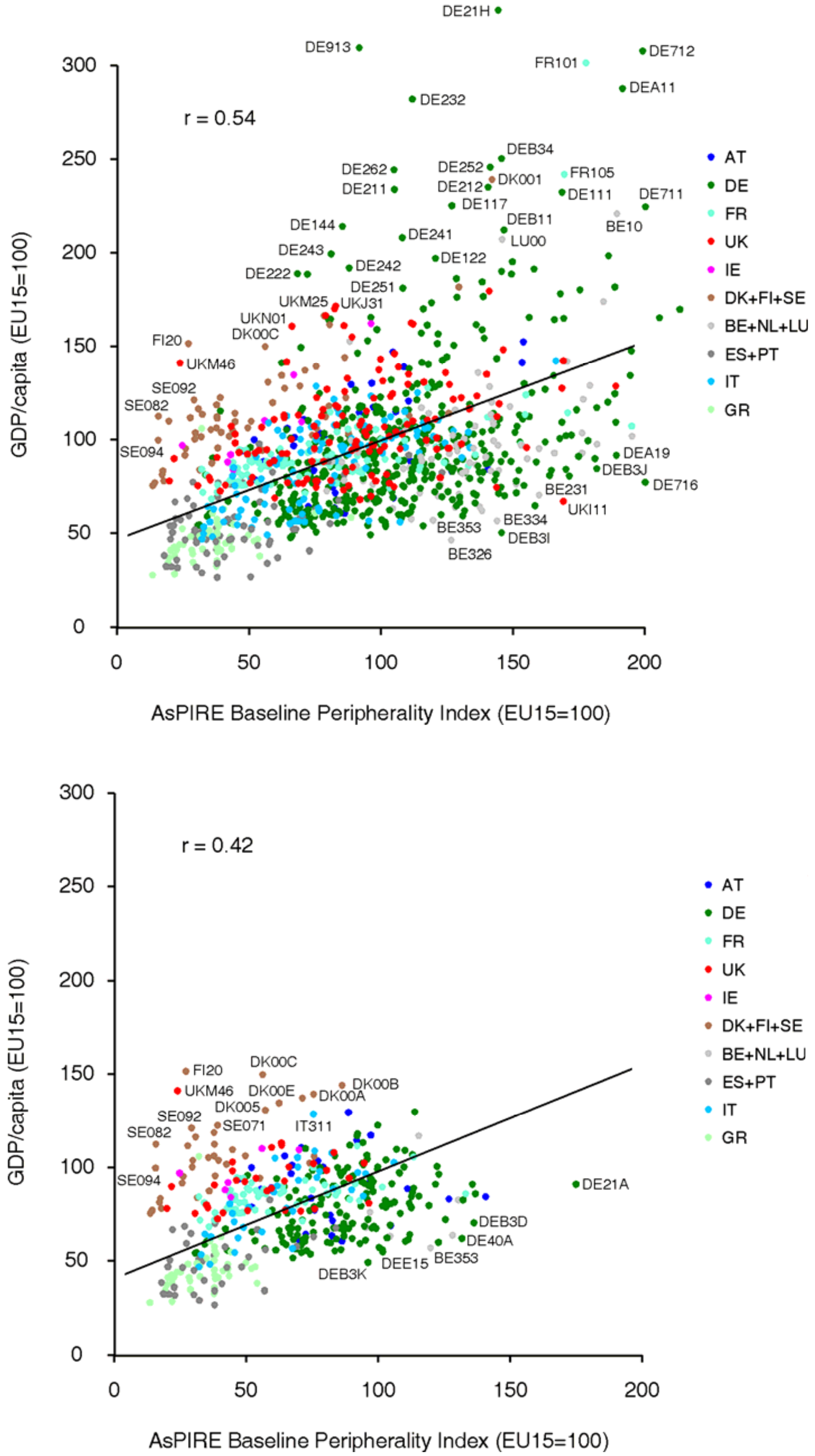

Figure 2.4. Accessibility v GDP/capita for NUTS-3 regions, all (top), only rural (bottom)

Figure 2.5 shows the spatial pattern of the residuals of AsPIRE Baseline Peripherality Indicator combined with GDP per capita. The regions are coloured according to their relative position to the diagonal in the scatter diagram of Figure 2.4. The following types of regions can be distinguished:

- The regions coloured in red perform economically better than their accessibility would suggest. Of these only some regions have above-average accessibility. The largest number of regions in this class, are peripheral regions in Portugal, Spain, southern France, Italy, Ireland, Scotland and in the Nordic countries.
- The regions coloured in blue are economically less successful than their accessibility would suggest. This group mainly includes regions with high and very high accessibility in the centre of Europe. Many regions belong to the economic centres of Europe. Another group are regions with economic problems, among them many old industrial regions in England, northern France, Belgium, the Netherlands and Germany. In these regions, the regional economy is not able to fully utilise the enormous locational potential. The real bottlenecks for their development seem not to be transport related but rather over-agglomeration diseconomies in the case of large agglomerations or an outdated economic structure in the case of old industrial cities.
- The regions in green are located in a buffer zone along the diagonal. They conform to the hypothesis that the higher the accessibility the higher the economic performance and vice versa, i.e. their residuals are small. Such regions do not show a clear spatial pattern as they can be found anywhere in Europe.

The spatial pattern of residuals suggests in general that peripheral regions perform better in economic terms than their location would suggest. And, vice versa, that more central regions have an economic performance that is lower than their location would suggest.

Figure 2.6 shows the same data as the previous map, but is restricted to rural regions only. Now it becomes visible which rural regions perform economically better than their location would suggest and which do not.

- Nearly all rural regions in the Nordic countries perform economically clearly above expectation given their peripheral location.
- Also most of the UK and Irish regions perform better than their location would suggest.
- In France, most rural regions do better than their location would suggest, however, regions near the French major agglomerations perform only according to their location potential.

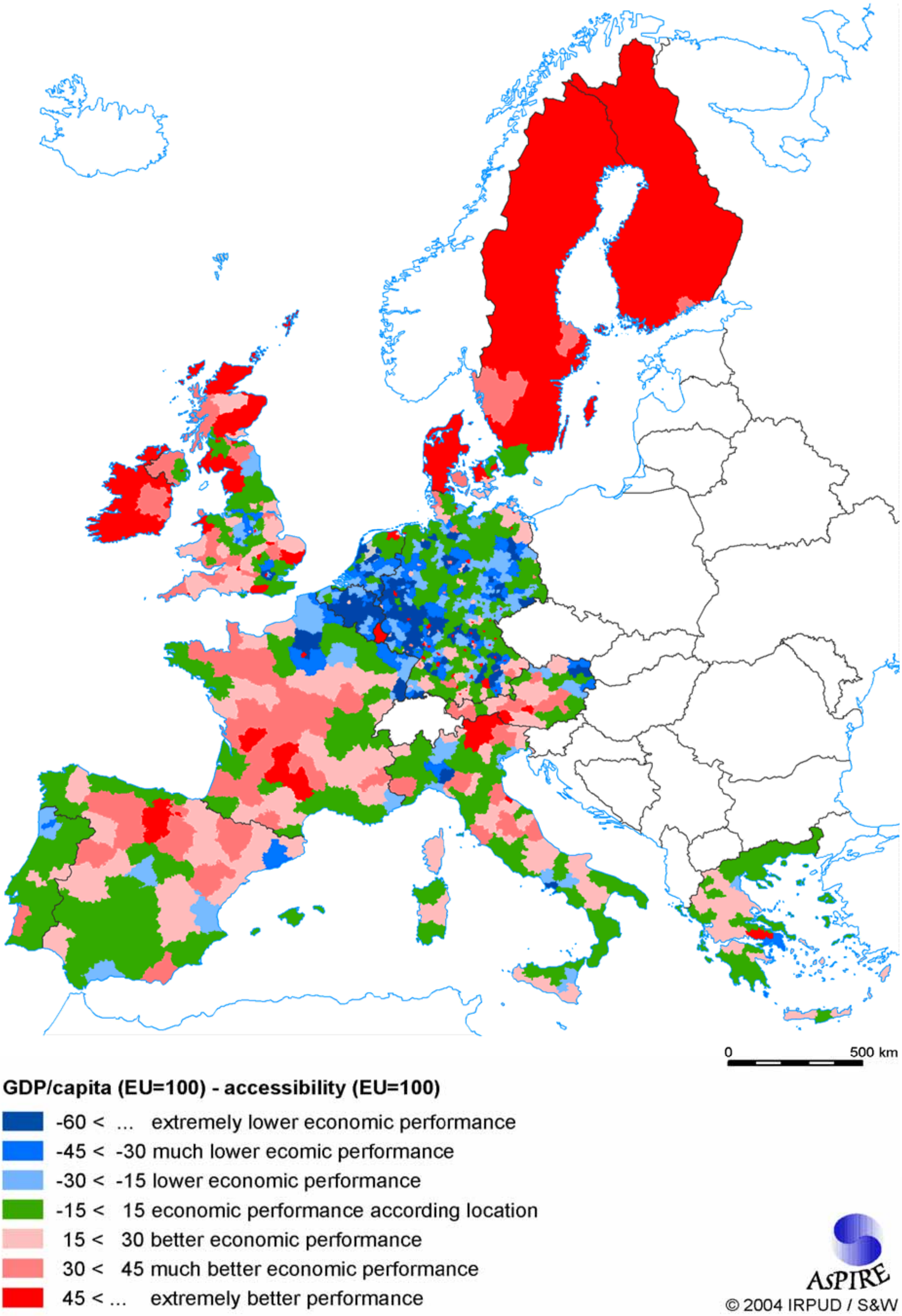

Figure 2.5. Residuals of accessibility v. GDP per capita, all NUTS-3 regions.

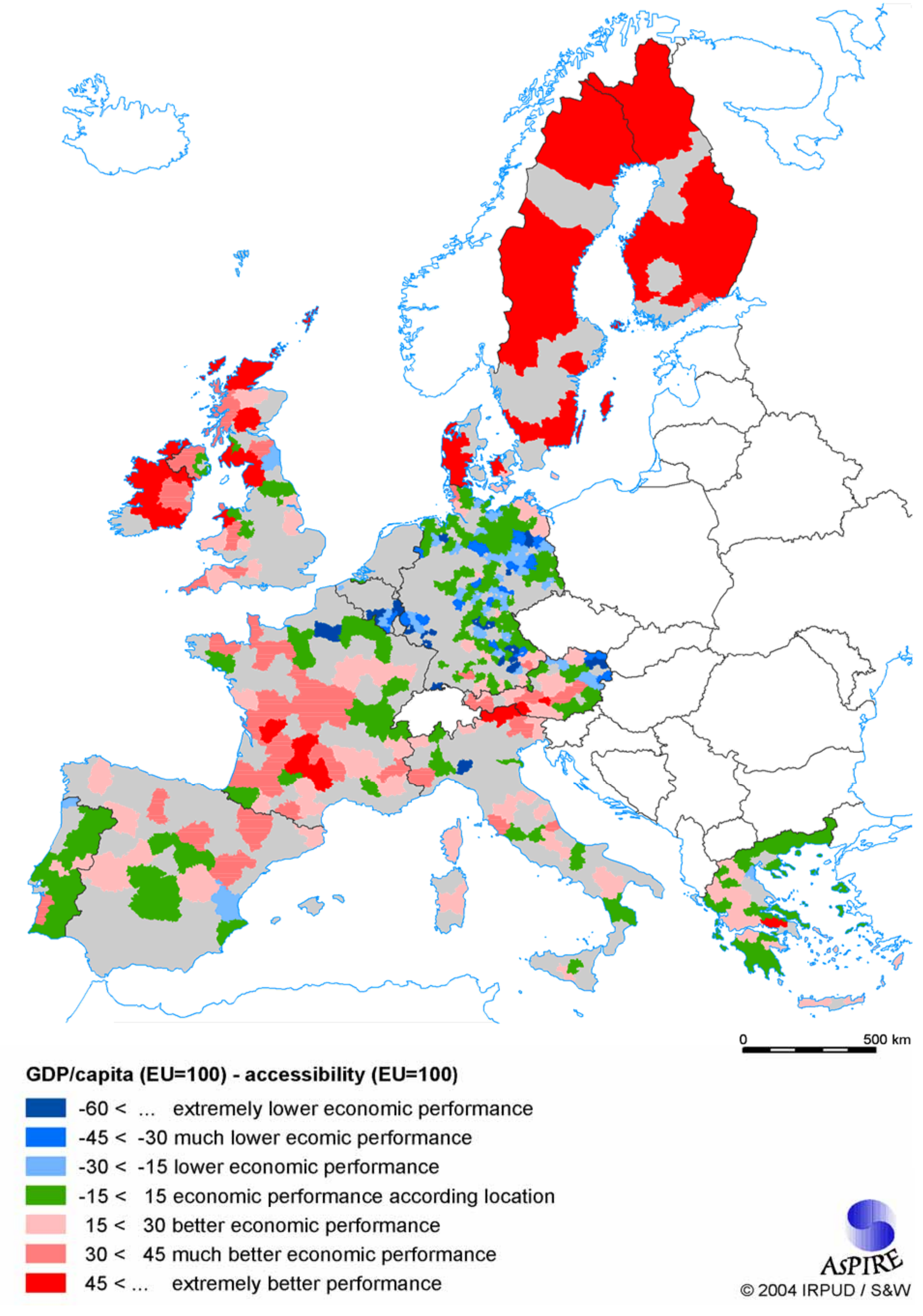

Figure 2.6. Residuals of accessibility v. GDP per capita, rural NUTS-3 regions.

- In Germany, many of the rural regions, located primarily in the New Länder, do much worse than their location would suggest. The remaining regions perform as expected.
- Austrian rural regions are doing better than expectation if they are located in the central parts of the Alps, regions closer to Vienna are only performing as expected or even worse.
- Portuguese rural regions are mostly performing as expected.
- Italian and Greece rural regions are either doing better than the location would suggest or are performing according to their location potential.

In general, there is a tendency that rural regions in peripheral areas tend to perform better than their location would suggest and that rural regions in more central areas do worse. Whereas the former seem to have other assets that compensate for lower accessibility, the latter cannot transfer their locational advantages into an appropriate economic performance. The second observation is that rural regions in southern Europe display a much more differentiated picture than rural regions of northern countries.

The relatively low correlation of the AsPIRE Baseline Peripherality Indicator with regional GDP per worker shows that accessibility is only one of several, transport and non-transport, factors determining regional economic performance. The residual maps show the differences between regional economic performance suggested by the location of a region and its real economic performance based also on other, hard and soft factors. These results confirm one of the basic hypotheses of the AsPIRE project (see Preface) that there are regions that appear to be performing relatively well despite a peripheral location and thus are exhibiting "low Aspatial Peripherality (AsP)" and other regions that seem to be under-performing in relation to their location and thus can be described as having "high AsP". Thereby, the regional or local characteristics can influence the regional economic performance in both directions, positive or negative (see Figure 2.7).

In a situation where relative location can explain only part of regional economic performance, non-spatial issues and soft location factors come into play. Within the AsPIRE project these factors are called aspatial (AsP) factors as they seem not to vary systematically across space. It is the task of the subsequent chapters, first to present those other factors and then to assess their individual contribution and joint interaction for a better explanation of regional economic performance.

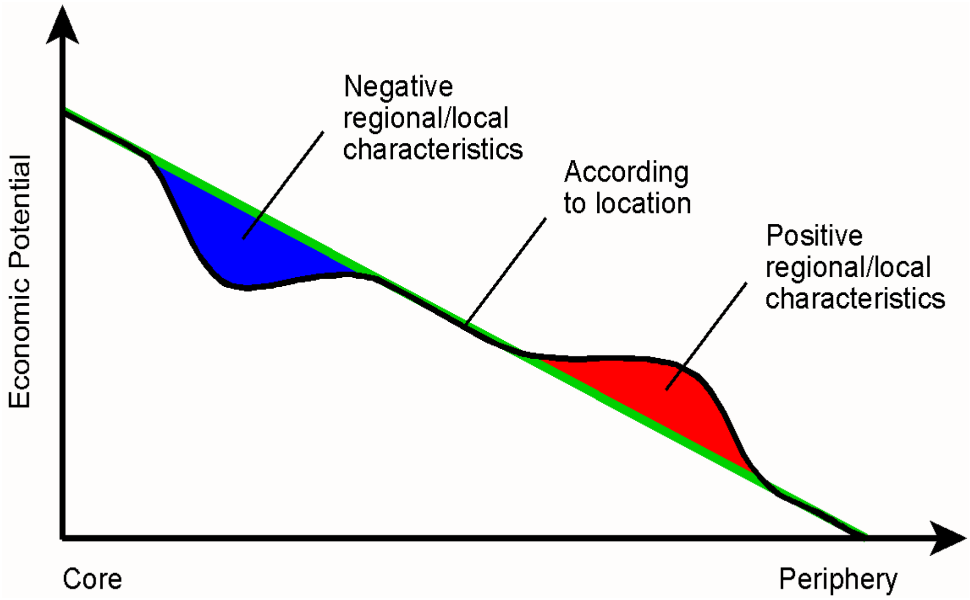

Figure 2.7. AsPIRE Baseline Peripherality Indicator v GDP per capita (NUTS-3 regions).

III Presentation of AsP Indicators

This chapter presents the statistical indicators compiled by the project team to reflect the extent of 'aspatial peripherality' in all regions of the European Union. These indicators were conceptually justified and described in Deliverable D18 (Lückenkötter et al., 2003), so that the current chapter can focus entirely on the data. These are analysed regarding their statistical distribution and, for selected indicators, regarding their spatial distribution across the EU. In line with the conceptual framework of the AsPIRE project the indicators are discussed under the five AsP themes ICT, business networks, governance, social capital and tourism.

3.1 ICT Indicators

In Deliverable D18 indicators on information and communication technology (ICT) were grouped under the following headings: ICT infrastructure, spread of websites, ICT prices, ICT expenditure, use of ICT (by households, by governments, by businesses) and the focal issue of e-commerce. All in all 55 indicators were identified and analysed. Based on data completeness and reliability 22 ICT indicators were selected for further analysis and inclusion in the current deliverable.

Table 3.1 presents these selected ICT indicators, focussing on basic statistical characteristics of the datasets. The table shows the maximum, minimum and arithmetic mean as well as the standard deviation of each indicator. These measures were calculated and are presented in the table for (a) all 1085 NUTS-3 regions and (b) the 442 rural regions of the European Union. Comparing the values of (a) and (b) yields the following overall results:

- For 18 of the 22 indicators the mean of the rural regions is lower than the mean of all regions. This confirms that overall the conditions and the use of ICT in rural regions is lagging behind non-rural regions.
- For 11 of the 22 indicators the standard deviation of the rural regions is higher than the standard deviation of all EU regions. This indicates that in regard to ICT the differences between rural regions are about the same as among the non-rural regions.

As regards the spatial distribution of the ICT data European maps were produced for each indicator. Analysing these maps showed that most ICT indicators display a similar pattern. This can be illustrated by focussing on four maps (see Figures 3.1 to 3.4).

Table 3.1: Statistical characteristics of selected ICT indicators

		All regions (1085)				Rural regions (442)			
		Minimum	Maximum	Mean	St.Deviation	Minimum	Maximum	Mean	St.Deviation
I2	ISDN subscriptions per capita	0.00	0.22	0.10	0.10	0.00	0.22	0.10	0.10
I4	Cable modem/DSL connections	0.00	2.70	0.93	0.68	0.00	2.70	0.87	0.66
I5	Internet access prices ADSL	27.07	113.2	33.81	10.38	27.07	113.2	33.99	11.62
I7B	Price of fixed line telephone call	0.11	0.57	0.42	0.10	0.14	0.57	0.43	0.10
I13	Households using computers	11.00	61.00	29.15	8.93	11.00	61.00	27.00	8.25
I14	Households with Internet access	10.00	64.00	38.24	10.86	10.00	64.00	35.81	11.87
I15	People using E-mail	50.00	85.82	67.29	7.25	50.00	85.82	65.99	8.73
I16	Internet users per capita	0.13	0.52	0.33	0.08	0.13	0.52	0.32	0.09
I17	PCs per 100 inhabitants	8.00	56.00	31.87	9.60	8.00	56.00	30.27	11.09
I22	Employment in IT sector	0.30	5.30	1.59	0.54	0.40	3.20	1.49	0.49
I25	Computer prof. per 1,000 inhabitants	1.33	16.19	7.60	3.09	1.33	16.19	6.95	2.92
I26	IT enterprises per 1,000 population	0.35	2.71	1.03	0.65	0.35	2.71	0.95	0.59
I27	% GDP of IT sector	2.49	7.43	4.20	1.25	2.49	7.43	4.08	1.24
I28	Turnover in the ICT / GDP	0.00	22.57	10.53	3.99	0.00	22.57	10.06	4.83
I33	SMEs using e-government	40.00	131.0	68.41	12.43	40.00	131.0	67.77	14.62
I38	Secure servers / million inhabitants	17.00	155.0	70.71	37.28	17.00	142.0	67.29	38.84
I40	Online sales / total sales	0.06	0.68	0.25	0.12	0.06	0.68	0.24	0.12
I42	Online buyers	0.40	4.70	1.97	0.94	0.40	4.70	1.87	1.08
I46	Internet domains per capita	0.02	0.22	0.06	0.04	0.02	0.22	0.06	0.05
I53	Total ICT expenditure as % of GDP	4.41	9.85	6.82	1.16	4.41	9.85	6.62	1.13
I54	Households using modem	0.65	24.29	4.56	3.44	0.65	17.44	3.93	3.09
I55	Households using online services	0.44	30.00	6.95	4.66	0.44	20.50	5.77	4.17

(blue = higher, red = lower values compared to corresponding values of all EU regions)

Figure 3.1 shows the number of personal computers per 100 inhabitants in the 15 EU member states. The map reveals a clear north-south divide. Scandinavian countries as well as the Netherlands and Luxembourg have the highest density of computers, followed by Ireland, UK and the other central European countries. The southern European countries finally have a much lower computer density, in fact Greece's density is less than one fifth of Sweden's computer density.

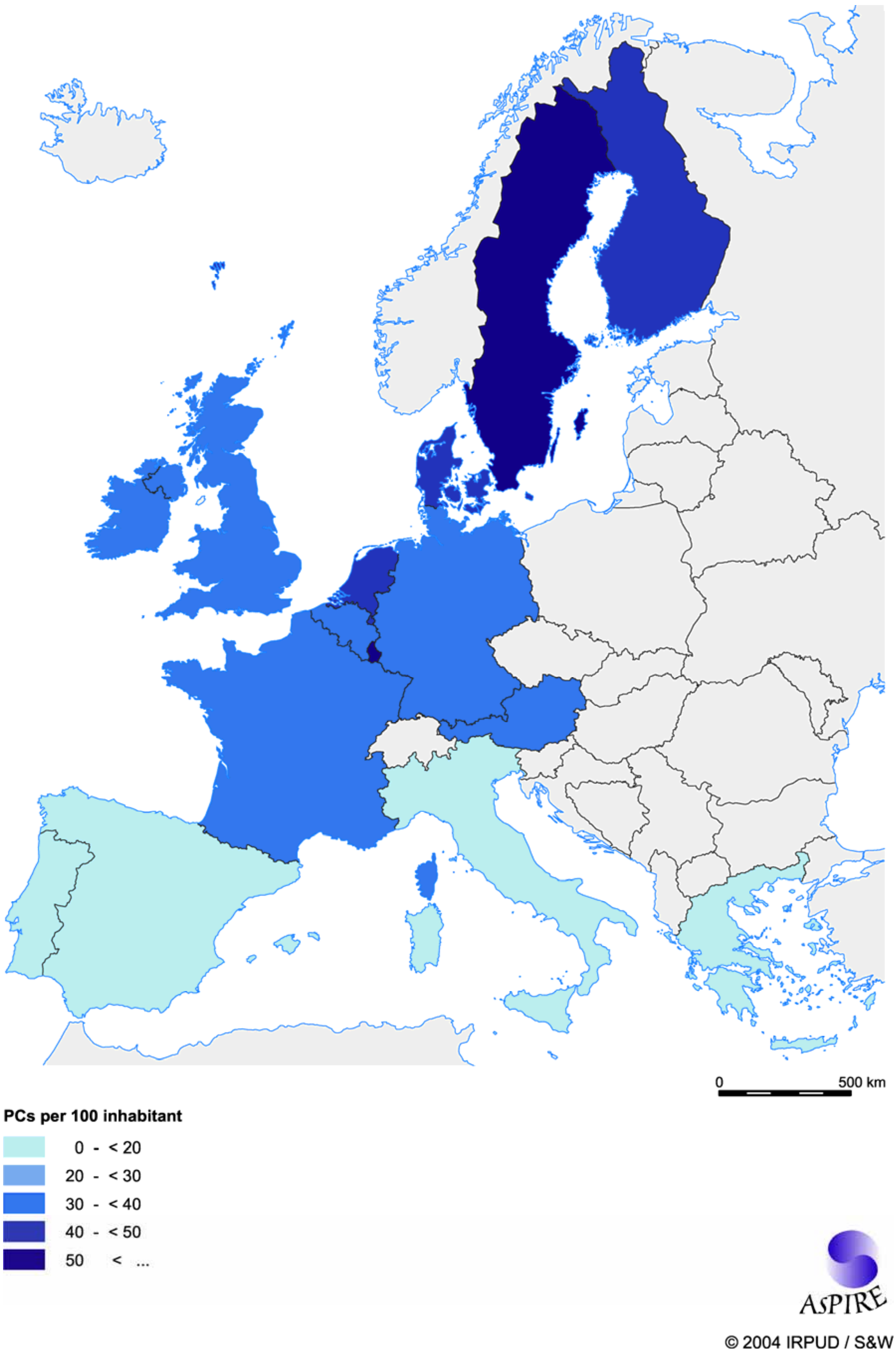

Figure 3.1. I17 – PCs per 100 inhabitants 1999-2001 (Eurostat 2002)

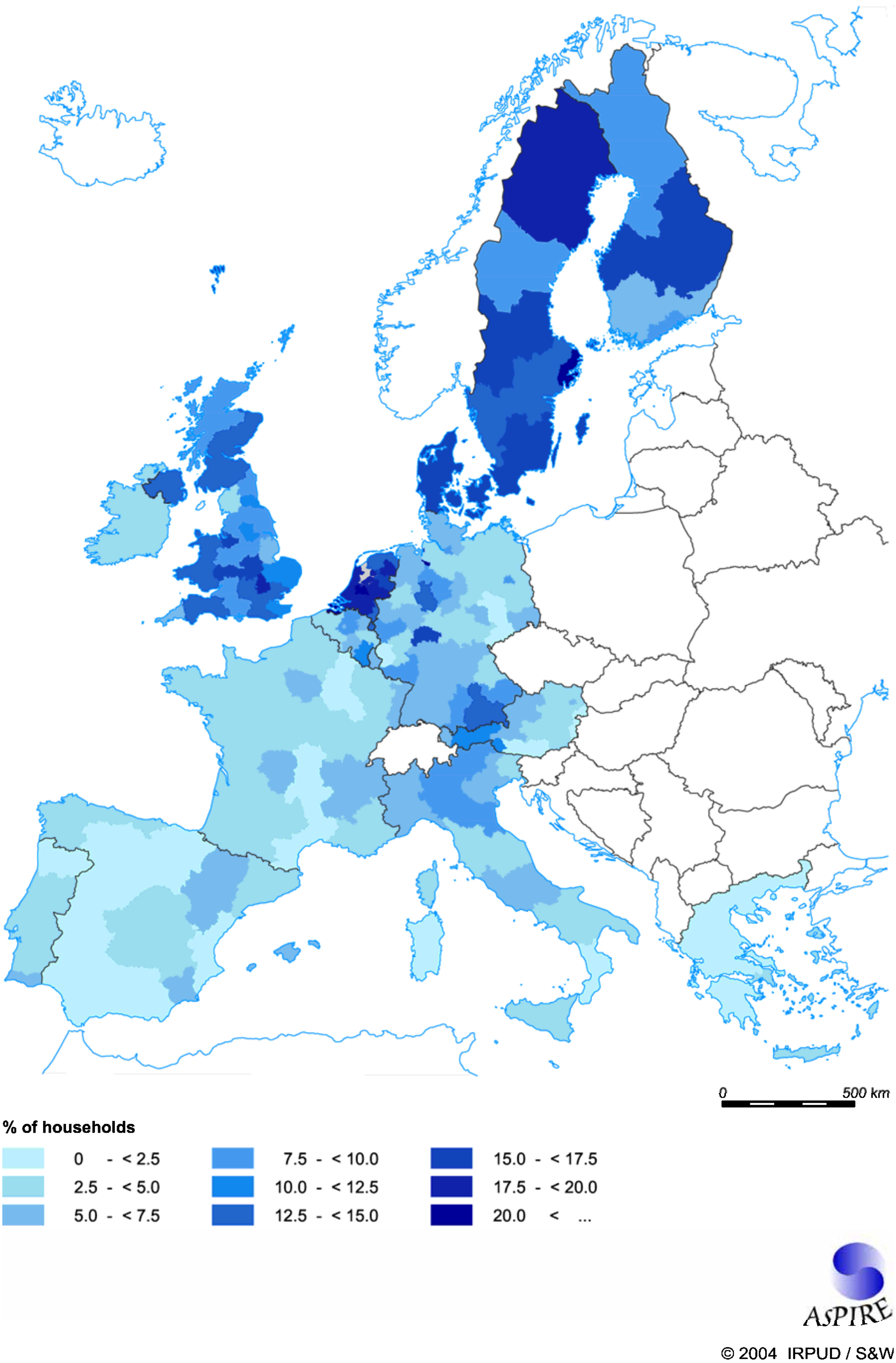

Figure 3.2. I55 – Households with access to or using online services 1996 (Eurobarometer)

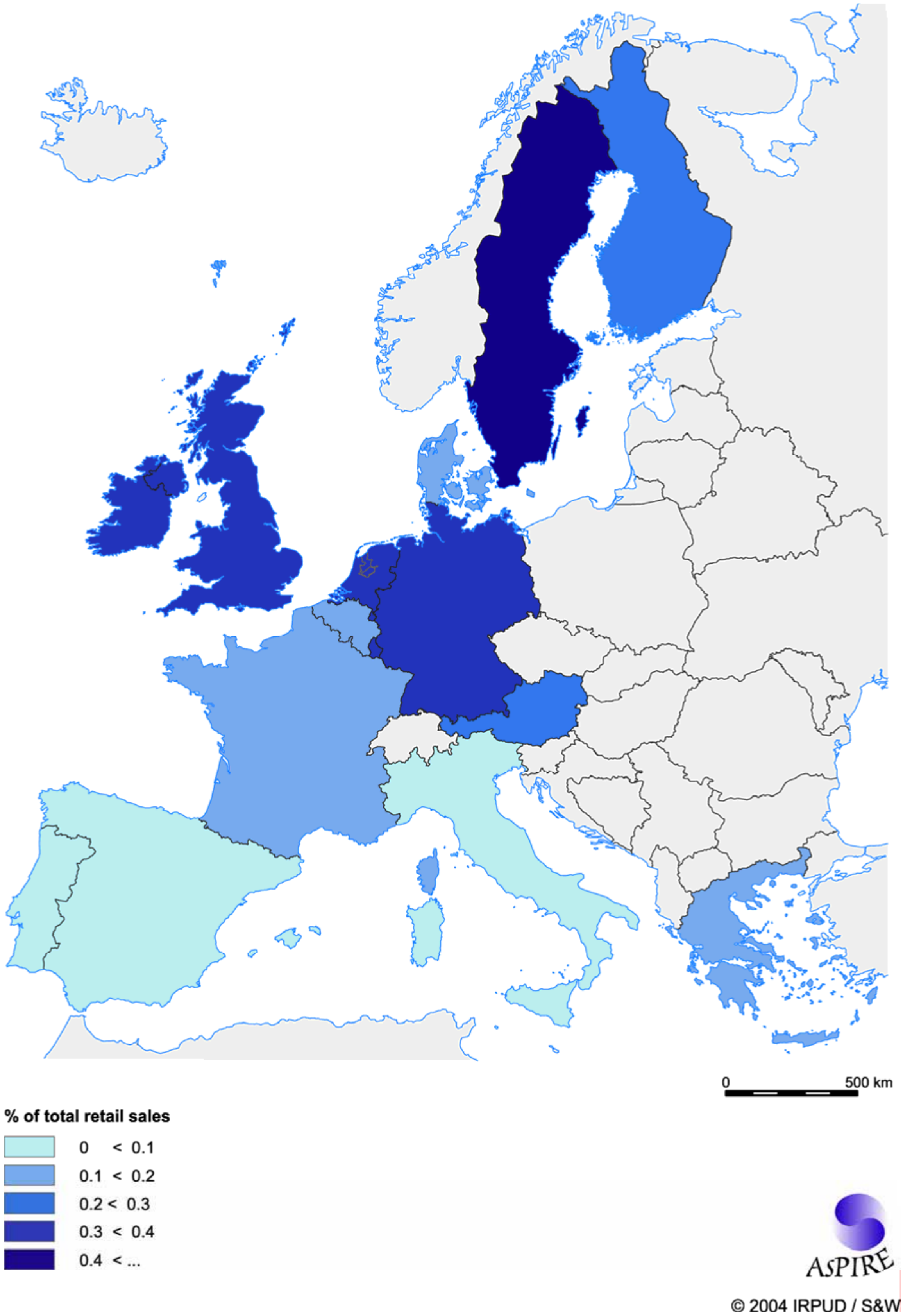

Figure 3.3. I40 – Share of online sales on total retail sales in 1999 (Eurostat 2002)

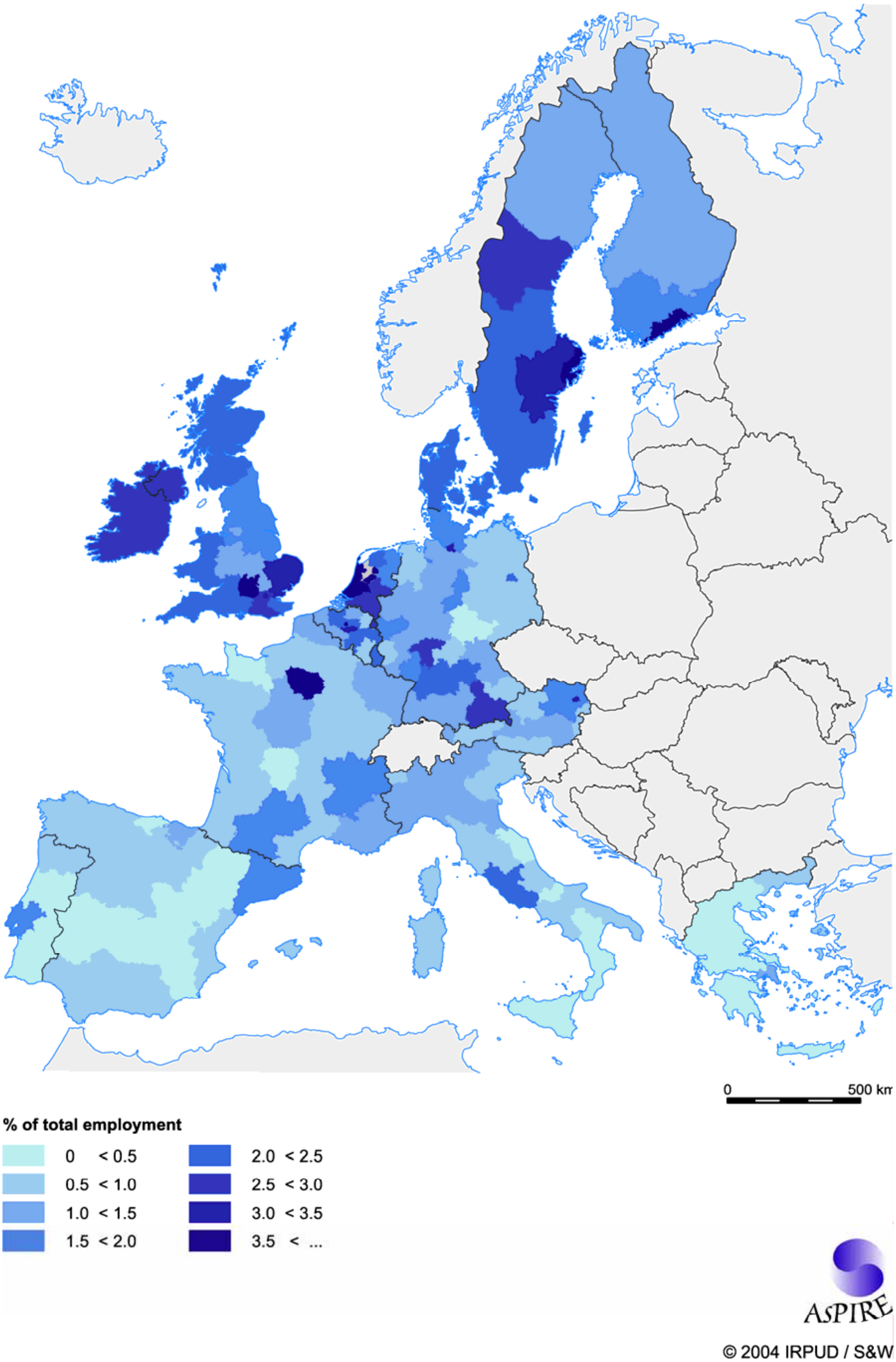

Figure 3.4. I22 – Share of employment in IT sector in 1999 (Emergence 2003)

While the previous indicator reflected entirely on ICT infrastructure, I55 also addresses the use of ICT. Figure 3.2 shows the share of households that have access to or use the internet. Even though the internet penetration rate has surely increased significantly since 1996, the assumption is that the overall patterns of advanced, 'pioneering' regions and 'laggard' regions persist. These patterns are almost identical – albeit on a more fine-grained geographical resolution – to the previous indicator. The only noteworthy difference is UK's more advanced position compared to most of central Europe. Within countries differences are in some but not all cases very significant (e.g. in Germany and the UK), clearly highlighting the advantage of the urban agglomerations of a country.

Figure 3.3 focuses on the commercial use of the internet by showing the share of online sales on total retail sales. This indicator reflects at the same time the availability of e-commerce sites and the ICT behaviour of customers. Again the overall north-south patterns are similar to the examples before, only Denmark has a lower and Greece a little higher relative position.

Finally, Figure 3.4 shows macroeconomic impacts of ICT, namely the share of employees in the IT sector on total employment. While the shares are generally not very high compared to other sectors, the leading role of Scandinavia, UK, Ireland and central European countries is nevertheless obvious. This indicator also highlights clearly that IT related business activities are concentrated in the urban agglomerations of each country.

3.2 Business Networks Indicators

In Deliverable 18 indicators on business networks were grouped under the headings innovation networks, capital networks, horizontal business networks (clusters), vertical business networks and formal business networks. Owing to the elusive nature of the (often informal) business networks, only 10 indicators and corresponding datasets could be identified, mostly reflecting only on preconditions for the emergence of business networks and not on business networks themselves. Seven indicators were chosen for further statistical analysis.

Table 3.2 presents these selected business networks indicators, focussing again on basic statistical characteristics of the datasets. Comparing the values of all EU regions with only the rural regions the following overall observations can made:

Table 3.2: Statistical characteristics of business networks indicators

		All regions (1085)				Rural regions (442)			
		Minimum	Maximum	Mean	St.deviation	Minimum	Maximum	Mean	St. deviation
B1	% manuf. SMEs in innovation coop.	4.5	37.4	13.03	5.37	4.5	37.40	12.98	5.96
B2d	Participation in EU innovation programs	0	1	0.41	0.49	0	1.00	0.43	0.50
B3	% venture capital	0.07	0.41	0.21	0.09	0.07	0.41	0.19	0.07
B4	% firms with high location coefficient	0	19.55	1.71	3.71	0	19.55	2.12	4.36
B5	Number of regional clusters	0	5	0.16	0.50	0	3.00	0.09	0.34
B6a	% SMEs with int. business (1999)	21	56.5	24.72	4.37	21	56.50	25.65	5.38
B6b	% SMEs with int. business (2001)	18.5	61.5	29.41	7.20	18.5	61.50	29.83	8.56
B9	Business incubators per 100,000 pop.	0	4.62	0.21	0.47	0	4.41	0.18	0.46

(blue = higher, red = lower values compared to corresponding values of all EU regions)

- For five of the seven indicators the mean of the rural regions is only slightly higher or about the same as the mean of all regions. Only one indicator (B4) has a significantly higher mean for rural regions as compared to all regions. Overall this may indicate that the conditions for business networks to emerge are similar and do not differ so much across the EU territory.
- For five of the seven indicators the standard deviations of rural regions are higher than the standard deviation of all regions together. The conclusion is that business network conditions are more heterogeneous in rural regions than in urban regions.

The spatial distribution of the business indicator data shall be discussed using four indicators as examples (see Figures 3.5 to 3.8).

Figure 3.5 highlights those regions that participate(d) in three programmes of the European Union for regional innovation systems. Except for Denmark, Luxembourg and Ireland regions in all countries participated in the programmes. No overarching international pattern can be detected, only perhaps that in southern European countries these programmes have been implemented in a large number of regions. A rough analysis of the sub-national distribution indicates that often peripheral (and economically lagging) regions participated in the programmes, but more central, urban or semi-urban regions did so as well. Thus regional innovation networks were fostered by these programmes in a great variety of regions.

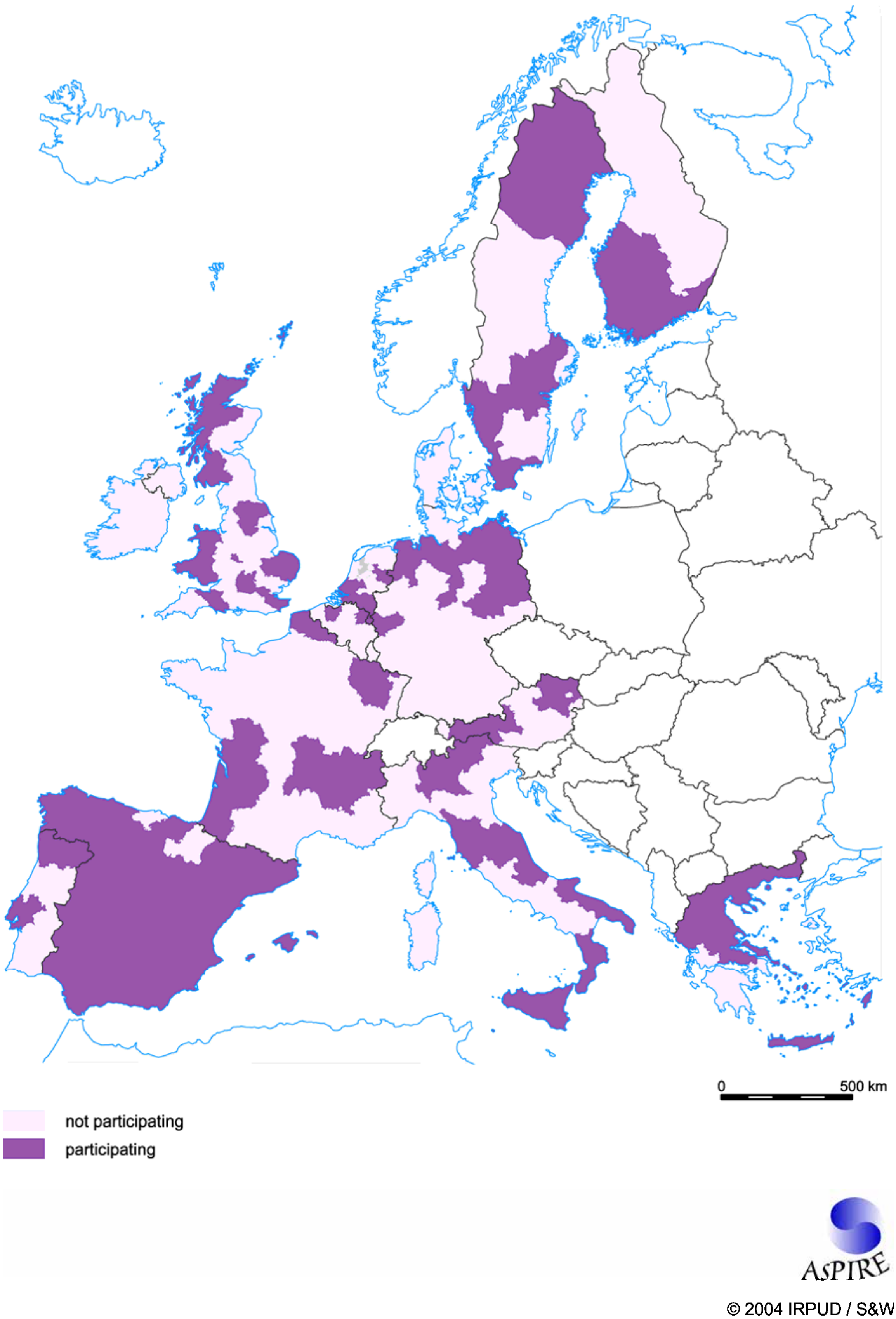

Figure 3.5. B2d – Participation in EU Regional Innovation Programmes (IRPUD 2004)

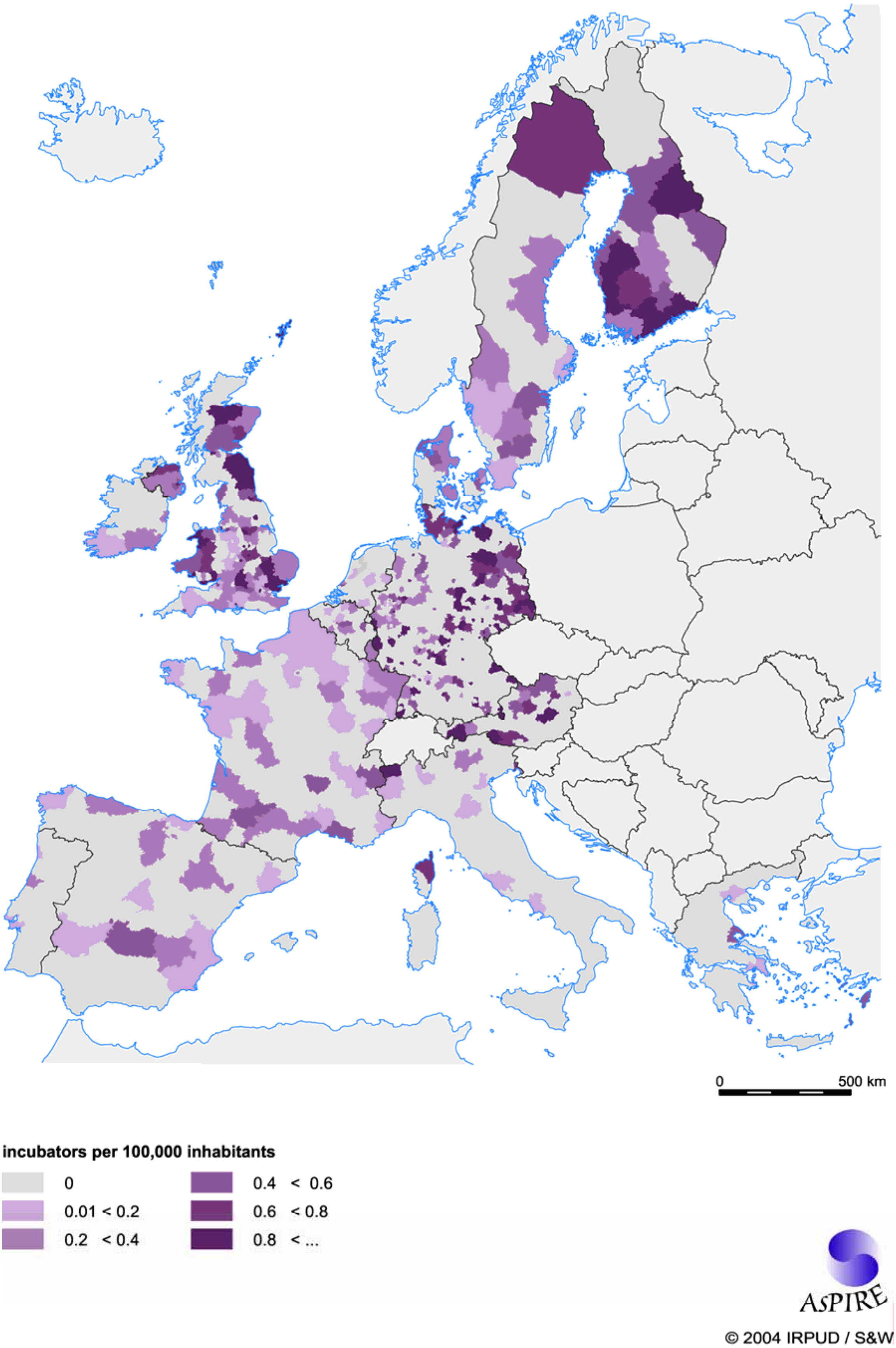

Figure 3.6. B 9 – Business incubators per 100,000 inhabitants (DG Enterprise 2004)

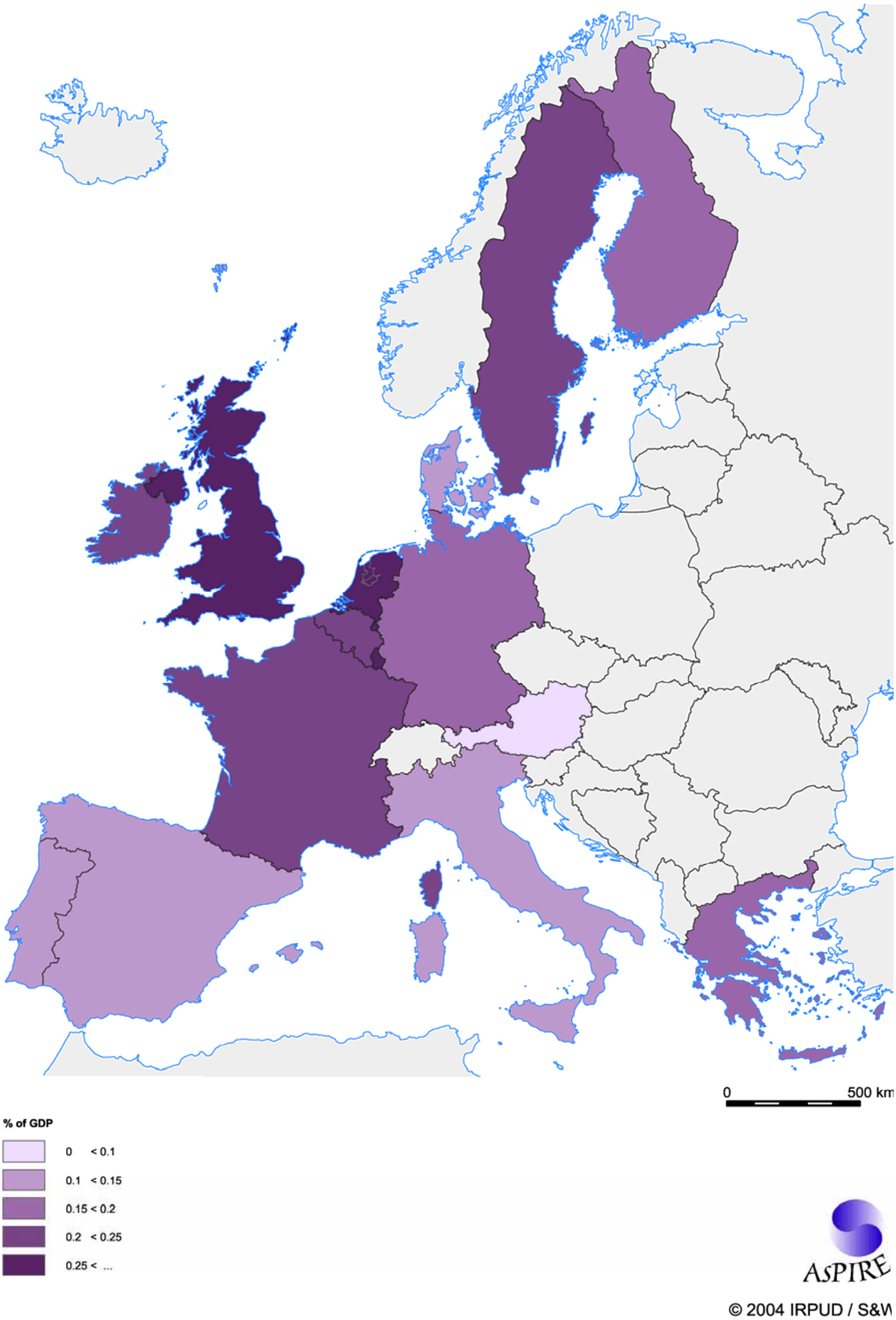

Figure 3.7. B3 - Venture capital as % of GDP (European Communities 2002)

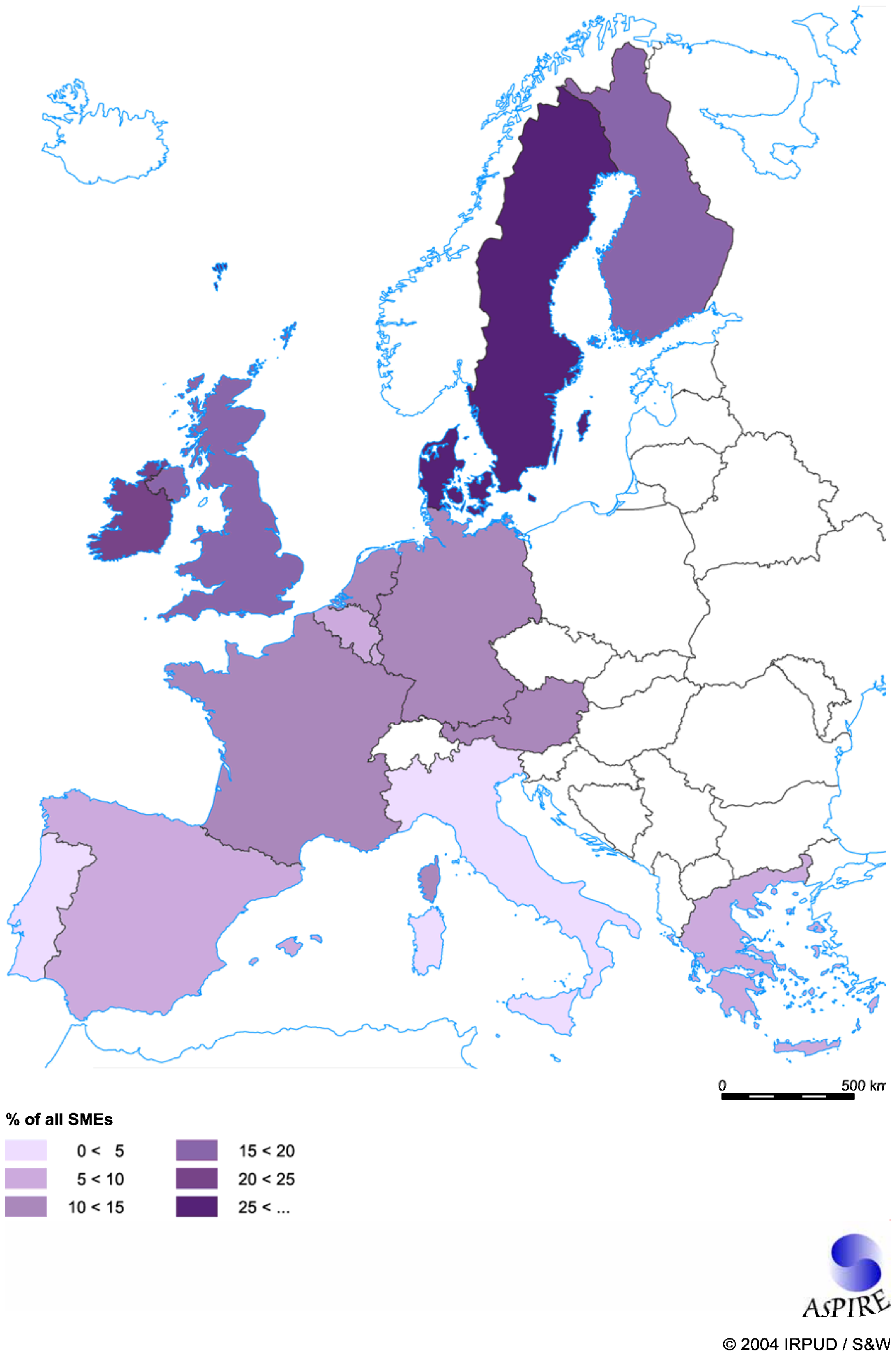

Figure 3.8. B1 - Manufacturing SMEs involved in innovation co-operations (Eurostat 2002)

Figure 3.6 presents the location and concentration of business incubators in the EU member states, assuming that in and around such facilities business networks flourish. Drawing on a comprehensive database containing more than 700 business incubators, the map may not show all, but surely a large proportion of incubators existing in Europe. The overall impression is that many regions have at least one, but equally many (especially in southern Europe) do not have a business incubator. Concentrations of incubators can be found in Austria, Germany, the UK and Finland. Most regions with relative concentrations of incubators seem to be rural, while a substantial number of business incubators can also be found in urban regions. Thus the spatial analysis of this dataset does not lead to entirely conclusive results.

Another important indicator for (innovation) business networks is the amount of venture capital available. Figure 3.7 shows the amount of venture capital in relation to GDP. In northern and central European countries relatively more venture capital is available than in southern countries, with Finland, Denmark and Germany taking medium positions. Differences between countries are not very great, implying that in regard to access to innovation-oriented capital conditions do not differ as greatly between EU countries compared to other indicators.

However, when analysing the only indicator that directly reflects on a special type of business networks (share of businesses involved in innovation co-operations, Figure 3.8) one recognises a clear and familiar spatial pattern: northern European countries are in the lead, followed by central European countries, while southern European countries have the lowest values. Thus, while other data on different types of business networks are not available, the existing data ‘softly’ point in the direction of this north-central-south pattern.

3.3 Governance Indicators

According to D18 regional governance structures can be divided into governance processes (public participation, government intervention in the economy) and governance outputs (government efficiency, public law and order, political stability). As with business networks it is difficult to obtain statistical data on an elusive concept like governance which refers to the interrelations between the state, economy and civil society. However, 20 indicators reflecting directly or indirectly on governance have been identified and put into the AsP database

Table 3.3 presents the governance indicators and some basic statistical measures describing the datasets. Comparing the values of all EU regions with only the rural regions the following overall observations can made:

Table 3.3: Statistical characteristics of governance indicators

		All regions (1085)				Rural regions (442)			
		Minimum	Maximum	Mean	St.deviation	Minimum	Maximum	Mean	St.deviation
G1a	Political stability index (2000/01)	0.79	1.61	1.13	0.19	0.79	1.61	1.13	0.20
G1b	Political stability index (2002)	0.73	1.63	1.00	0.21	0.73	1.63	1.02	0.23
G7a	Voice & accountability ind. (2000/01)	1.10	1.69	1.35	0.16	1.10	1.69	1.33	0.17
G7b	Voice & accountability index (2002)	1.05	1.72	1.41	0.17	1.05	1.72	1.38	0.18
G8a	Regulatory quality index (2000/01)	0.58	1.50	1.00	0.27	0.58	1.50	0.96	0.26
G8b	Regulatory quality index (2002)	1.13	1.93	1.52	0.21	1.13	1.93	1.49	0.22
G9a	Goverment efficiency index (2000/01)	0.65	1.86	1.46	0.38	0.65	1.84	1.39	0.40
G9b	Government efficiency index	0.79	2.14	1.66	0.37	0.79	2.14	1.58	0.39
G12a	Trust in justice system	21.05	85.71	56.09	11.63	27.40	85.44	56.66	12.11
G12b	Trust in police	21.05	85.71	56.09	11.63	27.40	85.44	56.66	12.11
G12c	Trust in civil service	20.59	76.00	48.10	10.53	20.59	76.00	47.38	10.04
G12d	Trust in national government	18.42	81.96	48.05	10.57	18.42	81.96	47.61	10.11
G13a	Rule of law (2000/01)	0.62	1.86	1.39	0.34	0.62	1.86	1.36	0.39
G13b	Rule of law (2002)	0.79	2.00	1.55	0.36	0.79	1.99	1.51	0.39
G14a	Control of corruption index (2000/01)	0.63	2.25	1.37	0.41	0.63	2.25	1.33	0.41
G14b	Control of corruption index (2002)	0.58	2.39	1.65	0.43	0.58	2.39	1.58	0.48
G15	Influence of citizens on government	0.51	17.16	5.24	3.71	0.51	17.16	4.96	3.42
G16	Satisfaction with democracy	1.93	3.22	2.37	0.25	1.93	3.00	2.37	0.24
G18	Voter turnout at national elections	55.23	94.92	75.56	8.86	55.31	93.92	75.29	7.97
G19	Voter turnout at regional elections	35.30	95.29	64.86	10.57	36.90	93.65	66.48	9.70

(blue = higher, red = lower values compared to corresponding values of all EU regions)

- For 14 of the 20 indicators the means of the rural regions are lower than the means of all regions. Thus the governance conditions in rural Europe seem to be worse than in urban regions.
- For 13 of the 20 indicators the standard deviations of rural regions are higher than the corresponding values of all EU regions. This indicates that rural regions are more heterogeneous in regard to governance than urban regions.

The spatial patterns of the governance data resemble those found in the previous AsP themes. The indicators and corresponding maps (see Figures 3.9 to 3.12) illustrate this.
Figure 3.9 shows the spatial distribution of the World Bank's government efficiency index. The indicator integrates 31 individual indicators from various sources which in combination yield the familiar picture of northern and central European countries leading and southern European countries lagging behind. Since government efficiency is an important factor at the interface with both the private sector and civil society, governance conditions seem to be more difficult in southern parts of the EU.

Figure 3.10 focuses on one particular functional area of government, namely the police service. Again, it can be seen that more citizens in northern and central Europe give the police in their regions positive ratings than in southern Europe. In addition there are significant differences within each country, which can range from below 50% to more than 80% approval within one country. While in some countries the more peripheral areas have less trust in the police (e.g. UK), in other countries it is the other way around (e.g. Greece or Spain). Hence these sub-national patterns seem to be more complex than the international patterns.

Figure 3.11 depicts the World Bank's regulatory quality index for the 15 EU member states. Again this composite indicator pools together 61 individual indicators from various sources, this time focussing on the nature and quality of governmental interventions in the economy (e.g. regulatory burdens on companies). Once more the Scandinavian and northern European countries are clearly leading compared to southern European countries. However, France's low performance and Spain and Portugal's relatively good performance are deviations from the familiar north-south divide. Nevertheless the overall conclusion remains in the north the state's regulations are more conducive for private businesses than in the south.

Finally, Figure 3.12 reflects on the interface between civil society and the state, as manifested in the voter turnout for the latest national legislative elections. In this case Finland, the UK and Ireland show relatively low turnout rates, while northern Italy has high participation rates. The overall picture is that of high public participation in central regions of Europe and lower participation in more peripheral regions. This also holds true for most sub-national differences. While these voting patterns thus differ somewhat from other indicators, the differences are only due to a few countries; all other data are still consistent with the familiar north/central vs. south patterns.

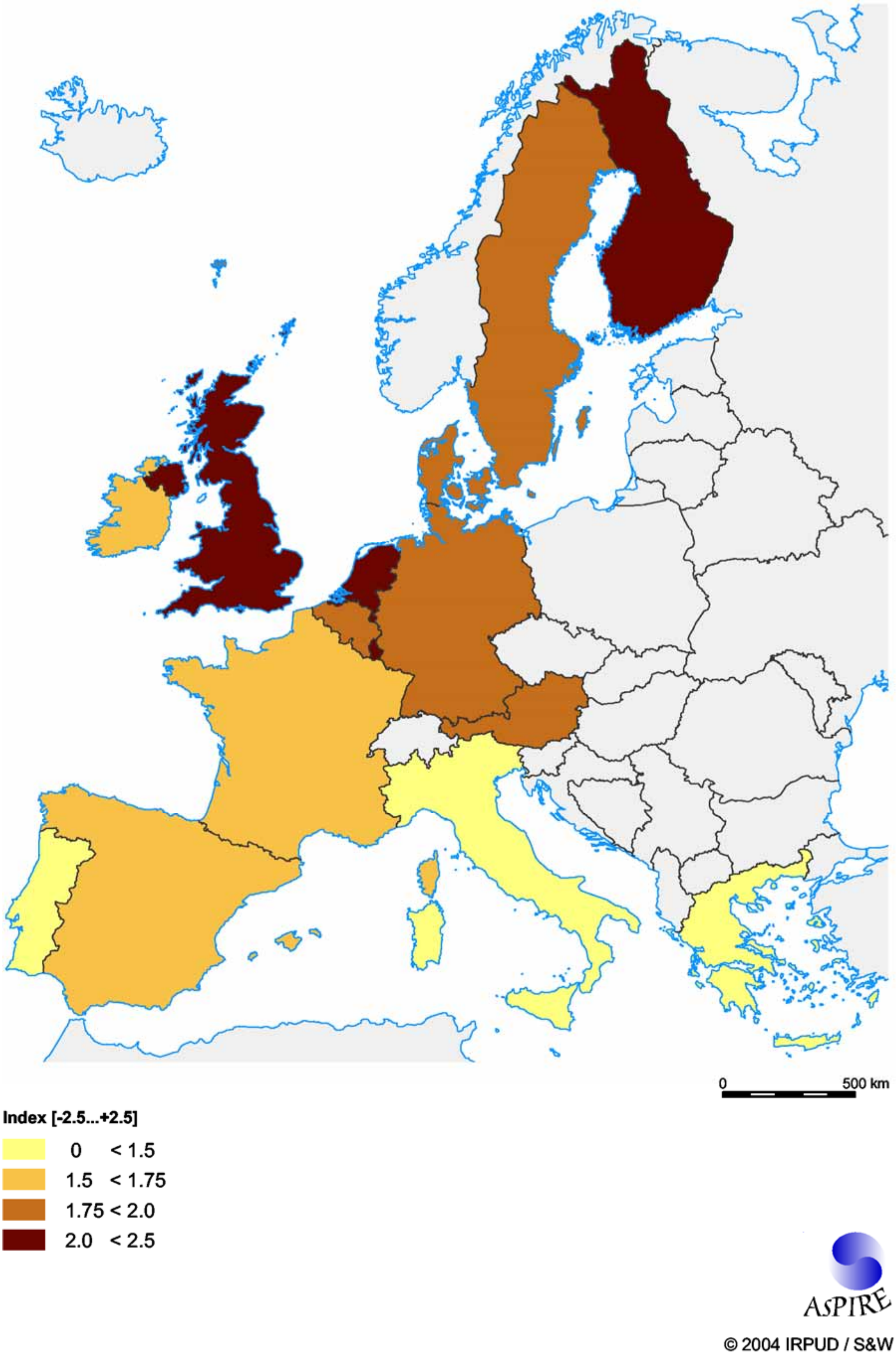

Figure 3.9. G9b - World Bank efficiency index (World Bank 2003)

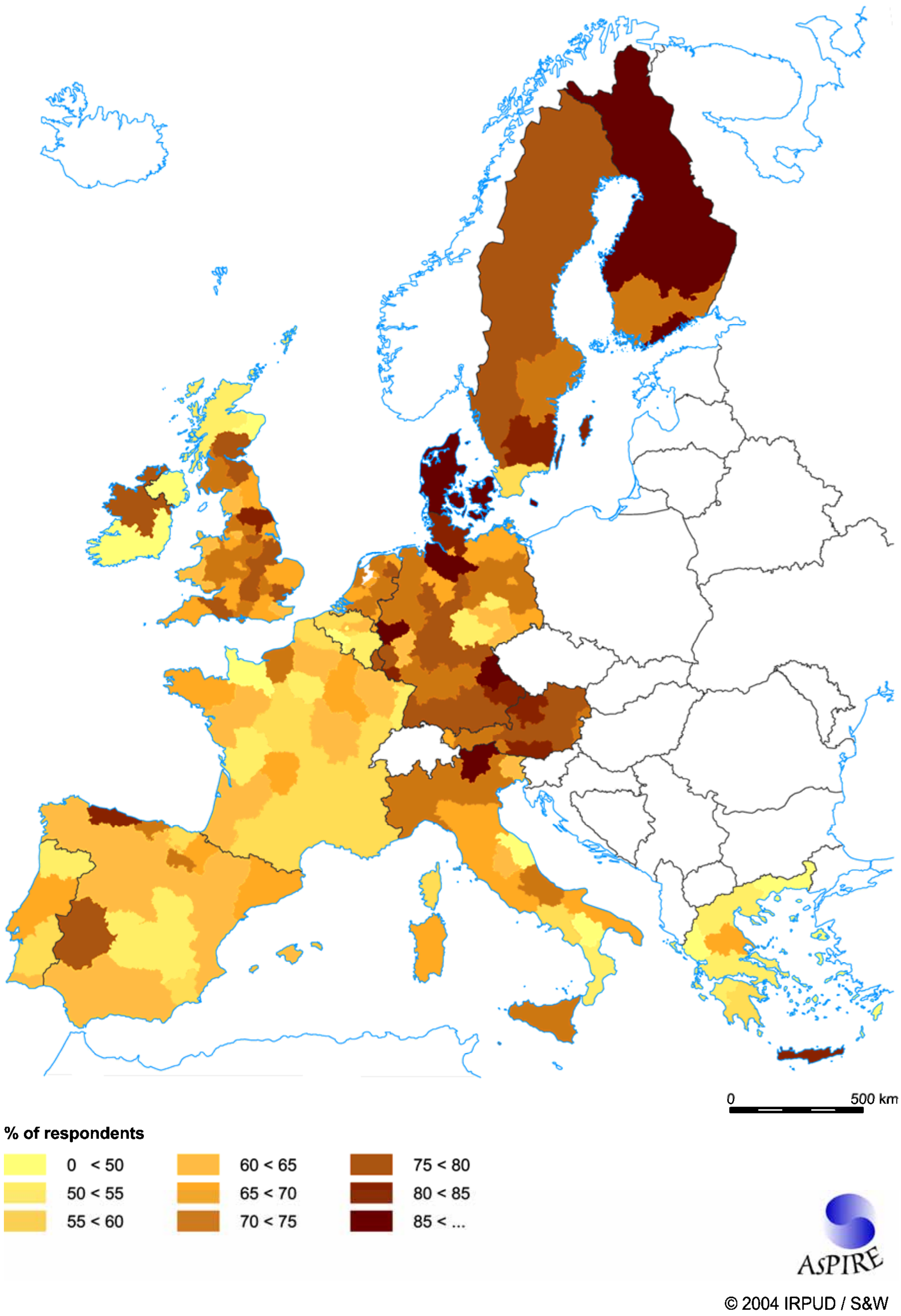

Figure 3.10: G12b - Trust in the police 1999-2002 (various Eurobarometer)

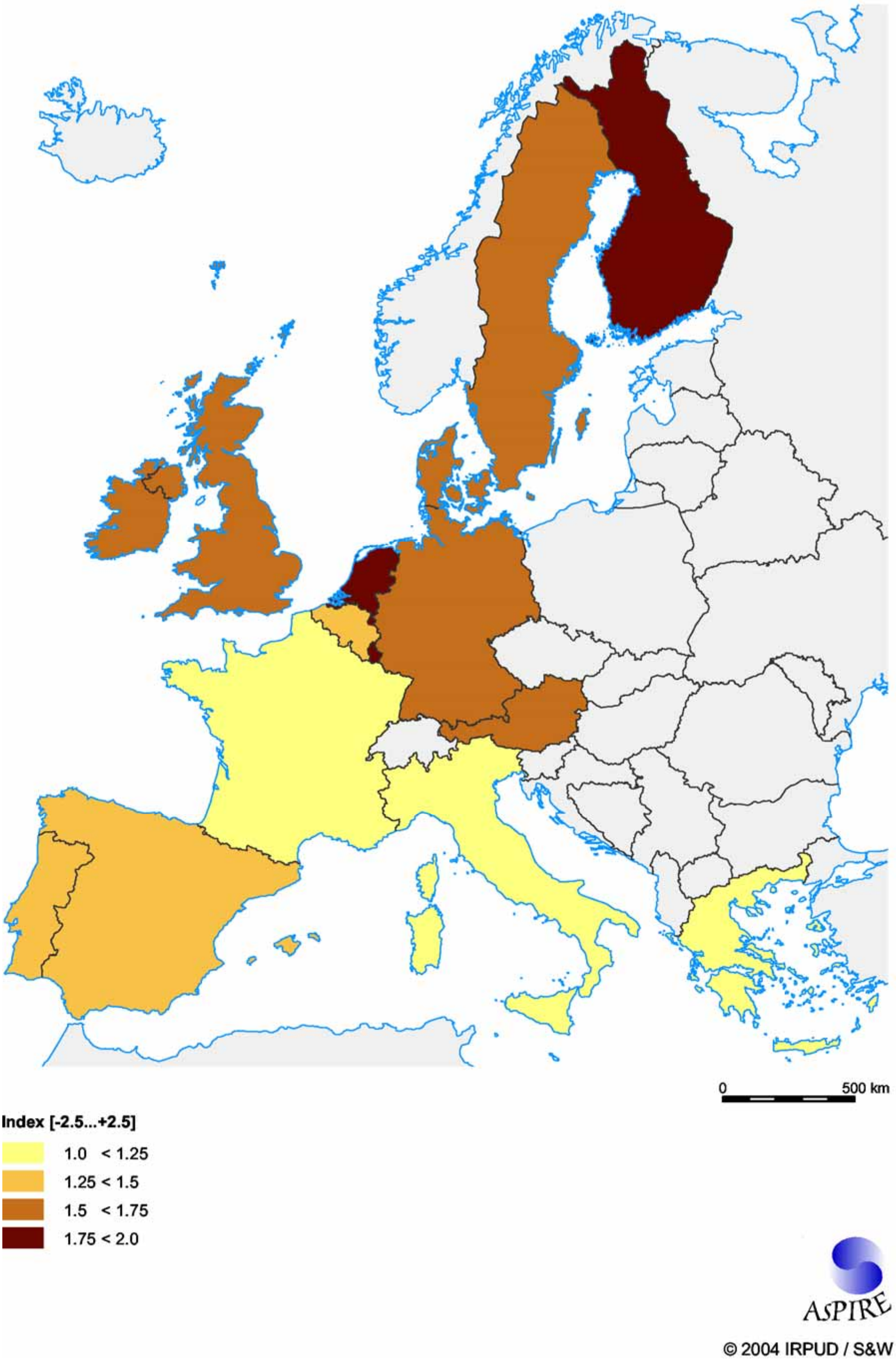

Figure 3.11. G8b - World Bank regulatory quality index (World Bank 2003)

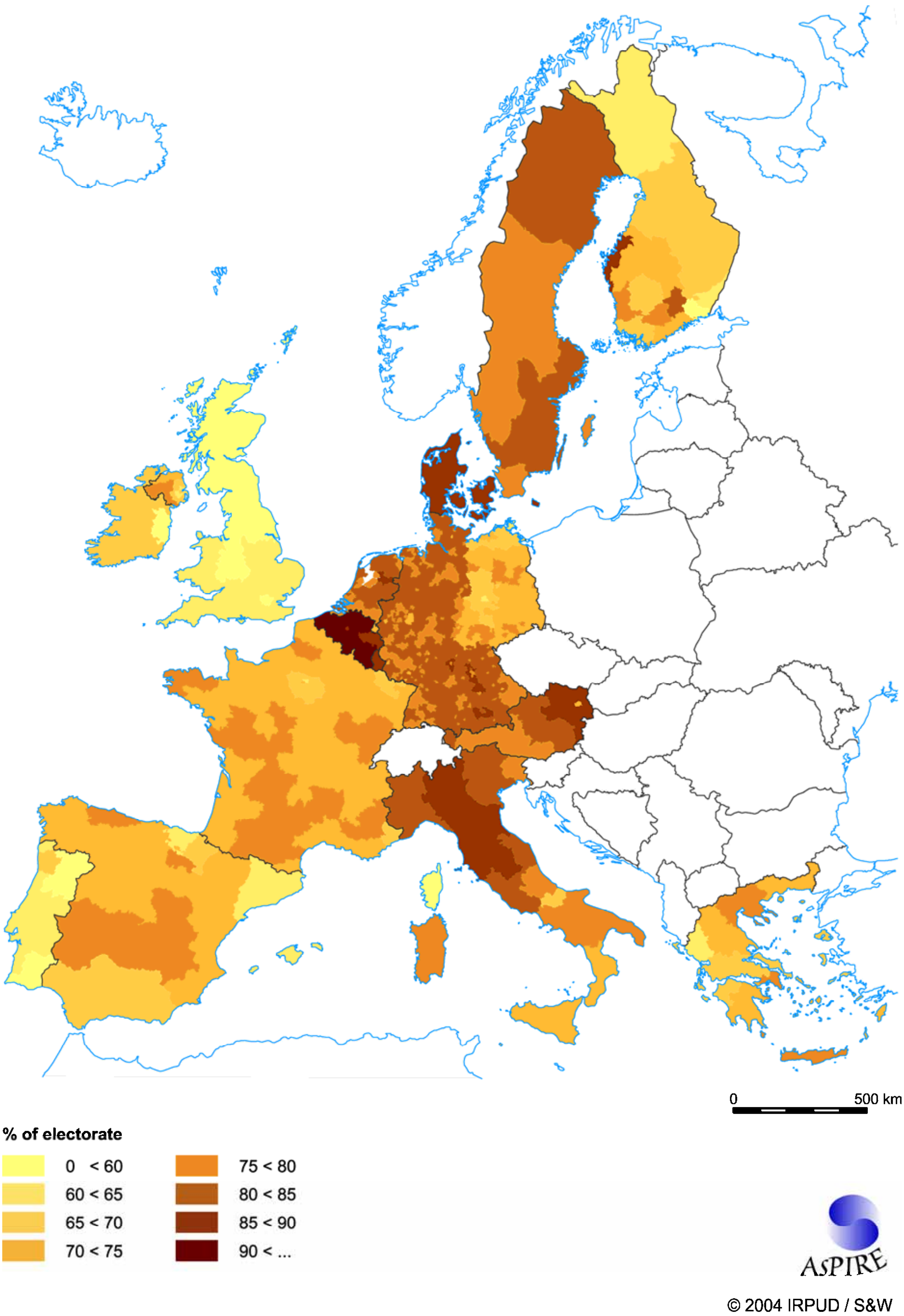

Figure 3.12. G 18 - Voter turnout at latest national election (various national sources)

3.4 Social Capital Indicators

Social capital indicators can be categorised into those relating to antecedents of social capital (social embeddedness, societal awareness, attachment to area of residence), civic engagement (membership in civic organisations, political participation, voluntary work) and outcomes of social capital (trust, values and norms). Deliverable 18 identified 16 indicators reflecting on these various aspects of social capital, to which 5 additional indicators were added for the purposes of this analysis (see Table 3.4).

Table 3.4 presents the social capital indicators used in this study and basic statistical measures describing the respective datasets. Comparing the values of the rural regions with those of all EU regions, the following observations can be made:

- For 13 of the 21 indicators the arithmetic means of the rural regions are lower than those of all EU regions, however, in most cases only very slightly lower. The same is true for the other 8 indicators for which rural regions have the same or slightly higher values. It thus seems that the quality or degree of social capital does not differ much between rural and urban regions of the EU.
- For 11 of the 21 indicators the relative standard deviation for rural regions is higher than the one for all EU regions. For all other indicators the differences are mostly marginal. However, for two important antecedent indicators (S2b, S5a) and the very important output indicator 'trust in other persons' (S10) rural regions have significantly higher standard deviations. This again indicates that there is greater variability among rural regions than among urban regions.

The spatial patterns of the social indicator data will be exemplified using four indicators depicted in the maps developed (see Figure 3.13 to 3.16).

An important indicator reflecting on the awareness of local and political affairs is the share of people who daily read a newspaper. Figure 3.13 maps the corresponding data for NUTS-2 regions of Europe. The emerging spatial pattern is clear: In northern and central European regions a far greater share of people read a newspaper daily than in western and southern European countries. Differences within the countries are relatively slight in those countries with overall high readership but greater in countries with low newspaper readership rates. The differences between the countries are the most important ones, though, implying a greater foundation for the emergence of social capital in the north than in the south of Europe.

Table 3.4: Statistical characteristics of social capital indicators

		All regions (1085)				Rural regions (442)			
		Minimum	Maximum	Mean	St.deviation	Minimum	Maximum	Mean	St.deviation
S2a	Watching TV-news daily	41.61	92.45	72.07	10.42	41.61	90.20	71.67	10.15
S2b	Reading newspapers daily	11.73	83.23	54.02	17.52	11.73	83.23	51.80	19.53
S2c	Listening radio-news daily	9.49	83.33	45.14	15.46	9.49	83.33	44.52	17.63
S5a	Attachment to town/village	2.18	4.00	3.32	0.24	2.60	4.00	3.35	0.25
S5b	Attachment to region	2.09	3.90	3.28	0.25	2.55	3.90	3.34	0.25
S5c	Attachment to country	2.60	3.87	3.32	0.25	2.65	3.87	3.37	0.25
S5d	Attachment to EU	1.50	3.75	2.65	0.33	1.50	3.75	2.66	0.32
S8b	Frequent political interest	5.73	21.19	16.33	3.90	5.73	21.19	16.65	3.89
S8c	Occasional political interest	43.52	65.99	59.15	6.32	43.52	65.99	58.53	6.79
S8g	Combined political interest indicator	0.27	0.51	0.46	0.06	0.27	0.51	0.46	0.06
S9b1	Time spent with colleagues	11.54	32.98	15.81	5.23	11.54	32.98	16.74	6.30
S9c1	Time spent at church	3.32	39.48	13.02	5.20	3.32	39.48	12.64	5.86
S10	Trust in other persons	8.33	82.35	32.46	13.11	8.65	70.73	32.22	13.89
S11	Trust in persons from other countries	38.57	97.62	71.23	9.91	38.57	97.62	71.64	9.38
S12a	Trust in institutions (European)	0.00	81.25	23.76	13.15	0.00	81.25	22.88	12.66
S12b	Trust in institutions (National)	0.00	80.56	44.58	15.67	0.00	80.56	46.53	15.71
S17	Political discussion	0.82	26.57	10.14	4.20	0.82	26.57	10.07	4.23
S18	Openness to foreigner	21.05	78.57	51.15	9.71	21.05	78.57	50.60	10.14
S19	Social more important than economic	20.97	85.17	55.75	10.15	26.28	85.17	57.65	10.42
S20	Voluntary engagement	6.25	70.00	28.85	11.31	6.25	70.00	28.11	11.14
S21	Membership	17.24	100.0	49.89	17.68	17.24	100.0	48.93	17.04

(blue = higher, red = lower values compared to corresponding values of all EU regions)

A second important antecedent indicator is the inhabitants' attachment to their town or village (Figure 3.14). The results are on first sight puzzling: obviously no clear international pattern can be detected, even though it is obvious that on the Iberian peninsula feelings of local attachment are highest. However, when focussing on the sub-national level it emerges that in most countries the more peripheral regions have the highest values while the more central regions have lower values of local attachment. In any case social capital may according to this indicator flourish more in Europe's peripheral/rural regions.

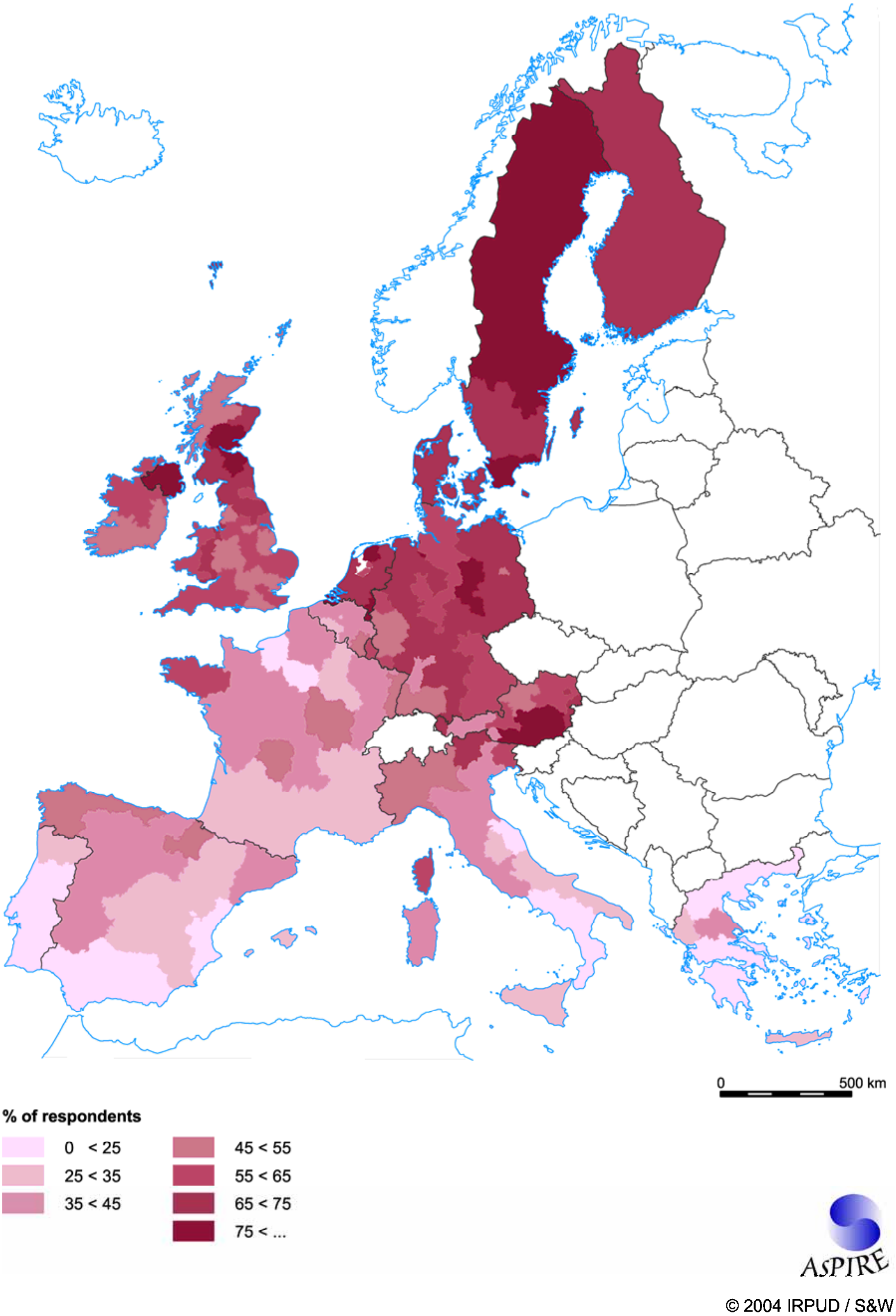

Figure 3.13: S2b – Share of people reading newspapers daily (Eurobarometer 44.2bis)

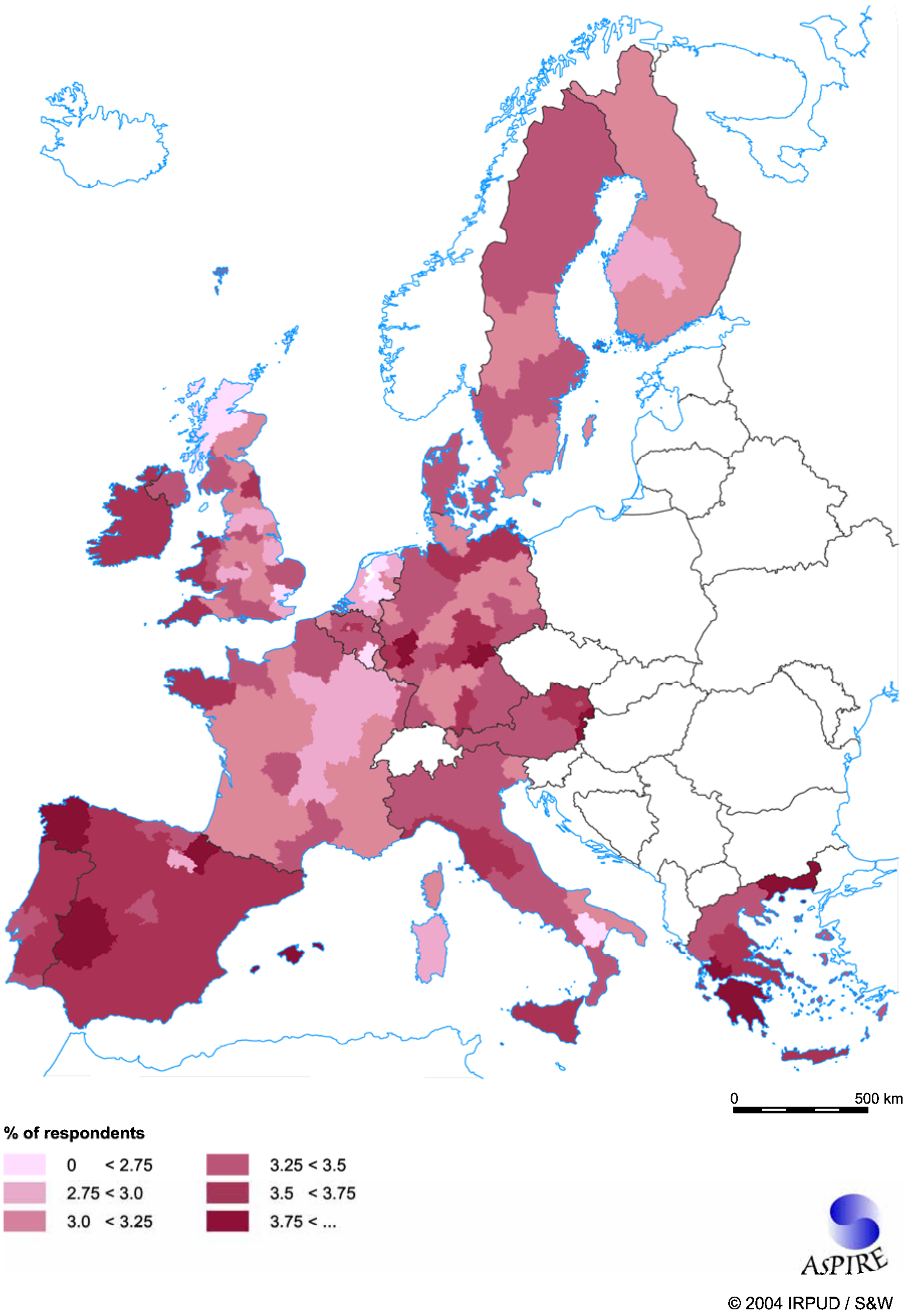

Figure 3.14. S5a – Degree of attachment to town or village 1998-2001 (Eurobarometers)

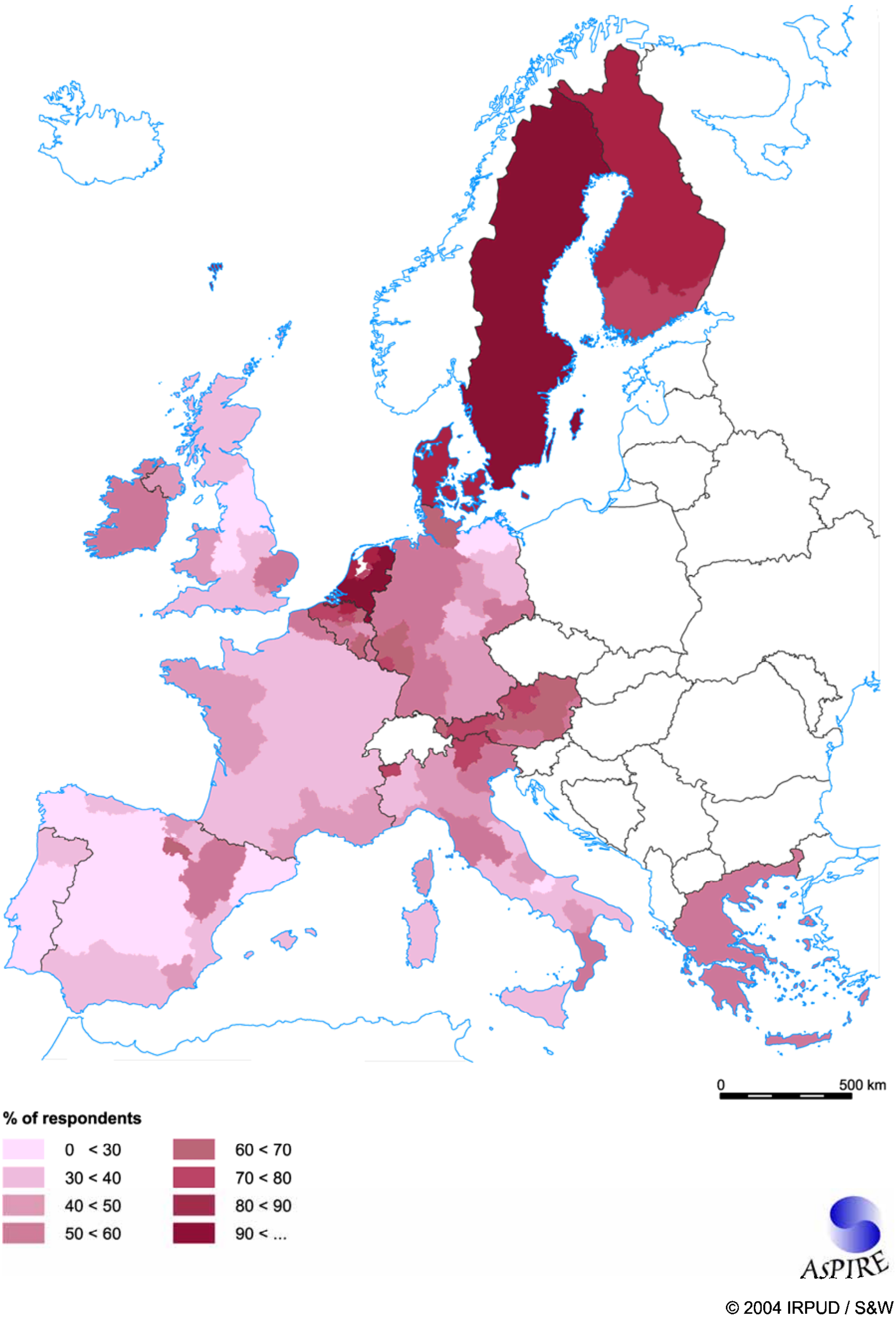

Figure 3.15. S21 – Membership in civic organisations (EVS 1999/2000)

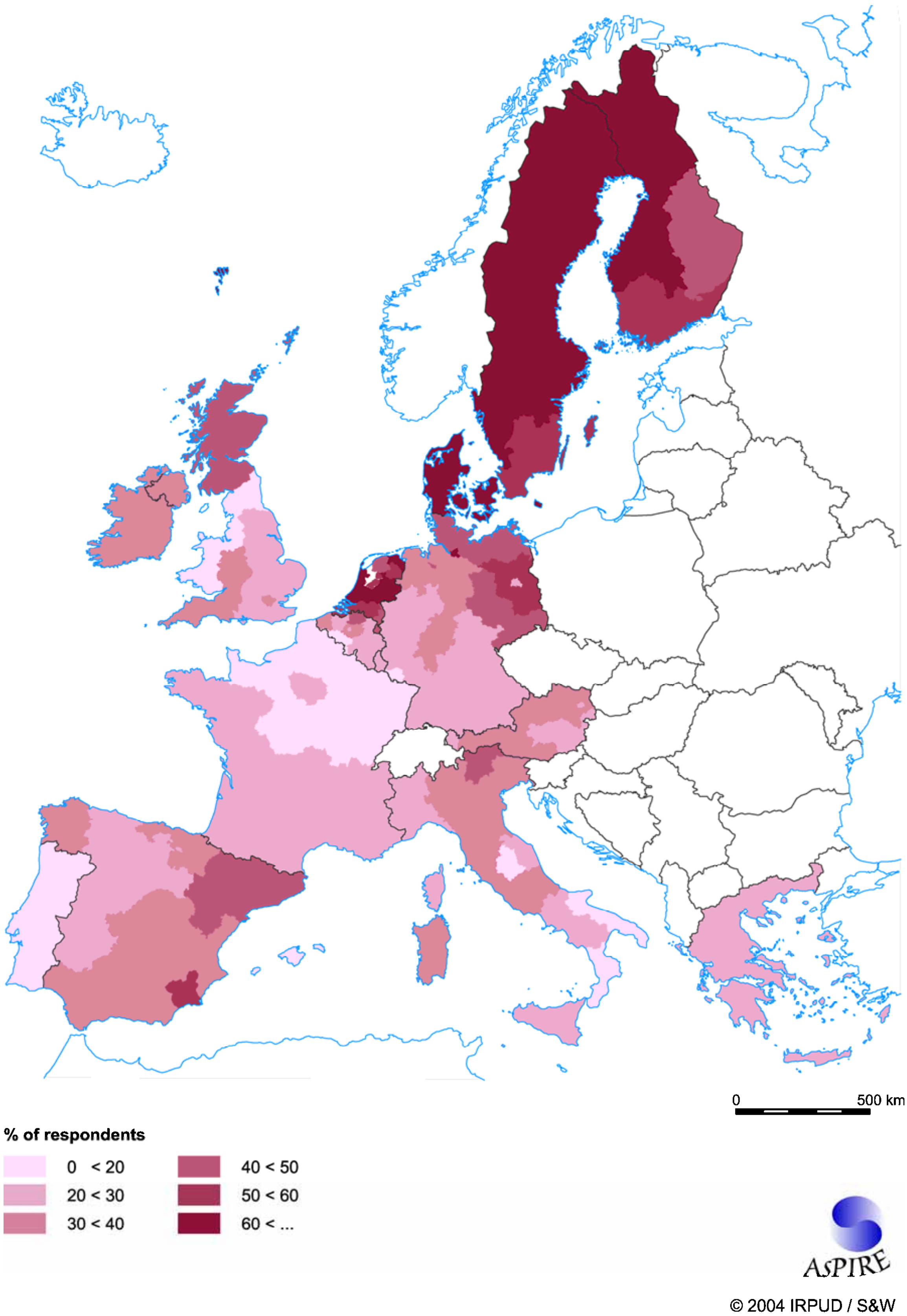

Figure 3.16. S10 –People who have trust in other persons (EVS 1999/2000)

Figure 3.15 depicts the spatial distribution of a civic engagement indicator, namely the share of people who are members in civic organisations. Here spatial patterns are a little less complex: The Scandinavian countries and the Netherlands exhibit high membership rates, followed by other central European countries, Ireland and – interestingly – Greece. All other southern and western European countries have relatively low membership rates. While a north-south decline can still be observed, the modest or even low membership levels in Germany and UK respectively ‘spoil’ this classic pattern a little.

Finally, Figure 3.16 presents the ultimate social capital indicator, ‘trust in other persons’, which is considered to be a major output indicator. The overall international spatial pattern is similar to the previous indicator, but Spain and the UK have somewhat caught up and show medium levels of trust. Focussing on the sub-national level significant differences within each country can be observed, e.g. in Germany, Spain, Italy and the UK. In these cases more peripheral regions show a higher level of trust which seems to be related to specific, historically grounded regional identities (Scotland, Catalonia, Trentino and Eastern Germany).

3.5 Tourism Indicators

Following Deliverable 18, tourism indicators can be broken down into supply-side indicators (physical and cultural attractiveness, gastronomy and accommodation services) and demand-side indicators (tourism arrivals and overnight stays). D 18 identified 18 tourism indicators and corresponding datasets, of which some were dropped and others combined to arrive at a robust set of 11 indicators presented below. A rough statistical analysis of the 11 datasets yielded the following results:

- For eight of the 11 indicators the arithmetic mean for the rural regions is about the same, higher or even significantly higher than the mean for all EU regions. This means that in terms of tourism attractiveness and infrastructure as well as tourism demand rural regions outperform urban regions.
- For seven of the 11 indicators the standard deviations of the rural regions are higher than the respective values of all EU regions. This means that rural regions are much more heterogeneous than their urban counterparts. Perhaps it is precisely this great variety that makes rural regions attractive to (urban) tourists.

As regards the spatial distribution of the tourism data the emerging patterns are very different from those of all previous indicators. Again, four selected indicators and their corresponding maps may serve as illustrations (Figures 3.17 to 3.20).

Table 3.5: Statistical characteristics of tourism indicators

		All regions (1085)				Rural regions (442)			
		Minimum	Maximum	Mean	St.deviation	Minimum	Maximum	Mean	St.deviation
T1	Annual solar radiation	1.35	5.00	3.25	0.67	2.20	5.00	3.40	0.72
T2	Elevation difference	0.00	4,260	674.3	777.5	2.00	4,260	903.9	859.8
T3	Slope gradient	0.00	37.40	7.59	6.34	0.00	37.40	9.34	7.57
T4	Coastline	0.00	111.1	2.68	7.69	0.00	57.94	2.66	7.24
T5	Attractive towns	0.00	16.00	1.58	1.97	0.00	16.00	1.73	1.95
T9	Accomodation establishments / cap.	0.01	62.89	1.39	3.50	0.07	62.89	2.17	4.31
T11	Hotel beds / cap.	0.00	0.03	0.00	0.00	0.00	0.03	0.00	0.00
T16+ 17	Overnight stays / cap.	0.31	86.71	5.21	6.40	1.14	64.37	6.32	7.73
T19	Lakefront	0.00	31.60	0.74	3.00	0.00	24.94	0.51	2.06
T20	Riverfront	0.00	36.03	3.99	4.64	0.00	12.90	2.62	2.24
T21	Mountain area	0.00	100.0	25.91	35.45	0.00	100.0	35.56	39.15

(blue = higher, red = lower values compared to corresponding values of all EU regions)

Figure 3.17 shows a basic physical feature with high relevance for tourism, namely mountains. Based on a definition of mountain areas by a recent study for DG Regio the map depicts the share of each region that is covered by mountains. Apart from mountainous areas in Sweden, the UK and some parts of Germany all mountains are concentrated in south-central and southern Europe. In fact almost the entire south of Europe is covered by mountains. In contrast most of the highly urban areas of central and northern Europe are not mountainous.

Access to oceans is also an important physical feature determining the touristic potential of a region. Figure 3.18 presents the length of coastline of each region in relation to the region's total geographic area. Of course, only 'the edges' of the continent possess coasts. In particular, owing to their rugged coastlines, regions in the UK, Denmark, Germany and the Netherlands as well as Greece have the highest coastline-area-ratio in the EU. The southern European coastal regions are furthermore attractive due to their warm climate, while the northern coastal regions are closer to the major urban agglomerations of Europe and may thus attract more short-term tourism. Quite a number of coastal regions are fairly densely populated and would not qualify as being rural even though they are situated 'on the edge' of the continent.

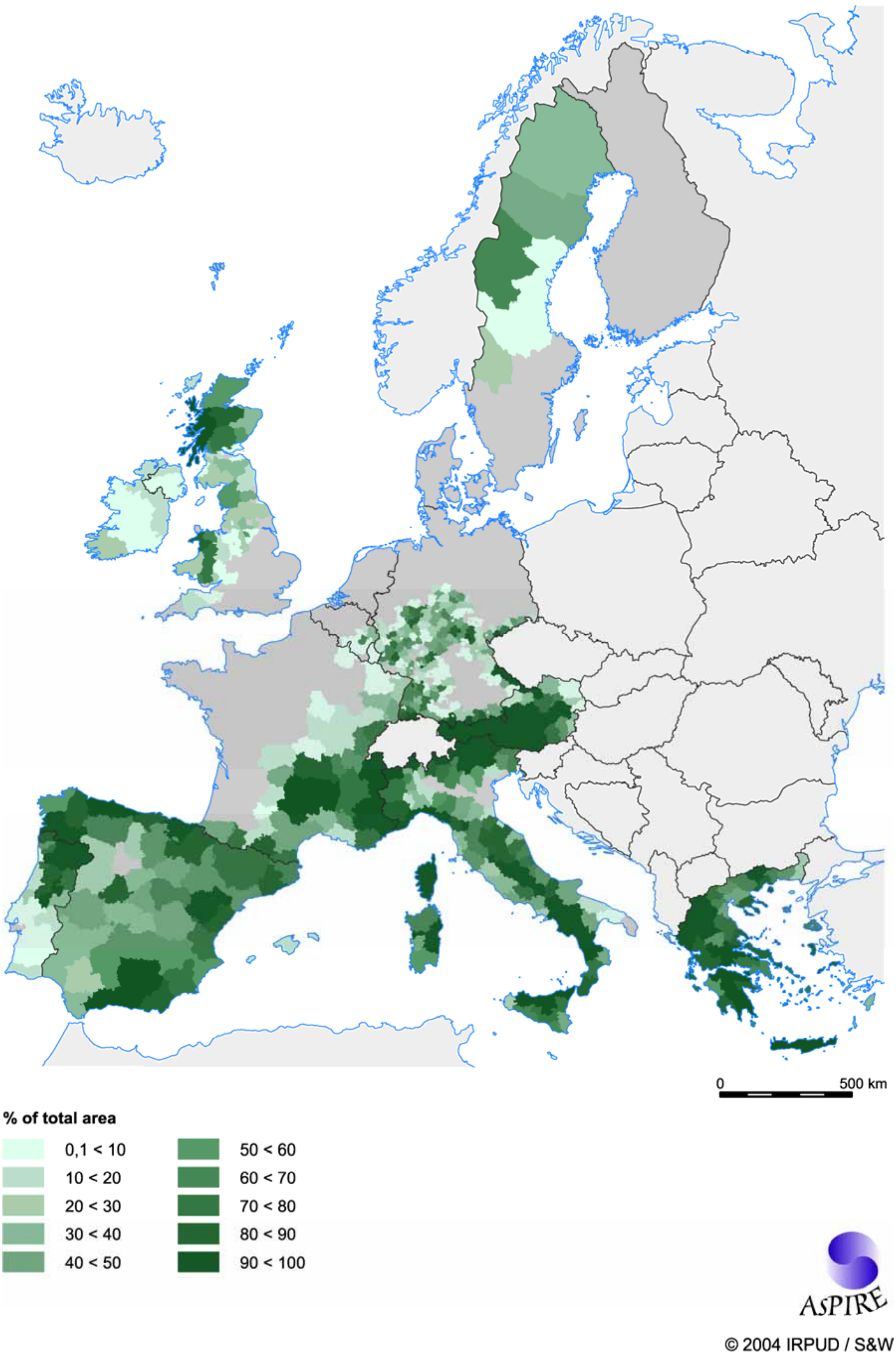

Figure 3.17. T 21 - Share of mountainous area on total area of a region (IRPUD 2004)

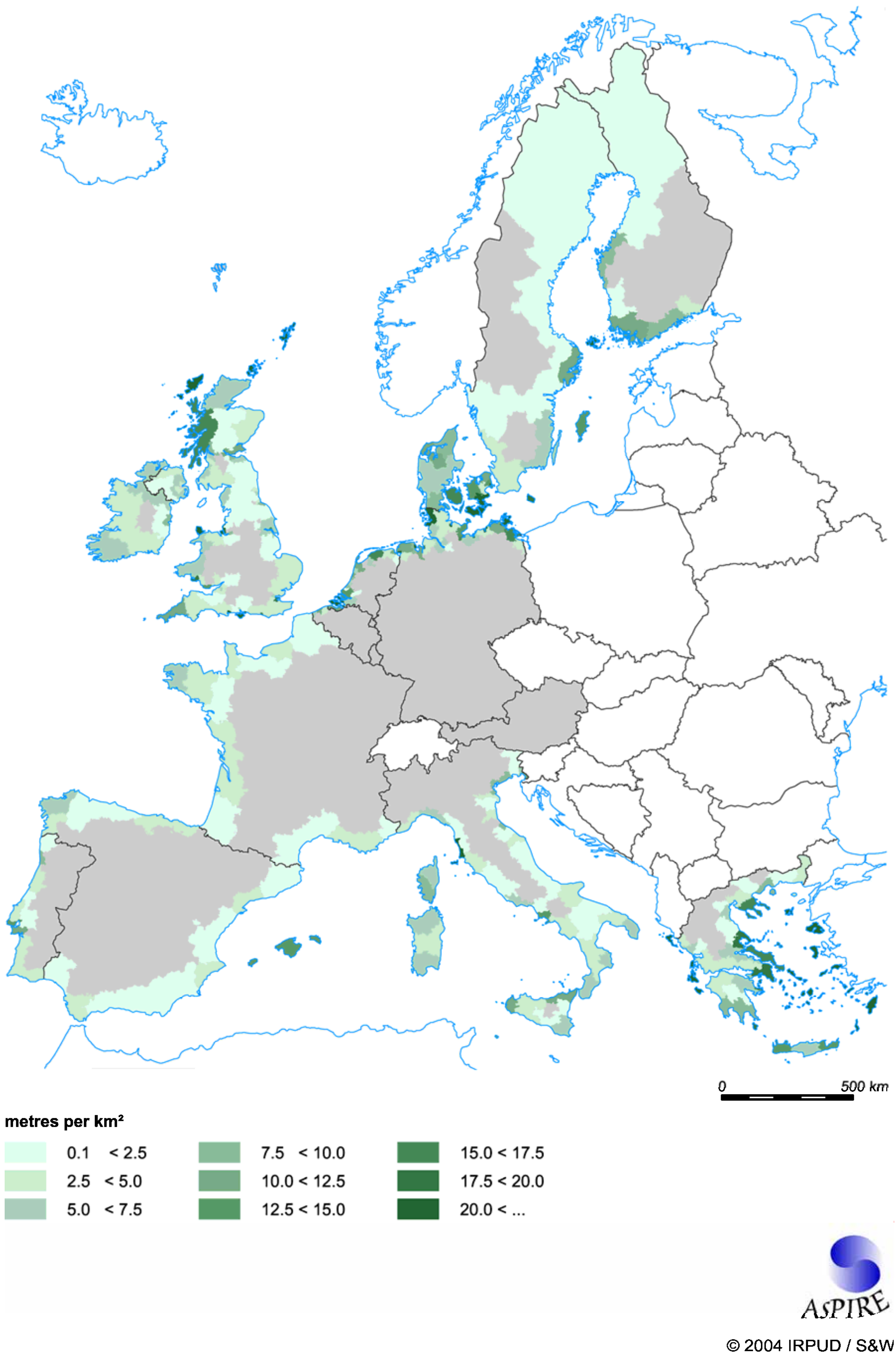

Figure 3.18. T 4 - Coastline in relation to total area of a region (IRPUD 2004)

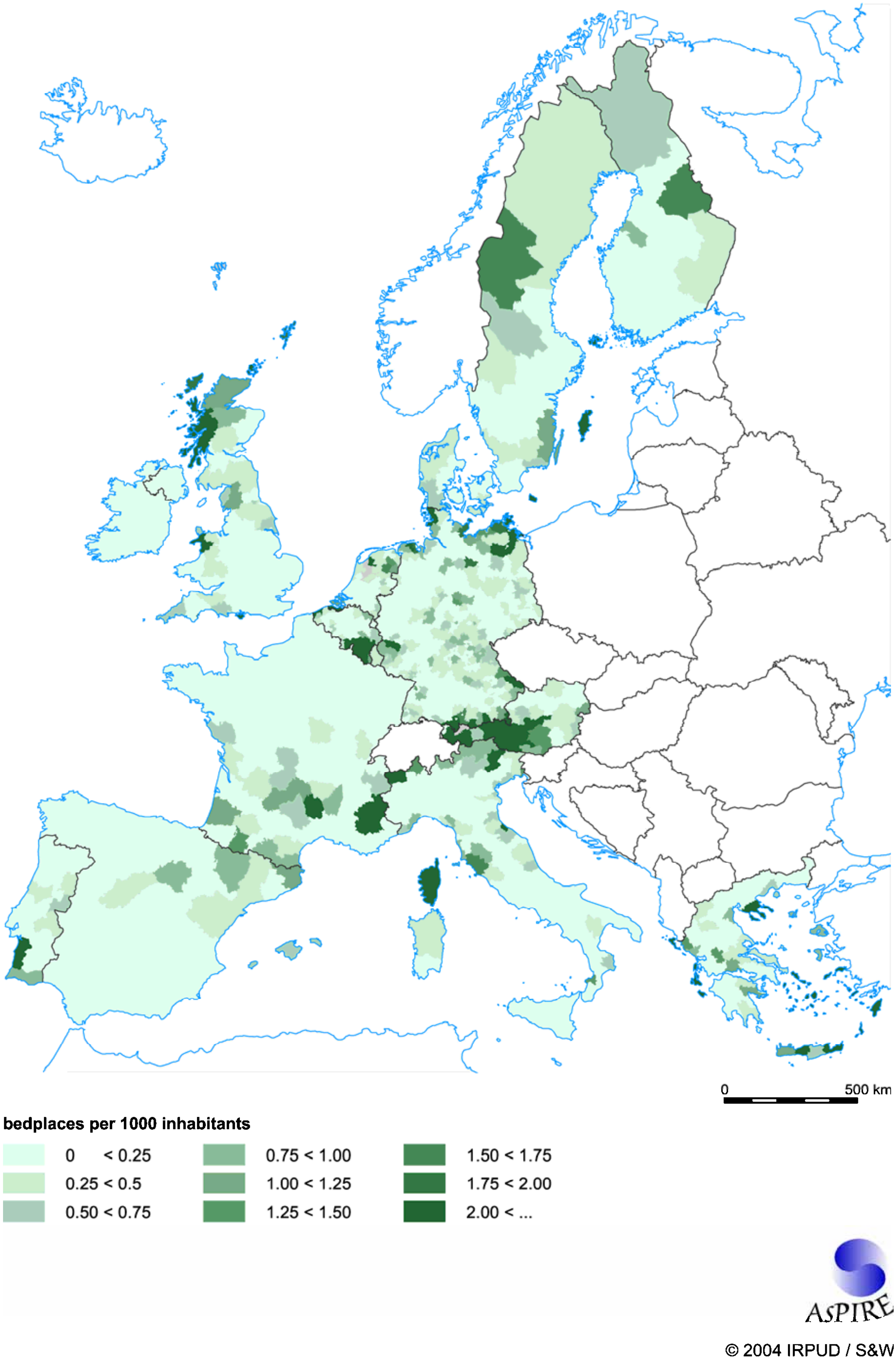

Figure 3.19: T 11 - Bed-places per 1000 inhabitants (Eurostat 2003)

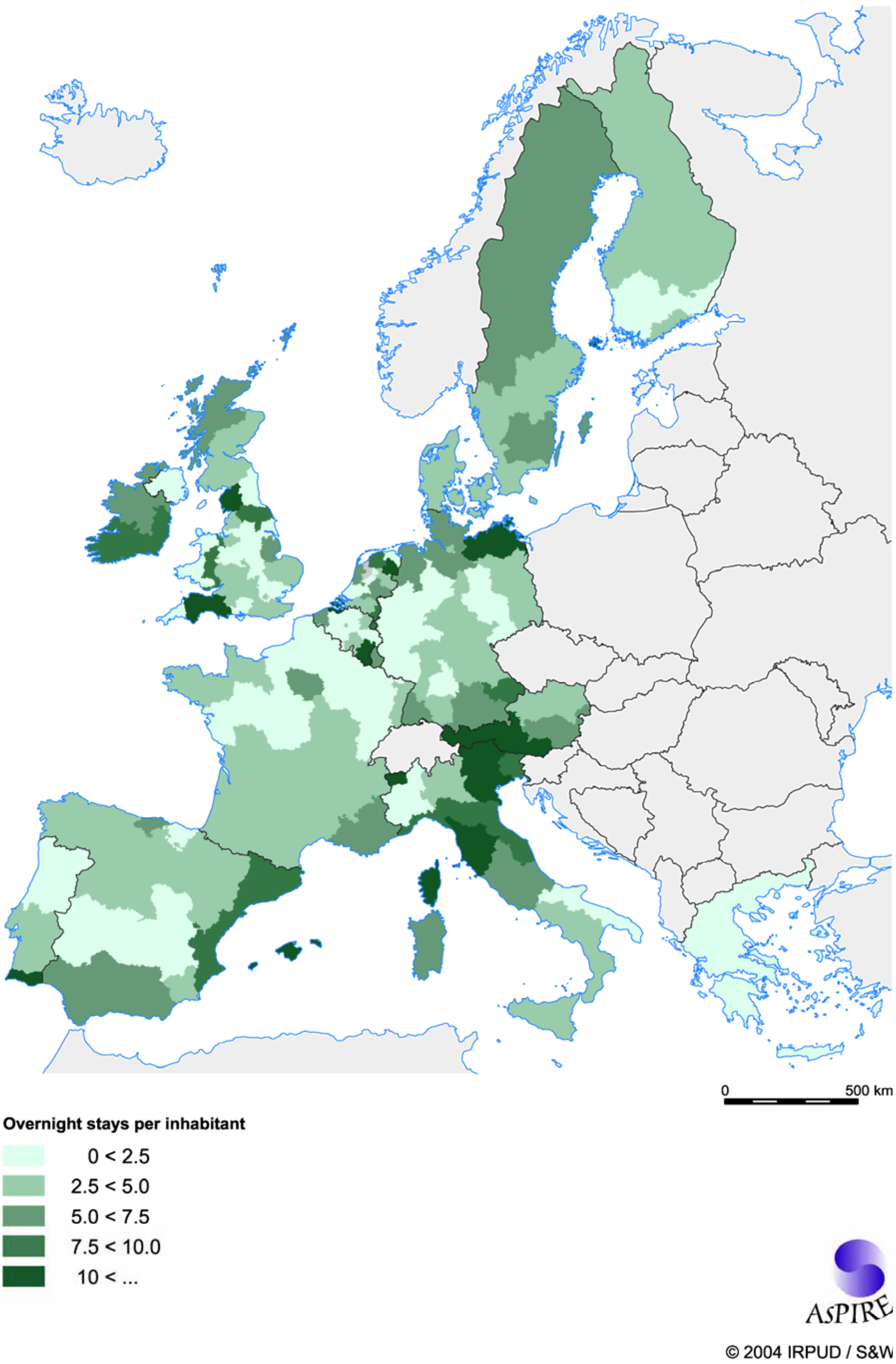

Figure 3.20. T 16/17 – Total overnight stays per inhabitant (Eurostat 2003)

Another (non-physical) supply-side indicator is bed-places per 1,000 inhabitants. Figure 3.19 shows high concentrations of bed-places precisely in mountainous and coastal areas. While some urban centres can be detected (e.g. Stockholm, Rome, Venice) most of the accommodation infrastructure seems to be located in rural areas. However, the degree of concentration is very high, leaving most rural regions with relatively low accommodation levels.

Finally Figure 3.20 presents the overnight stays per inhabitant, the most important demand-side indicator for tourism. The overall pattern is very much like the one in the previous map, only the southern European coasts are benefiting even more from tourism than their accommodation potentials would suggest. While in general coasts and mountain areas are clearly attracting most of the tourism business, all other rural areas are also participating significantly, catering perhaps more to short-term visitors from not too distant urban areas.

3.6 Summary

Based on Deliverable 18 data sets of 82 indicators were compiled and analysed reflecting on the five AsPIRE themes ICT, business networks, governance, social capital and tourism. Looking at the results in toto the following summary and conclusions can be drawn:

- In general the means for the rural regions were (albeit in most cases slightly) lower than the means of all EU regions in total. Thus AsP conditions in rural regions of Europe are overall rather a little worse than better than in urban regions. The only exception are business network indicators, many of them directly or indirectly reflected on government policies, though, which may be specifically targeted at rural regions.
- In contrast the standard deviations were generally higher, sometimes even substantially higher for rural regions than for all EU regions in total. This implies that in terms of AsP rural regions are more heterogeneous than their urban counterparts.
- As regards spatial distributions, the prevailing pattern showed high values for northern and central Europe and lower values for southern (and western) Europe. While this north-south decline may be the ‘grand pattern’ underlying most datasets, there often are complex variations and deviations from this distribution.
- Some indicators even have completely different spatial patterns (e.g. tourism indicators). The second most often found pattern occurred on the sub-national level and divided peripheral from more central regions, with the high/low attributes depending on the indicator.

The most interesting outcome of this analysis may be that in contrast to expectations the rural regions of the European Union are not more homogenous but more heterogeneous than the urban regions – at least regarding the AsP indicators. It will be the task of the next chapters to investigate how these heterogeneous data relate to economic output indicators.

IV KEY ECONOMIC AND ASP INDICATORS

Chapter 3 has revealed that most of the factors constituting "aspatial peripherality" are distributed over the European territory rather heterogeneously. According to the main hypothesis of the AsPIRE project, these differences might contribute to the explanation of differences in economic performance of rural regions in Europe (see D1). In order to test this assumption, the following section analyses the statistical correlations between the AsP indicators identified for each of the five AsPIRE-themes – ICT, Business Networks, Governance, Social Capital and Tourism – and a selection of economic output variables.

4.1 Method

The economic relevance of the AsP variables is analysed by bi-variate correlations and multivariate regression analyses and are presented for each theme in three steps:

- Bi-variate correlations: 60 out of the 82 AsP indicators of the AsP database compiled were correlated with two different output variables: first, regional GDP per capita, and second, the residual between regional GDP per capita and regional accessibility, both standardised to the average of the European Union. The Pearson correlations coefficients were calculated separately for all of the 1,085 EU NUTS-3 regions and for the subset of 442 regions defined as rural (see Chapter 2).
- Out of the pairs of correlated factors, a series of scatter diagrams were plotted to visualise some of the stronger correlations – both positive and negative ones – between selected AsP and economic variables.
- In addition, the indicators of each AsP theme were used as independent variables in additive multivariate regression models explaining the variance of 8 dependent variables:

gdpc1	GDP/capita in agriculture
gdpc2	GDP/capita in manufacturing
gdpsc3	GDP/capita in construction
gdpc4	GDP/capita in trade, transport, tourism
gdpc5	GDP/capita in financial services
gdpc6	GDP/capita in other services
gdpc7	Total GDP per capita
gdpc8	Residual GDP/accessibility

The coefficients of determination derived from the OLS stepwise regressions are displayed for both the total and the rural sample (1085 vs. 442 regions).

4.2 Key Economic and ICT Indicators

The set of ICT indicators presented in Chapter 3 includes 21 ICT indicators. In the following we concentrate on a choice of 16 indicators (see Table 4.1). Despite the fact that most of the indicators are available only at NUTS-0 level, relatively high correlations to the economic output variables can be observed: In nearly half of the cases, the correlation coefficients exceed the 0.3 threshold. The highest correlations can be found in the rural sample (n=442) with regard to GDP per capita as correlated variable. According to the expectations, the only notable negative correlations exist between the telecommunication price variable (I7B) and the economic variables.

Table 4.1: Bi-variate correlations: ICT and GDP/capita

		all Nuts-3 regions (n=1085)		rural Nuts-3 regions (n=442)	
		Total GDP per capita	Residual GDP accessibility per capita	Total GDP per capita	Residual GDP accessibility per capita
I2	ISDN subscriptions per capita	0.17(**)	-0.23(**)	0.08	-0.48(**)
I7B	Price of fixed line telephone call	-0.23(**)	-0.21(**)	-0.52(**)	-0.56(**)
I13A	% households who use computer	0.29(**)	0.03	0.66(**)	0.30(**)
I14	% households with Internet access	0.37(**)	0.08(**)	0.67(**)	0.26(**)
I15	% people using E-mail	0.32(**)	0.19(**)	0.56(**)	0.23(**)
I16	Internet users per capita	0.36(**)	0.08(*)	0.50(**)	0.13(**)
I17	PCs per 100 inhabitants	0.42(**)	0.03	0.65(**)	0.17(**)
I22	% employment in IT sector	0.32(**)	0.05	0.65(**)	0.36(**)
I26	IT enterprises per 1,000 population	0.20(**)	0.25(**)	0.44(**)	0.56(**)
I27	% GDP of IT sector	0.25(**)	0.14(**)	0.35(**)	0.19(**)
I38	secure servers / million inhabitants	0.34(**)	0.17(**)	0.53(**)	0.24(**)
I40	% of online sales	0.30(**)	0.06(*)	0.35(**)	0.11(*)
I42	% online buyers	0.33(**)	0.09(**)	0.48(**)	0.19(**)
I46	Internet domains per capita	0.14(**)	0.15(**)	0.45(**)	0.45(**)
I54	% households using modem	0.33(**)	0.08(**)	0.50(**)	0.28(**)
I55	% households using online services	0.37(**)	0.10(**)	0.59(**)	0.32(**)

* significant at 0.05 level (2-sides)

**significant at 0.01 level (2-sides)

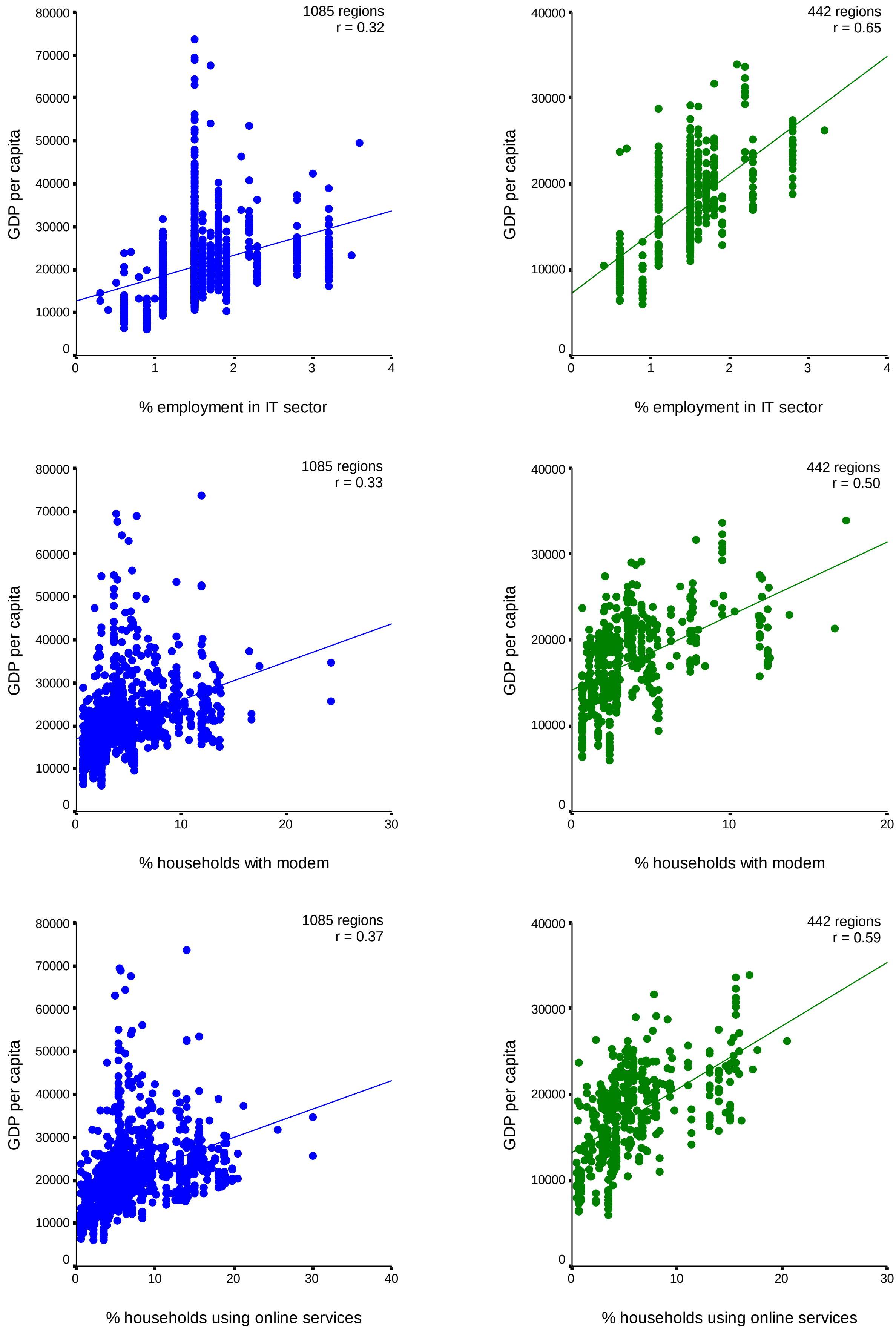

Figure 4.1. Bi-variate correlations, selected ICT-indicators and GDP per capita

Table 4.2: The explanatory power of ICT variables

Dependent variable	Coefficient of determination (r^2)	
	All regions (1085)	Rural regions (442)
GDP in agriculture	0.47	0.49
GDP in manufacturing	0.25	0.41
GDP in construction	0.38	0.56
GDP in trade, transport, tourism	0.23	0.51
GDP in financial services	0.23	0.50
GDP in other services	0.31	0.66
Total GDP	0.27	0.63
Residual GDP/accessibility	0.24	0.57

Altogether, ICT infrastructure and its use is clearly positively related to wealth expressed by GDP, and seems to be particularly linked to the economic success of rural regions. The “share of households using online services” alone “explains” about one third of the GDP variance in rural regions (see Figure 4.1). Together, the ICT factors attain a coefficient of determination (r^2) ranking from 0.23 (GDP in financial services, 1085 regions) to 0.66 (GDP in other services, 442 regions).

The multivariate analysis confirms one of the main results obtained by the bi-variate one: ICT factors are particularly suited for the explanation of GDP-level differences in rural regions. In general, they appear more often and with higher absolute values in the “rural” regression models than in the ones run with a sample of 1,085-regions.

4.3 Key Economic and Business Networks Indicators

Contrary to the ICT indicators, the Business Networks indicators are hardly correlated with the two GDP variables. The “share of manufacturing SMEs involved in innovation cooperations” (B1) is the sole variable clearly connected to the regional wealth level (see Table 4.3). Moreover, the variables B3 (share of venture capital), B5 (number of clusters cited in literature) and B9 (business incubators per 100,000 inhabitants) are modestly, but positively correlated with GDP. In contrast, regions participating in the EU innovations programmes (B2d) as well as regions with increasing international contacts (B6a) are generally marked by below-average GDP levels.

Table 4.3: Bi-variate correlations: business networks and GDP/capita

		all Nuts-3 regions (n=1085)		rural Nuts 3 regions (n=442)	
		Total GDP per capita	Residual GDP accessibility per capita	Total GDP per capita	Residual GDP accessibility per capita
B1	% manuf. SMEs in innovation coop.	0.36(**)	0.19(**)	0.60(**)	0.31(**)
B2d	EU Innovation Programs (B2a-c)	-0.19(**)	0.01	-0.23(**)	0.02
B3	% venture capital	0.19(**)	0.03	0.23(**)	0.18(**)
B4	% firms with high location coefficient	-0.10(**)	-0.08(**)	-0.16(**)	-0.26(**)
B5	Number of regional clusters	0.16(**)	0.09(**)	0.11(*)	0.13(**)
B6a	increasing internat. contacts (1999)	-0.07(*)	0.21(**)	-0.05	0.32(**)
B9	Business incubators per 100,000 pop.	0.18(**)	0.23(**)	0.13(**)	0.12(**)

* significant at 0.05 level (2-sides)

**significant at 0.01 level (2-sides)

This may not bee too surprising: Both indicators represent a kind of business network (innovation networks, vertical networks); but they also stand for an economic disadvantage: In general, areas benefiting from (any kind of) funding can be thought of still lagging behind. Similarly, those regions whose international contacts *increase* the fastest probably depart from a low start level. However, a really unexpected result is constituted by the slight, but significant and negative correlation coefficients of B4: Apparently, regions with businesses in branches with high location coefficients cannot benefit from these "potential clusters”. One should yet keep in mind that the mere concentration of businesses, mirrored by location coefficients, does not necessarily imply inter-firm cooperation and networks.

As shown in the scatter diagrams, the different business networks variables available at regional level hardly explain the GDP variance in the European regions (see Figure 4.2). Even all business networks variables taken together explain only 10% (GDP in agriculture, 1,085 regions) to a maximum of 43% (total GDP, 442 regions) of the regional variance in GDP. It is noticeable that the coefficients of determination are clearly higher in the rural than in the total samples (see Table 4.4).

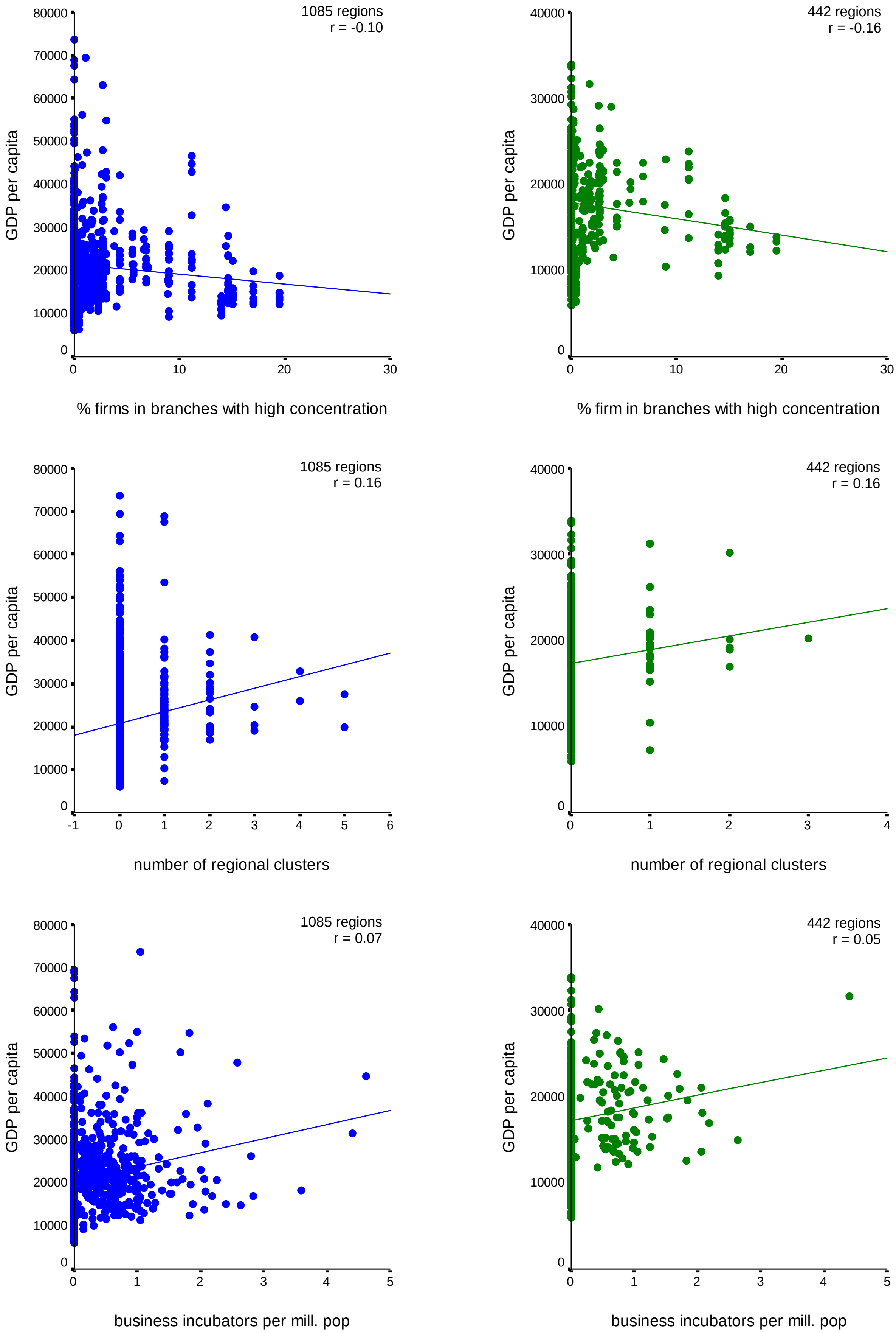

Figure 4.2. Bi-variate correlations, selected business networks indicators and GDP/capita.

Table 4.4: The explanatory power of business networks variables

Dependent variable	Coefficient of determination (r^2)	
	All regions (1085)	Rural regions (442)
GDP in agriculture	0.10	0.12
GDP in manufacturing	0.13	0.30
GDP in construction	0.27	0.38
GDP in trade, transport, tourism	0.10	0.12
GDP in financial services	0.10	0.21
GDP in other services	0.18	0.36
Total GDP	0.20	0.43
Residual GDP/accessibility	0.12	0.26

4.4 Key Economic and Governance Indicators

The governance indicators are partly available at national level (NUTS-0), partly at regional level (NUTS-2). Interestingly, most of the "national variables" display higher bi-variate correlations with the GDP variables than the regional ones. Among the indicators with the clearest relation to GDP are the "voice and accountability index" (G7b), the "government efficiency index" (G9b), the "rule of law index" (G13a) and the "control of corruption index" (G14b). The high scores of these (national) indicators can be explained in two ways: First, they all are composite indicators, hence they combine a large set of indicators. They might generally have a higher explanatory power here than single indicators. Second, the result corresponds to the estimation that the international differences in the governance systems (e.g. tax systems, administrative structures, budget allocations) prevail over the regional ones.

Out of the indicators available at regional level, the highest correlation coefficients are attained by the indicators on "trust in institutions" (G12a-c) and by the "voter turnout at national elections" (G18) (Figure 4.3). In contrast, the "satisfaction/dissatisfaction with democracy" (G16, G17) and the "voter turnout at regional elections" are not significantly related to GDP. The "influence of citizens on government" (G15) even seems to exert a slightly negative effect on wealth (see Table 4.5). Generally, the Governance indicators attain higher correlations in the rural sample (n=442) than in the one for all 1,085 European NUTS-3 regions.

The aggregated explanatory power of all governance indicators varies with the respective dependent variable, ranking from a coefficient of determination of only 0.15 (GDP in trade transport and tourism, n=1,085) to a maximum one of 0.6 (GDP in other services, n=422). Again, the coefficients of correlation are notably higher in the rural areas (see Table 4.6).

Table 4.5: Bi-variate correlations: governance and GDP/capita in rural areas

		all Nuts-3 regions (n=1085)		rural Nuts-3 regions (n=442)	
		Total GDP per capita	Residual GDP accessibility per capita	Total GDP per capita	Residual GDP accessibility per capita
G1b	Political stability index (2002)	0.09(**)	0.02	0.15(**)	0.13(**)
G7b	Voice & accountability index (2002)	0.34(**)	-0.03	0.47(**)	0.05
G8b	Regulatory quality index	0.29(**)	0.04	0.42(**)	0.11(*)
G9b	Government efficiency index	0.35(**)	-0.02	0.55(**)	0.06
G10	IMD Government efficiency Index	0.26(**)	0.24(**)	0.52(**)	0.33(**)
G11	Global Current Competitiveness Index Rank (2001) (75 countries),	-0.40(**)	0.08(*)	-0.55(**)	0.05
G12a	Trust in institutions: Justice	0.18(**)	0.05	0.18(**)	0.05
G12b	Trust in institutions: Police	0.33(**)	0.10(**)	0.44(**)	0.04
G12c	Trust in institutions: Civil service	0.18(**)	0.02	0.27(**)	0.11(*)
G13a	Rule of law (2000/01)	0.36(**)	-0.01	0.52(**)	0.02
G14b	Control of corruption index (2002)	0.34(**)	0.03	0.53(**)	0.12(*)
G15	Influence of citizens on government	0.07(*)	-0.18(**)	-0.14(**)	-0.36(**)
G16	Satisfaction with democracy	-0.08(**)	0.10(**)	-0.04	0.22(**)
G17	Dissatisfaction with democracy	-0.03	0.02	-0.02	-0.02
G18	Voter turnout at national elections	0.12(**)	-0.23(**)	0.32(**)	-0.24(**)
G19	Voter turnout at regional elections	-0.07(*)	-0.02	0.06	-0.05

* significant at 0.05 level (2-sides)

**significant at 0.01 level (2-sides)

Table 4.6: The explanatory power of governance variables

Dependent variable	Coefficient of determination (r^2)	
	All regions (1085)	Rural regions (442)
GDP in agriculture	0.30	0.41
GDP in manufacturing	0.25	0.42
GDP in construction	0.37	0.53
GDP in trade, transport, tourism	0.15	0.37
GDP in financial services	0.21	0.55
GDP in other services	0.29	0.60
Total GDP	0.22	0.52
Residual GDP/accessibility	0.20	0.44

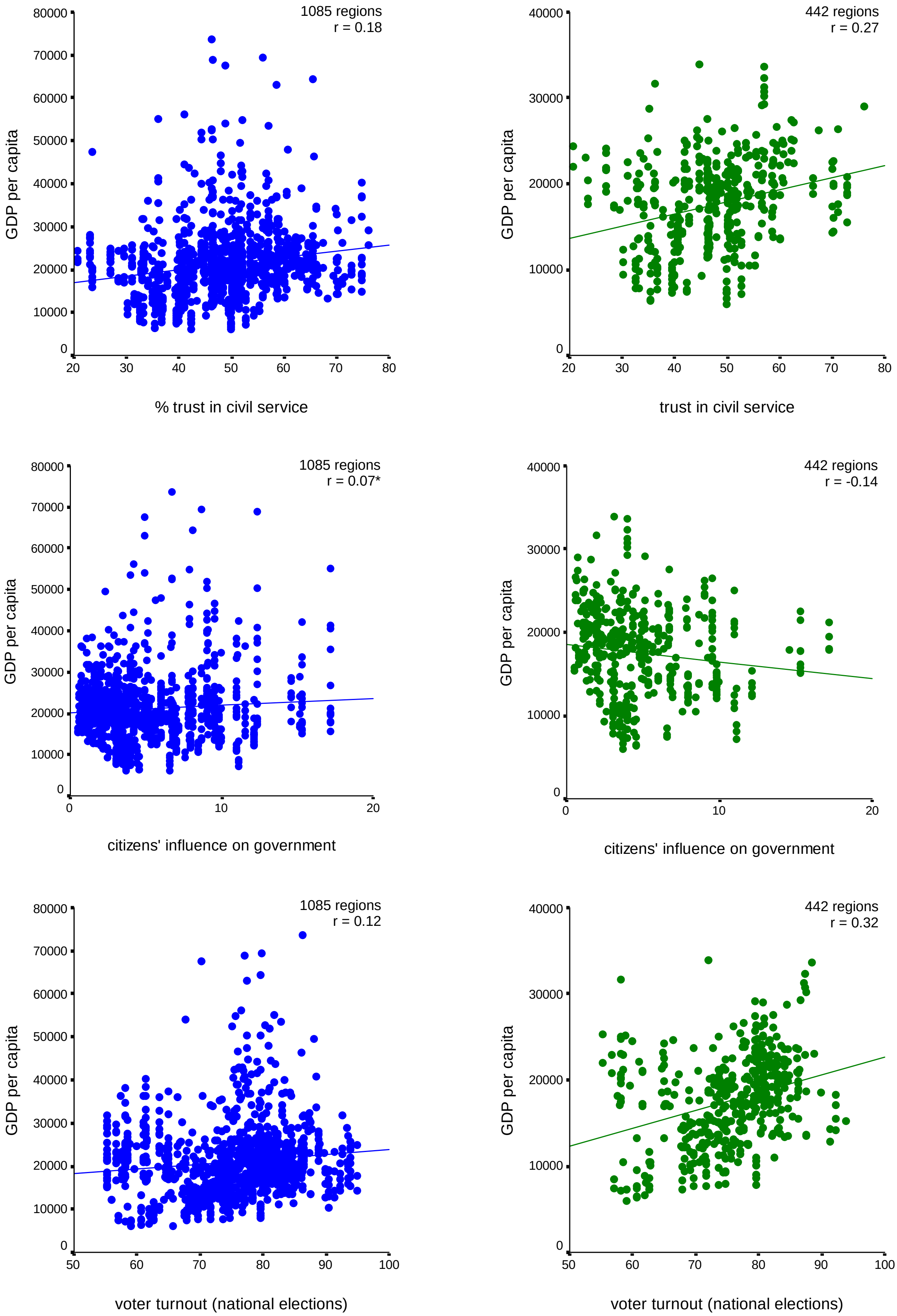

Figure 4.3. Bi-variate correlations, selected governance indicators and GDP per capita

4.5 Key Economic and Social Capital Indicators

In the subsequent analysis, social capital and social networks are covered by ten variables. Three indicators stand for the “antecedents” of social capital: the share of people regularly reading newspapers (S2b) and the attachment to town/village or region (S5a/b). Four indicators mirror values and norms such as political interest (S8g, S17), openness to foreigners (S18) and the importance of social values compared to economic ones (S19). Finally, the selection contains two classic network indicators (membership and engagement in associations, S20, S21) and “trust in other persons” as immediate outcome of social networks (S10).

Altogether, the bi-variate correlations with GDP per capita and the residual from accessibility and GDP per capita are rather low. Only in the rural sub-sample a couple of coefficients are above the 0.3 level (see Table 4.7). Interestingly, the networks and trust indicators show the highest interdependencies with the GDP variables, while most other variables are only insignificantly or even negatively related to regional wealth. The high scores of the trust and engagement variables are in line with the findings of e.g. Francis Fukuyama (1995) and Robert Putnam (1993). They are also mirrored by the scatter diagrams (see Figure 4.4).

Table 4.7: Bi-variate correlations: social capital and GDP/capita in rural areas

		all Nuts 3 regions (n=1085)		rural Nuts 3 regions (n=442)	
		Total GDP per capita	Residual GDP accessibility per capita	Total GDP per capita	Residual GDP accessibility per capita
S2b	% reading newspapers daily	0.30(**)	0.02	0.47(**)	0.01
S5a	Attachment to town/village	-0.22(**)	-0.03	-0.36(**)	-0.25(**)
S5b	Attachment to region	-0.25(**)	0.03	-0.46(**)	-0.14(**)
S8g	Combined political interest indicator	0.20(**)	-0.09(**)	0.26(**)	-0.20(**)
S10	% trust in other persons	0.16(**)	0.15(**)	0.41(**)	0.31(**)
S17	Political discussion	-0.16(**)	0.07(*)	-0.17(**)	0.18(**)
S18	Openness to foreigner	-0.19(**)	-0.10(**)	-0.38(**)	-0.16(**)
S19	Social more important than economic	-0.28(**)	-0.11(**)	-0.43(**)	-0.16(**)
S20	Voluntary engagement	0.15(**)	0.15(**)	0.29(**)	0.45(**)
S21	Membership in associations	0.16(**)	-0.04	0.33(**)	0.24(**)

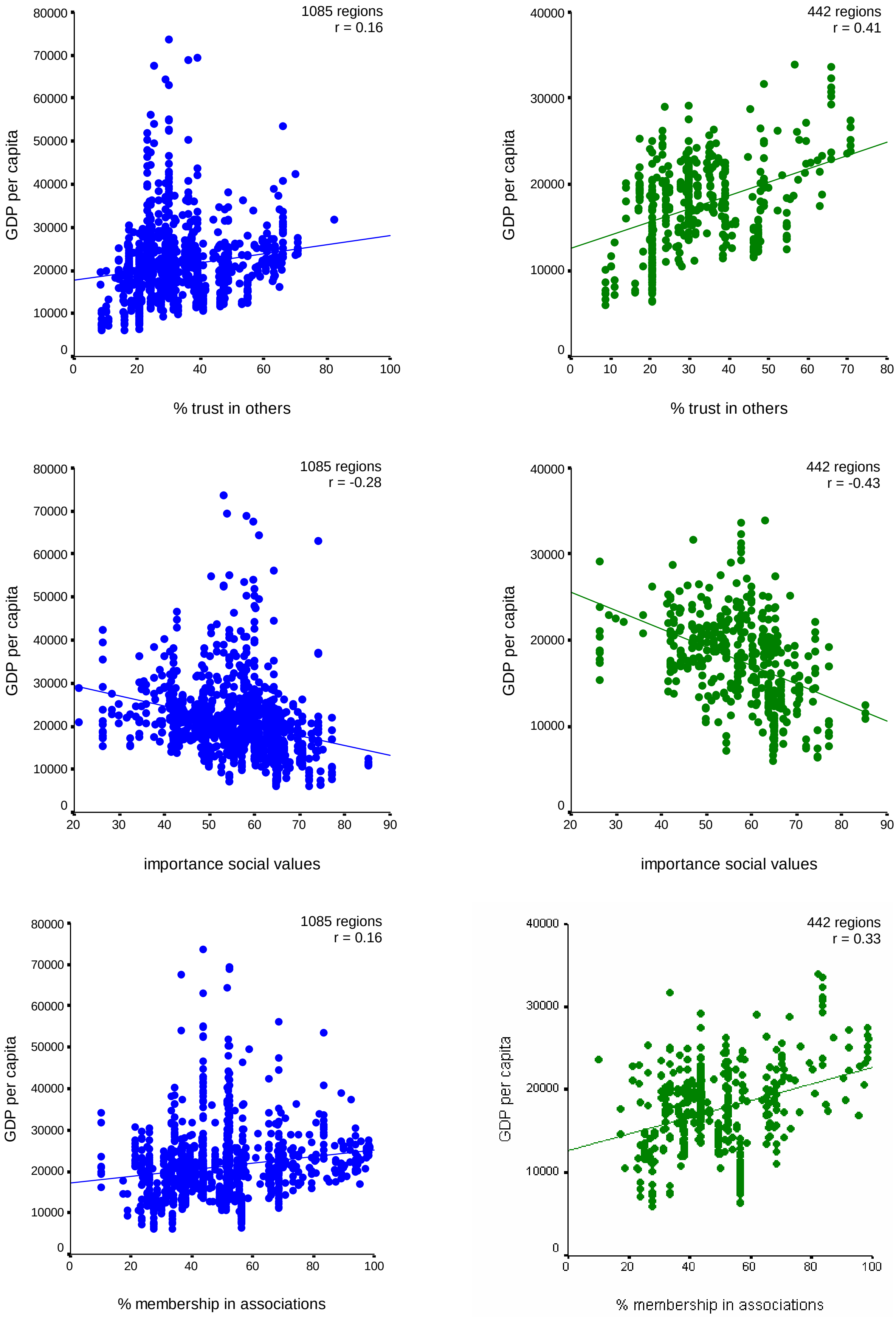

Figure 4.4. Bi-variate correlations, selected social capital indicators and GDP per capita

Taken together, the social capital variables are hardly suited to explain disparities in GDP/capita among the 1,085 European regions. However, if the regressions are run for the sample of rural regions (n=442), the social capital indicators can explain about one third of the variance in GDP (see Table 4.8).

Table 4.8: The explanatory power of social capital variables

Dependent variable	Coefficient of determination (r^2)	
	All regions (1085)	Rural regions (442)
GDP in agriculture	0.23	0.28
GDP in manufacturing	0.20	0.35
GDP in construction	0.31	0.43
GDP in trade, transport, tourism	0.15	0.32
GDP in financial services	0.17	0.39
GDP in other services	0.17	0.37
Total GDP	0.20	0.50
Residual GDP/accessibility	0.08	0.37

4.6 Key Economic and Tourism Indicators

The indicators chosen for the tourism sector cover both the supply side (e.g. attractive towns, mountain areas) and the demand side (e.g. accommodation establishments). Interestingly, except from the indicators on lakefront and riverfront, none of the tourism variables included in the analysis is positively related to regional wealth (Table 4.9). The three indicators displaying the regional relief profile (T2, T3, T21) as well as the indicator on “annual solar radiation” (T1) are even negatively correlated to GDP. However, the described bi-variate correlations do not allow for the simple conclusion that “tourism does not matter”. They rather mirror the problems of finding adequate, solely tourism-related indicators. While a high annual solar radiation favours the tourism sector, it may also counteract other types of economic activity. Similarly, regions with high share of mountainous areas are attractive for some kinds of tourism, but may hinder the establishment of e.g. manufacturing plants. Also the positive correlation found in the case of the “river front”-indicator (see Figure 4.5) is at least two-sided: On the one hand, rivers represent tourist attractions; on the other hand, they can be classified as important transport infrastructures. Hence, it is difficult to deduce the economic relevance of tourism indicators from simple bi-variate analyses. However, even the multivariate regressions do not lead to clear results in the tourism case. The achieved coefficients of determination are relatively low (see Table 4.10).

Table 4.9: Bi-variate correlations: tourism and GDP/capita

		all Nuts-3 regions (n=1085)		rural Nuts-3 regions (n=442)	
		Total GDP per capita	Residual GDP accessibility per capita	Total GDP per capita	Residual GDP accessibility per capita
T1	Annual solar radiation	-0.38(**)	0.08(*)	-0.53(**)	-0.02
T2	Elevation difference	-0.26(**)	0.14(**)	-0.13(**)	0.16(**)
T3	Slope gradient	-0.21(**)	0.11(**)	-0.09	0.11(*)
T4	Coastline	-0.04	0.18(**)	0.00	0.26(**)
T5	Attractive towns	-0.08(*)	0.17(**)	0.13(**)	0.34(**)
T9	Accommodation establishments / cap.	-0.03	0.11(**)	0.21(**)	0.17(**)
T11	Hotel beds / cap.	-0.08(*)	0.08(**)	0.07	0.09
T17	Overnight stays / cap.	0.01	0.18(**)	0.13(**)	0.15(**)
T19	Lakefront	0.20(**)	0.06(*)	0.09	0.27(**)
T20	Riverfront	0.36(**)	-0.04	0.11(*)	-0.22(**)
T21	% Mountain areas	-0.30(**)	0.07(*)	-0.22(**)	0.066

* significant at 0.05 level (2-sides)

**significant at 0.01 level (2-sides)

Table 4.10: The explanatory power of tourism variables

Dependent variable	Coefficient of determination (r^2)	
	All regions (1085)	Rural regions (442)
GDP in agriculture	0.13	0.13
GDP in manufacturing	0.19	0.29
GDP in construction	0.20	0.29
GDP in trade, transport, tourism	0.19	0.29
GDP in financial services	0.20	0.11
GDP in other services	0.20	0.25
Total GDP	0.26	0.39
Residual GDP/accessibility	0.08	0.27

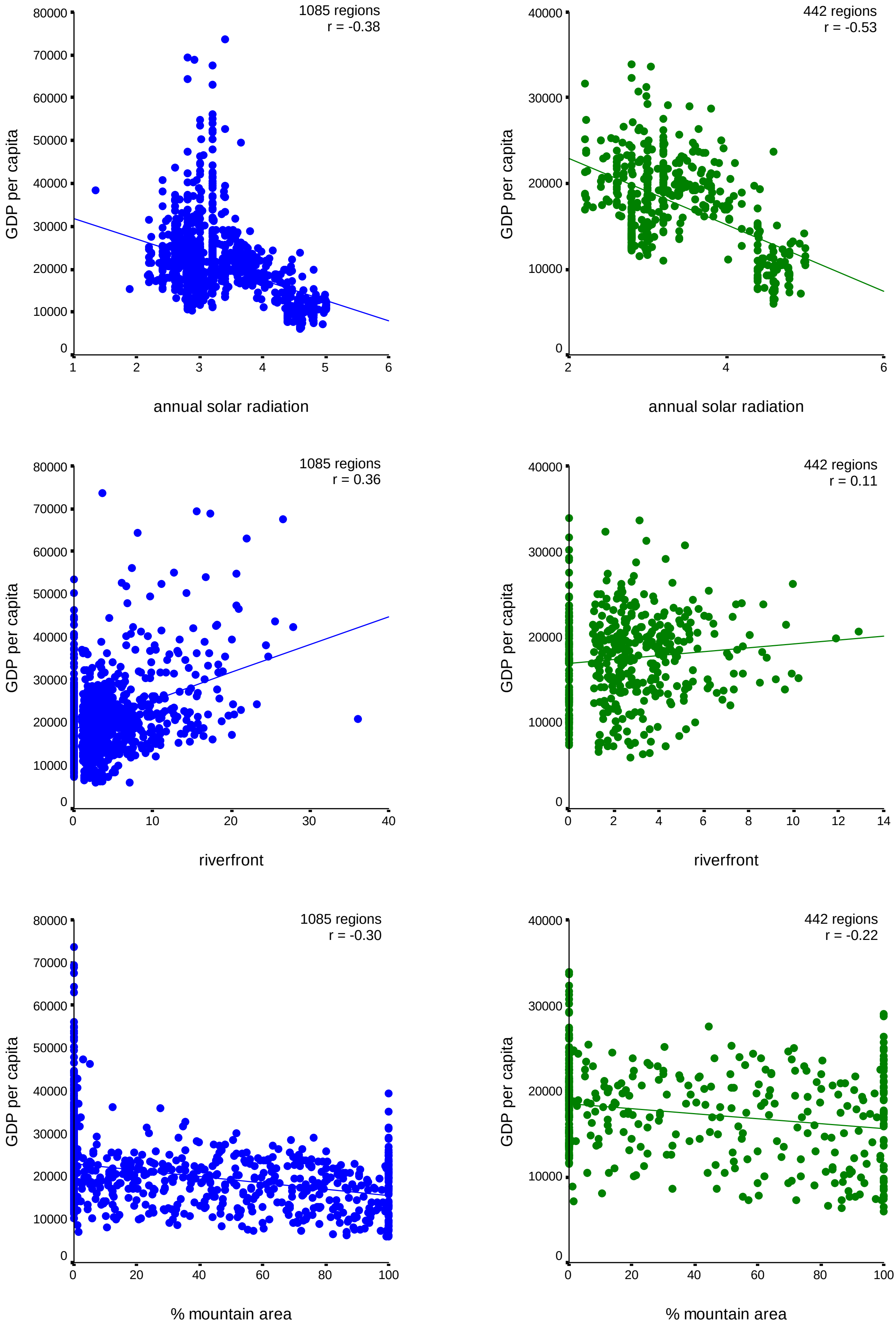

Figure 4.5. Bi-variate correlations, selected Tourism indicators and GDP per capita

4.7 Summary

In this chapter, the interdependencies between key economic indicators and AsP factors were analysed. A selection of indicators for each of the five AsP themes was correlated with eight economic output variables. The results only partly confirm the economic relevance of AsP factors.

- *ICT:* Most of the ICT-variables are positively and significantly correlated with regional wealth. The variables most clearly related to the GDP level within the regression models are “share of households who use computer” and the “share of GDP of the ICT sector”.
- *Business networks:* The interdependencies between endowment with business networks and regional wealth seem to be rather low. Except for the “share of businesses involved in innovation cooperations”, the chosen indicators appear to be only modestly correlated with the various GDP-variables.
- *Governance*: The aggregated explanatory power of all governance indicators varies considerably with the respective dependent variable and is generally higher in rural regions than in all regions. Governance indicators available at national level as composite indices show often higher bi-variate correlations with GDP than indicators available at the regional level.
- *Social capital:* Both the bi-variate correlations and the multivariate regressions reveal relatively low interdependencies between social capital endowments and regional economic success. However, the positive impact of “trust” and “civic engagement” as traditional social capital variables is clearly confirmed.
- *Tourism*: Most of the tourism variables are insignificantly or even negatively related to regional wealth. This is partly due to the multi-facetted effects that typical indicators of “tourism attraction” (e.g. solar radiation) exert on other economic activities.

A general conclusion is that the coefficients of determination attained by the five AsP factors vary significantly, depending on the regional sample and the variable explained. As a rule, they are clearly higher for the sub-sample of rural areas. This is partly due to the higher homogeneity of the (smaller) sample, but can also be interpreted as a confirmation for the hypothesis expressed by the AsPIRE-team that factors of “aspatial peripherality” are of particular relevance for the economic success of *rural* regions.

V THE EXPLANATORY POWER OF ASP INDICATORS FOR REGIONAL ECONOMIC DEVELOPMENT

In this chapter it will be examined how much the AsP indicators presented in Chapter 3 and analysed theme by theme in the previous chapter contribute together and also together with hard location factors to explaining the differences in economic performance of the regions in Europe.

5.1 Method

For this purpose, a subset of the full range of AsP indicators calculated for NUTS-3 regions in the European Union was selected for an in-depth analysis. The selected indicators cover all five themes of AsPIRE:

ICT	I2	ISDN subscriptions per capita
	I14	% households with Internet access
	I22	% employment in IT sector
	I26	IT enterprises per 1,000 population
	I27	% GDP of IT sector
	I40	% of online sales
	I42	% online buyers
	I46	Internet domains per capita
	I54	% households using modem
	I55	% households using online services
Business networks	B1	% SME in innovative co-operation
	B2d	EU innovation programmes
	B3	% venture capital
	B4	% firms with high location coefficient
	B5	Number of regional clusters
	B6a	% SME with international business
	B9	Business incubators
Social capital	S2b	% reading newspapers daily
	S5a	Attachment to town/village
	S5b	Attachment to region
	S8g	Combined political interest indicator
	S10	% trust in other persons
	S17	Political discussion
	S18	Openness to foreigner
	S19	Social more important than economic
	S20	Voluntary engagement
	S21	Membership
Governance	G1b	Political stability index
	G8b	Regulatory quality index
	G9b	Government efficiency index

	G12a	Trust in institutions: Justice
	G12b	Trust in institutions: Police
	G12c	Trust in institutions: Civil service
	G14b	Control of corruption index
	G15	Influence of citizens on government
	G16	Satisfaction with democracy
	G18	Voter turnout at national elections
	G19	Voter turnout at regional elections
Tourism	T1	Annual solar radiation
	T2	Elevation difference
	T3	Slope gradient
	T4	Coastline
	T5	Attractive towns
	T11	Hotel beds per capita
	T17	Overnight stays per capita
	T19	Lakefront
	T20	Riverfront
	T21	% Mountain areas

In addition, a number of 'hard' location factors usually applied in location analyses were included in the analysis. The following data were taken from the databases of the EU projects IASON and ESPON 2.1.1:

Economy	shag1	% GDP of in agriculture
	shag2	% GDP in manufacturing
	shag3	% GDP in construction
	shag4	% GDP in trade, transport, tourism
	shag5	% GDP in financial services
	shag6	% GDP in other services
Accessibility	acc91	Accessibility, road/rail, travel
	acc92	Accessibility, road/rail/air, travel
	acc93	Accessibility, road/rail, travel/freight
	acc94	Accessibility, road, freight
	acc95	Accessibility to regional labour
	L1	Baseline peripherality indicator
	L2	National peripherality indicator
Endowment	soilq	Soil quality
	pdens	Population density
	devld	% developable land
	rdinv	R&D investment (% of GDP)
	eduhi	% higher education
Subsidy	subag	Agricultural subsidies (Euro/capita)
	subeu	European subsidies (Euro/capita)
	subna	National subsidies (Euro/capita)

These NUTS-3 data were used to predict regional GDP per capita for six industrial sectors and total GDP per capita using a regional quasi-production function of the form

$$q_r = A_{1r}^{\beta_1} A_{2r}^{\beta_2} \ldots B_{1r}^{\gamma_1} B_{2r}^{\gamma_2} \ldots e_r^{\delta}$$

where q_r is GDP per capita in region *r*, the $A_{.r}$, are AsP indicators and the $B_{.r}$ are the traditional 'hard' production factors and the $\beta.$, $\gamma_.$ and $\delta.$ are parameters to be estimated. The seven dependent variables to be estimated were:

gdpc1	GDP/capita in agriculture
gdpc2	GDP/capita in manufacturing
gdpsc3	GDP/capita in construction
gdpc4	GDP/capita in trade, transport, tourism
gdpc5	GDP/capita in financial services
gdpc6	GDP/capita in other services
gdpc7	Total GDP per capita

In addition, an eighth dependent variable was predicted: the residual between total regional GDP per capita standardised to the average GDP per capita of the European Union (EU15) and regional accessibility standardised to the average accessibility of the European Union:

gdpc8	Residual GDP/accessibility

For each of the above eight dependent variables two sets of regressions were performed. One set of regressions used the data of all 1,085 NUTS-3 regions of the European Union. The other set of regressions used only data of the 442 regions classified as rural in AsPIRE. In each set, three different kinds of regressions were performed: The first type used only the above 48 AsP variables as predictors. The second kind used only the above 21 'hard' variables as predictors. The third kind used all 69 variables as predictors. So for each of the eight dependent variable six regressions were performed:

1,085 regions, only AsP variables
1,085 regions, only 'hard' variables
1,085 regions, all variables
442 regions, only AsP variables
442 regions, only 'hard' variables
442 regions, all variables

This resulted in 8 x 6 or altogether 48 regressions. The regressions were run as stepwise multiple regressions in which predictor variables were selected or deselected depending on their contribution to the F-level of the estimation.

5.2 Results

Figure 5.1 to 5.8 present the results of the six regressions per industrial sector as scatter diagrams showing the correlation between observed and predicted values of GDP per capita. Table 5.1 summarises the results in terms of the coefficient of determination or r^2.

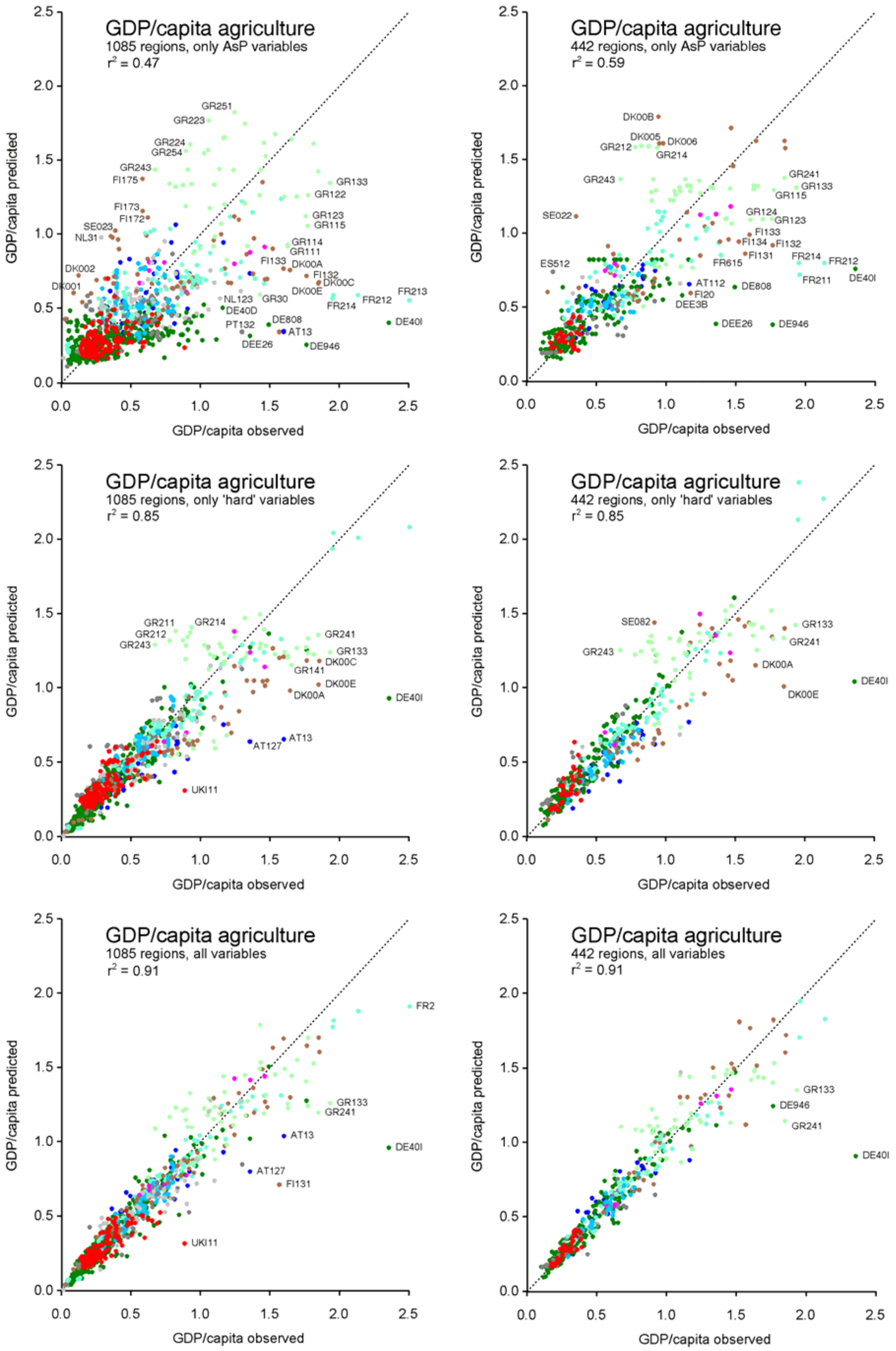

Figure 5.1. Comparison of regressions: GDP in agriculture

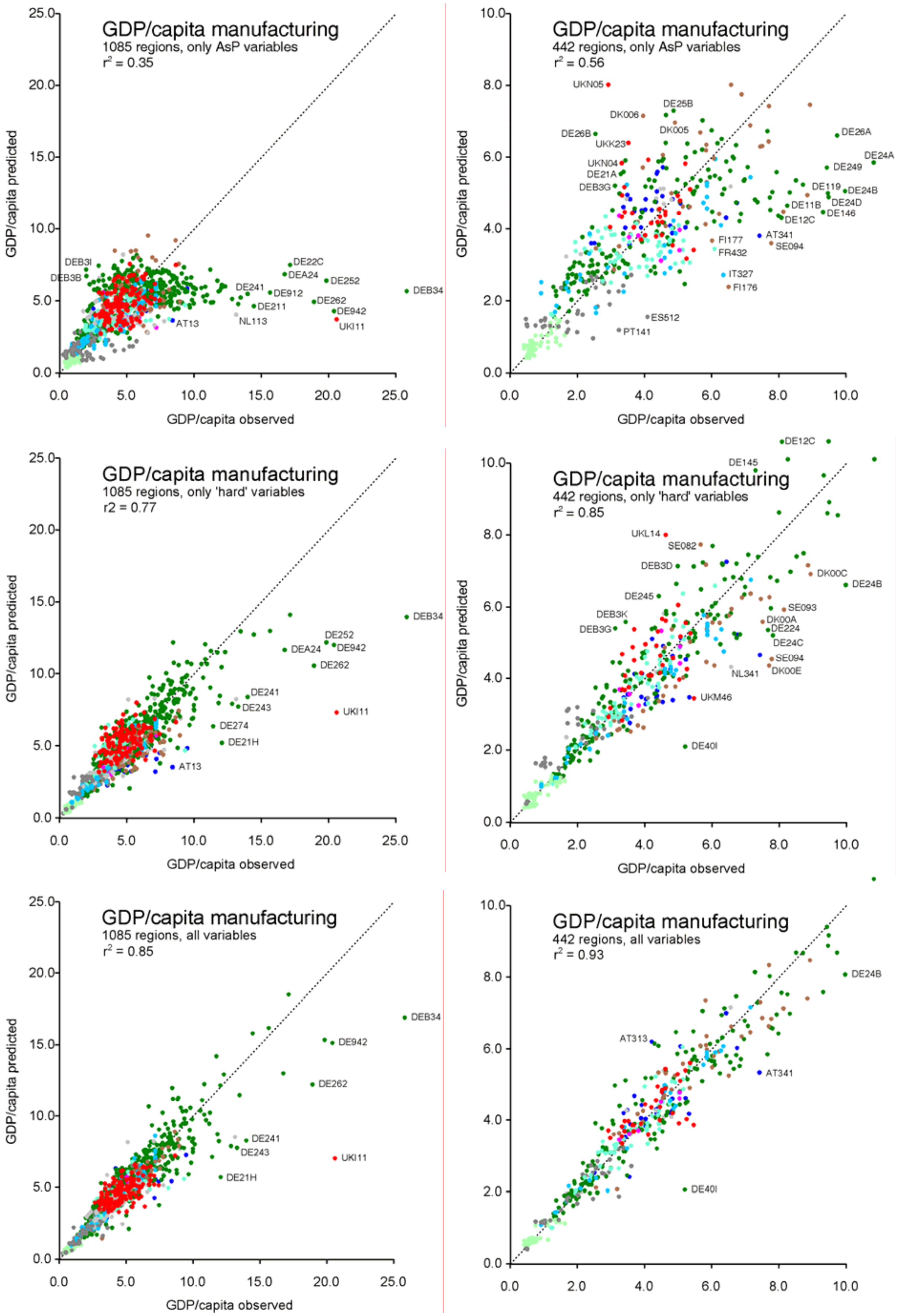

Figure 5.2. Comparison of regressions: GDP in manufacturing

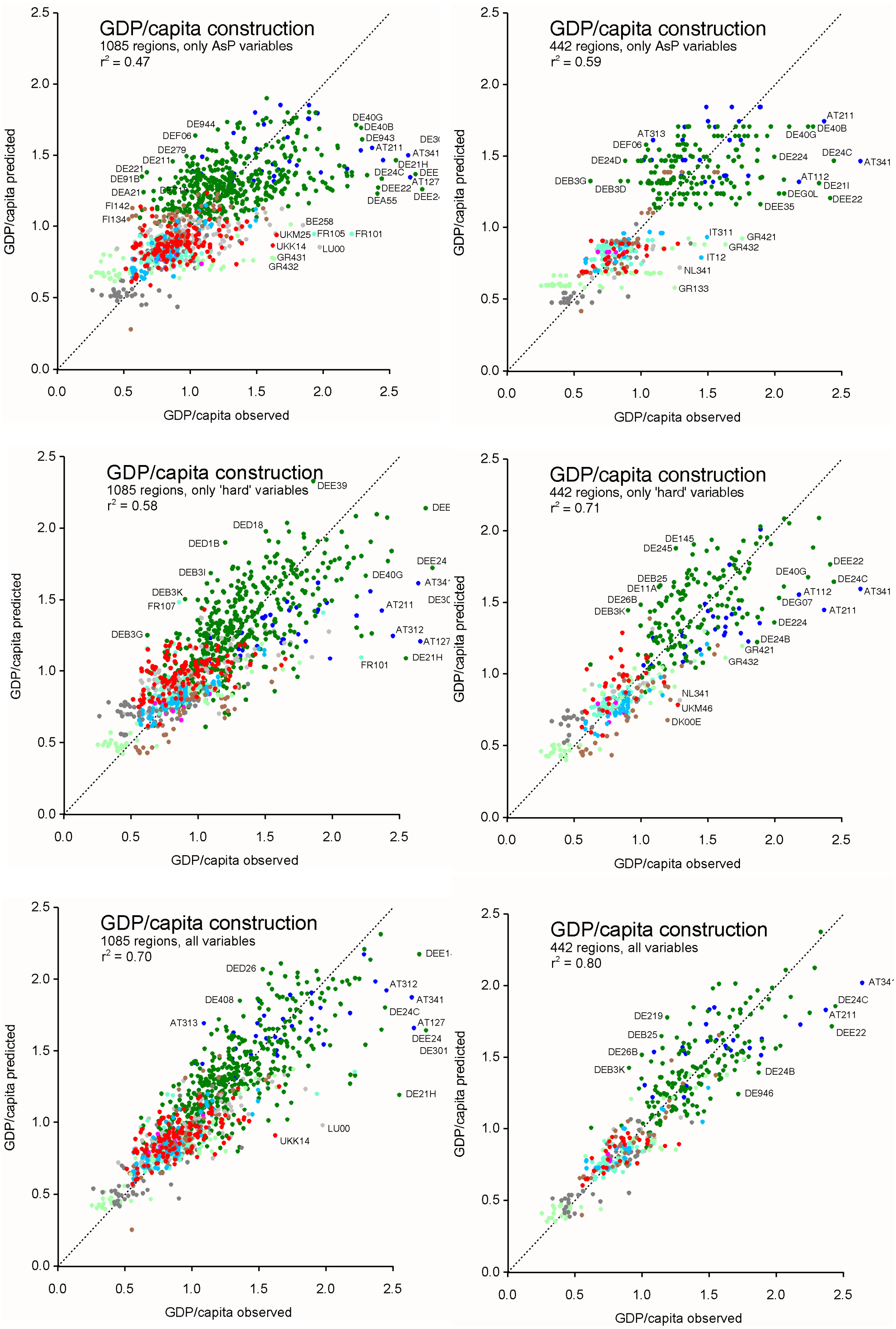

Figure 5.3. Comparison of regressions: GDP in construction

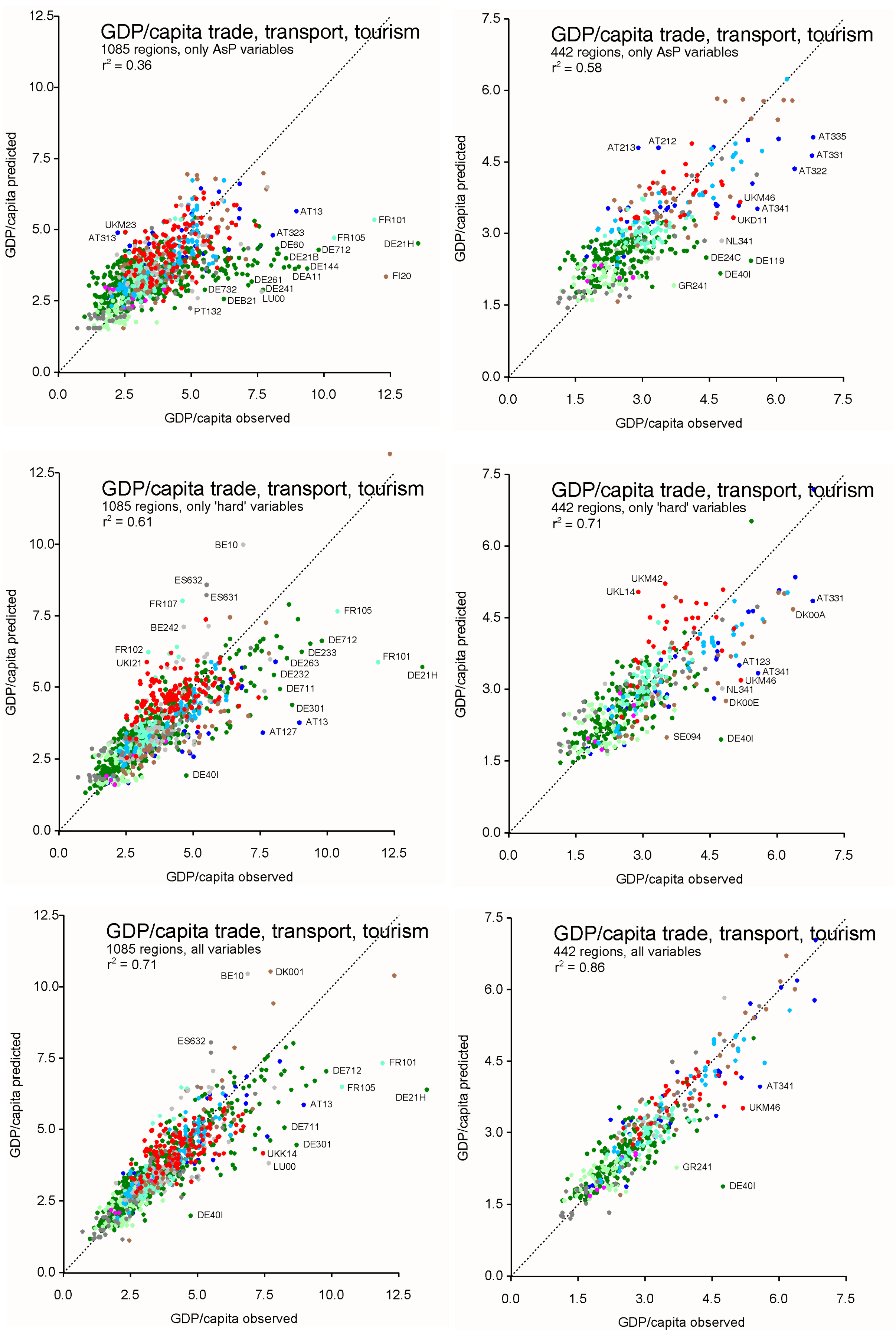

Figure 5.4. Comparison of regressions: GDP in trade, transport, tourism

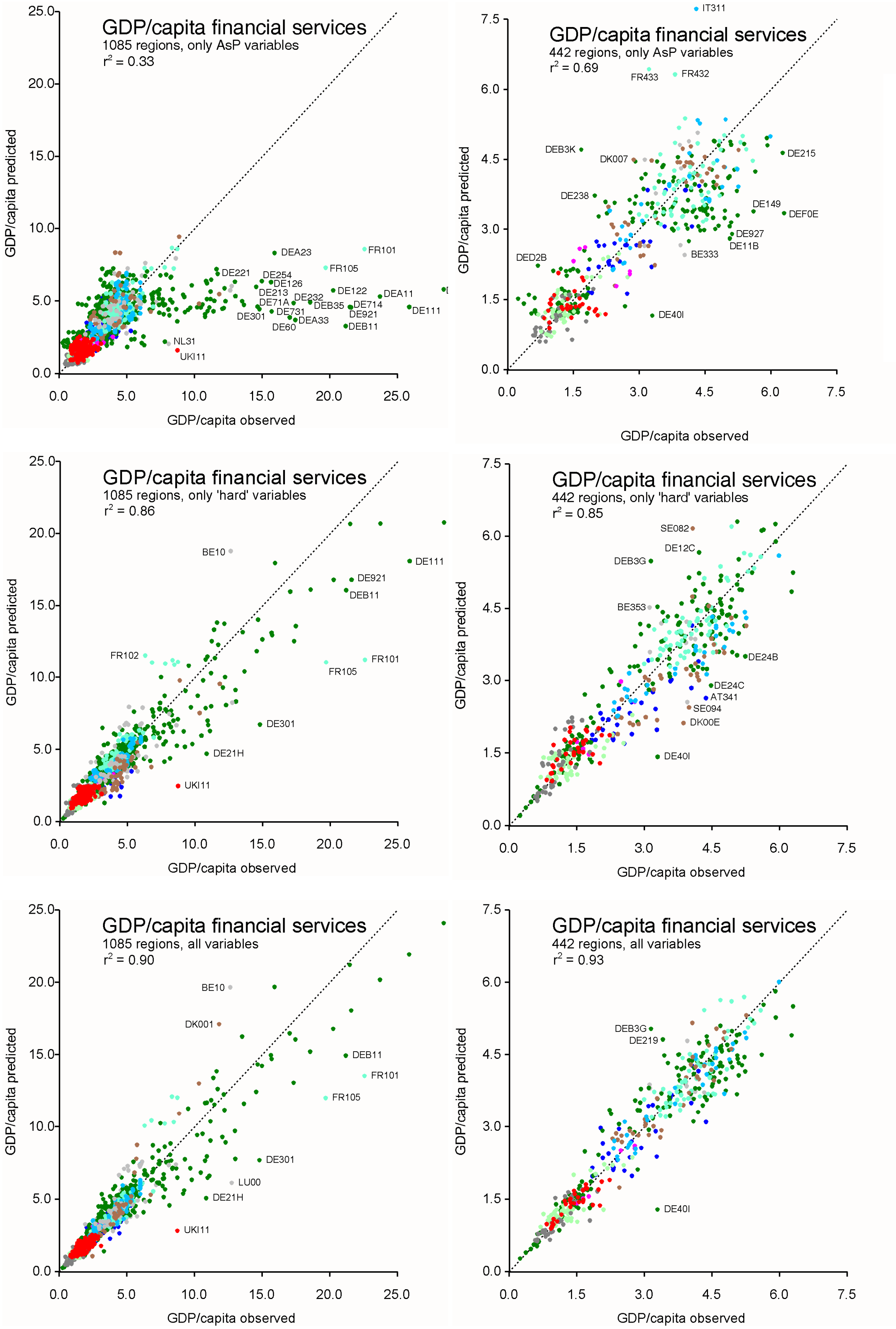

Figure 5.5. Comparison of regressions: GDP in financial services

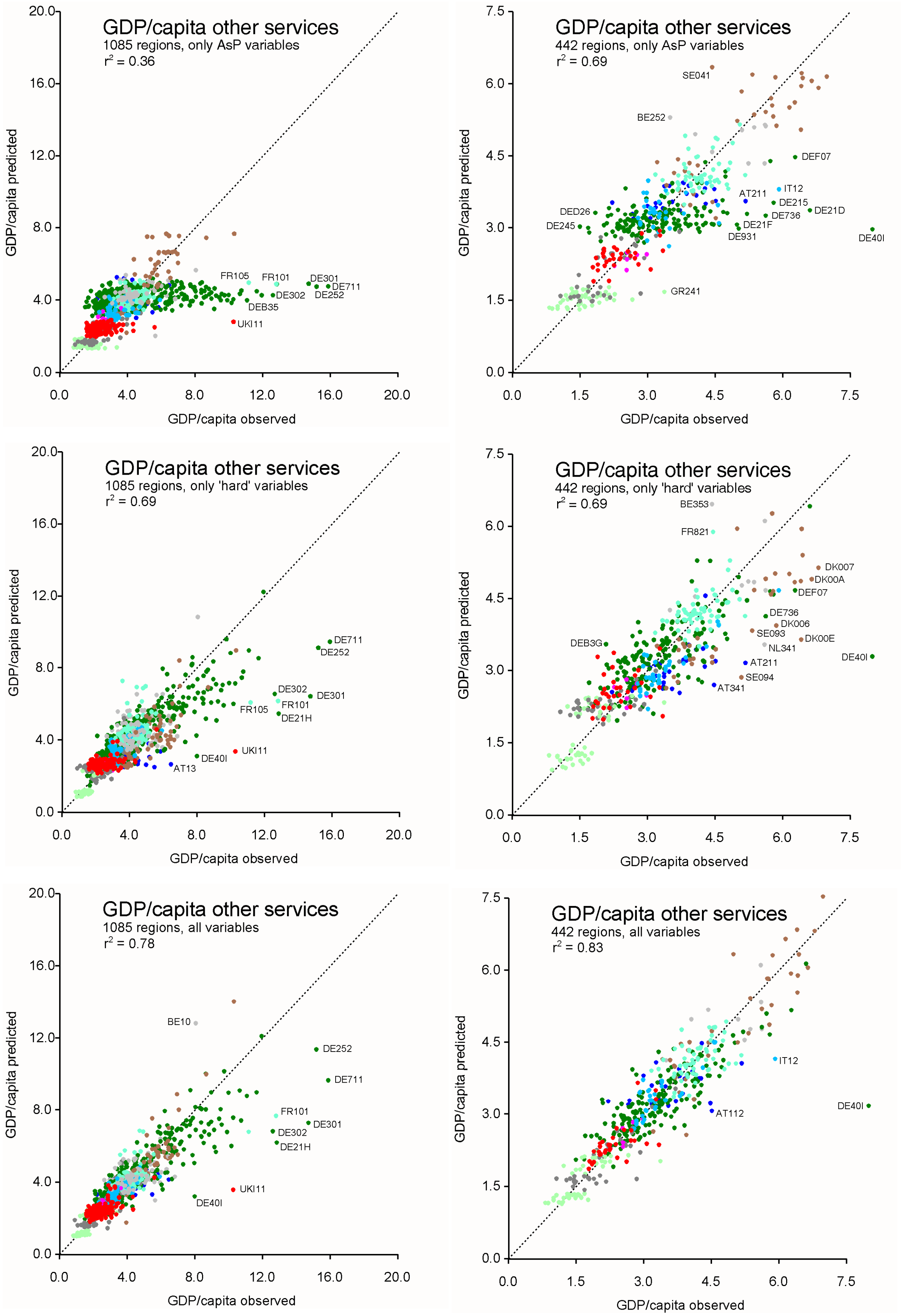

Figure 5.6. Comparison of regressions: GDP in other services

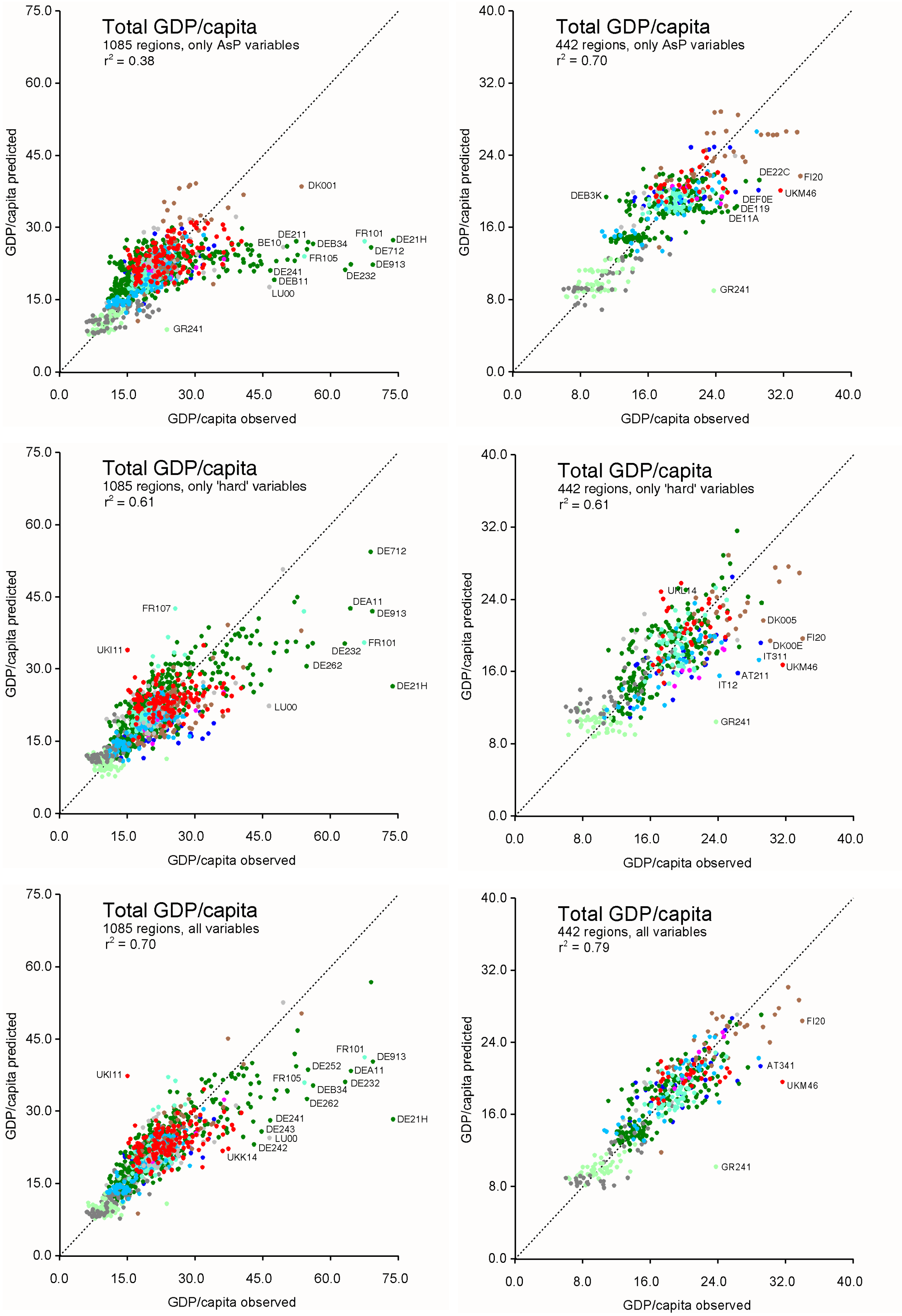

Figure 5.7. Comparison of regressions: total GDP

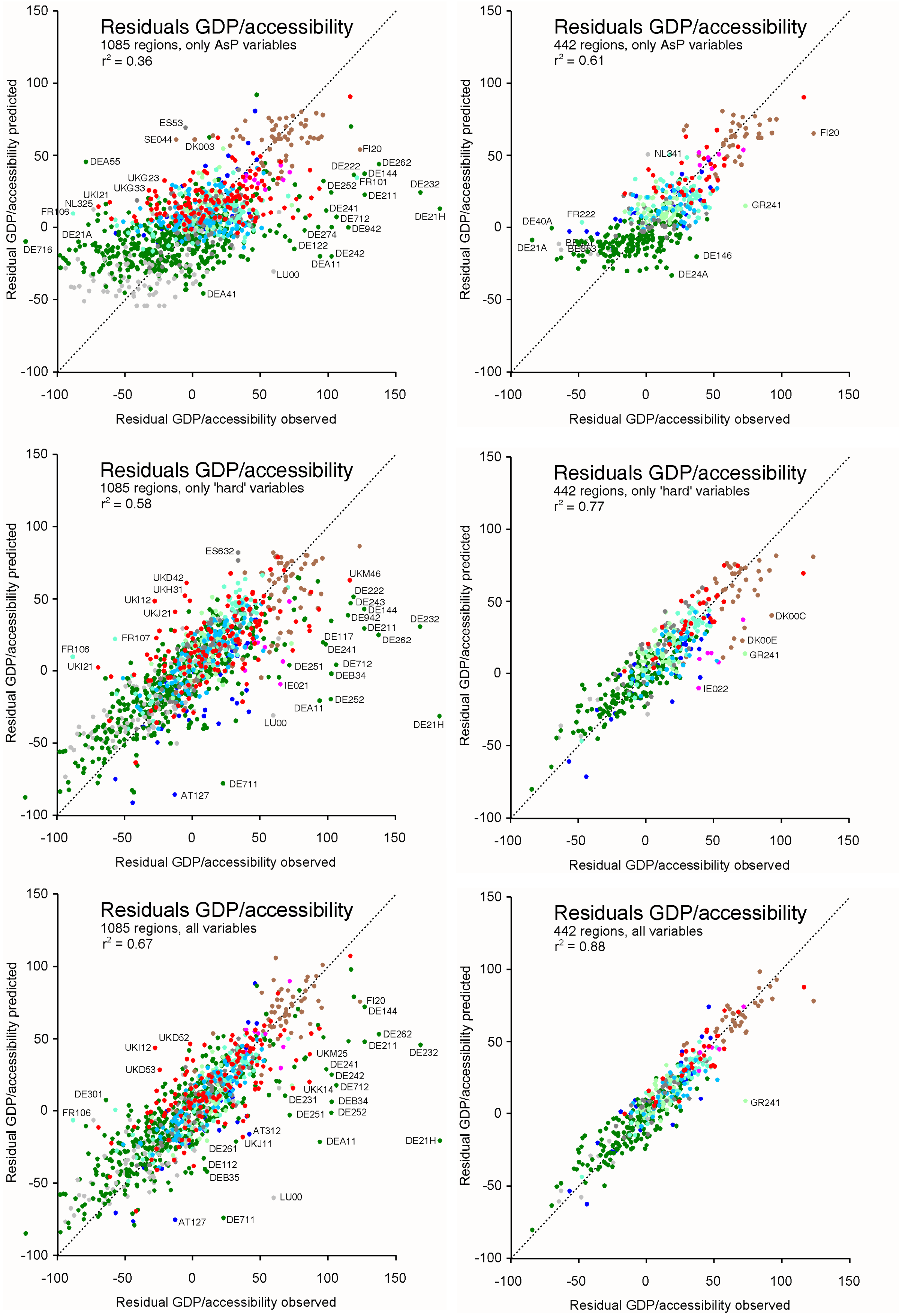

Figure 5.8. Comparison of regressions: residuals GDP/accessibility

Table 5.1: Comparison of regression results

	Coefficient of determination (r^2)					
	All regions (1085)			Rural regions (442)		
Dependent variable	Only AsP vari-ables	Only 'hard' vari-ables	All vari-ables	Only AsP vari-ables	Only 'hard' vari-ables	All vari-ables
GDP in agriculture	0.47	0.85	0.91	0.59	0.85	0.91
GDP in manufacturing	0.35	0.77	0.85	0.56	0.85	0.93
GDP in construction	0.47	0.58	0.70	0.59	0.71	0.80
GDP in trade, transport, tourism	0.36	0.61	0.71	0.58	0.71	0.86
GDP in financial services	0.33	0.86	0.90	0.69	0.85	0.93
GDP in other services	0.36	0.69	0.78	0.69	0.69	0.83
Total GDP	0.38	0.61	0.70	0.70	0.61	0.79
Residual GDP/accessibility	0.36	0.58	0.67	0.61	0.77	0.88

Figures 5.1 to 5.8 and Table 5.1 show a clear pattern: The estimations (expressed by the coefficient of determination r^2) improve as one moves from top to bottom and from left to right in Figures 5.1 to 5.8 and from left to right in Table 5.1. The interpretation is as follows:

- If the AsP variables are taken alone (as in the top row of Figures 5.1 to 5.8), the estimations are poorer than in all other cases. In particular the economic performance of large cities, such as London (UKI11), Paris (FR101), Berlin (DE301) or Munich (DE21H), is underestimated. The worst estimations are for GDP in manufacturing (r^2=0.35), trade, transport, tourism (r^2=0.36), financial services (r^2=0.33), other services (r^2=0.36), total GDP (r^2=0.38) and residual GDP/accessibility (r^2=0.36).

- If only the 'hard' variables are entered into the regression, the estimations are significantly better. Now coefficients of determination of between 0.58 and 0.86 are achieved. GDP in agriculture (r^2=0.85) and financial services (r^2=0.86) are explained best, whereas GDP in trade, transport, tourism (r^2=0.61) is more difficult to predict. However, the r^2 achieved are in general almost twice as high than if only AsP variables are taken into account.

- The best estimates are achieved if all variables, i.e. both AsP and 'hard' variables are included in the regression. Now r^2 of between 0.67 and 0.91 are achieved.

- If the regressions are conducted not for all 1,085 NUTS-3 regions in the European Union but only for the 442 regions classified as rural in AsPIRE, the estimation results improve. This can be attributed to the fact that the rural regions are more homogenous among themselves than the whole set of regions, which include also highly urbanised regions.

- In general the estimation results are superior for individual sectors than for total GDP as a whole. This can again be explained by the fact that the location preferences of individual sectors are more homogenous than those of all sectors taken together. Probably for the same reason, the explanation of the residuals between standardised GDP per capita and standardised accessibility results in lower r^2 than those for individual sectors.

A second way of analysing the results is to examine which of the 69 variables entered into the regressions had the greatest explanatory power. This was done by counting how many times each variable was selected in one of the 48 regressions conducted. Notwithstanding the fact that stepwise multiple regression is a heuristic procedure with a certain amount of randomness, it can be assumed that those variables that were selected most frequently contribute most to explaining the variation in the dependent variables.

The results of this analysis are presented in Tables 5.2 and 5.3. Table 5.2 shows the frequency counts of the 48 AsP variables tested. As each variable was included in 32 regressions, a variable can be selected a maximum of 32 times. Variables that were selected in at least half of the 32 regressions in which they were included are highlighted in grey in the table. It can be seen that the five AsPIRE themes contribute not evenly to the explanation:

- *ICT*. Surprisingly, none of the ten ICT variables reaches the score of 16 selections, although variable I54 (% households using modem) and I55 (%households using online services) almost do.

- *Business networks*. Two of the business networks variables are selected more than half of the maximum times possible: B3 (% venture capital) and B9 (Business incubators). This result underlines the importance of favourable business conditions for new firms.

- *Social capital*. Two variables qualify in this section: S8g (Combined political interest indicator) and S10 (% trust in other persons) indicating the importance of community spirit and personal relationships.

- *Governance*. Only variable G18 (Voter turnout at national elections) has the necessary score to get highlighted, a variable that seems related to the political interest indicator highlighted in the previous section.

- *Tourism*. Variable T18 (Overnight stays per capita) is the clear leader in this theme. This seems obvious because many visitors with overnight stays are a clear indicator of the attractiveness of a region for business travellers and tourists.

In summary, six AsP variables were selected in a regression more than 16 times; seven 'hard' variables reached that score, as Table 5.3 shows:

- *Economy*. Economic structure seems to continue to be a determining factor for the economic development of a region: four out of the six variables indicating the share of a sector in total regional GDP were selected 16 or more times. This result contradicts the frequently expressed opinion that in times of rapid economic change economic structure is no longer of great relevance for regional economic development.

- *Accessibility*. Accessibility also seems to be important for regional economic development: multimodal accessibility for passengers (acc91) was selected 16 times, with combined accessibility for travel and freight (acc93) almost as many times. However, the total selection frequency of accessibility (53) is much lower than for economic structure (115).

- *Endowment*. Population density (pdens) scores high among the endowment variables, as does educational attainment (eduhi). Surprisingly, R&D investment, one of the cherished variables of modern regional economics, was selected only five times.

- *Subsidy*. The clear winner here are European subsidies (subeu) indicating the importance of Structural Funds and other European tranfers.

Table 5.2: Frequency of representation of AsP variables in regressions

			Number of regressions								
			GDP in agriculture	GDP in manufacturing	GDP in construction	GDP in trade, transport, tourism	GDP in financial services	GDP in other services	Total GDP	Residual GDP/accessibility	**Total**
ICT	I2	ISDN subscriptions per capita	2	1	1			2	1	2	**9**
	I14	% households with Internet access		1						1	**3**
	I22	% employment in IT sector		1	1		1	2	3	1	**9**
	I26	IT enterprises per 1,000 population	2		2		2	1	1		**8**
	I27	% GDP of IT sector	1	1		1	1	2	2	2	**8**
	I40	% of online sales	1	2	3	1	1	1	1		**10**
	I42	% online buyers	2	2		1	1	1		1	**8**
	I46	Internet domains per capita	2	1		1	1	2			**7**
	I54	% households using modem	4	3	1	2	1	1	2		**14**
	I55	% households using online services	2	1		2	3	2	3		**13**
Business networks	B1	% SME in innovative co-operation	1	1	2	2	1	2	1	4	**14**
	B2d	EU innovation programmes	1	1	1		1				**4**
	B3	% venture capital	2	2	3	3	3	1	2	2	**18**
	B4	% firms with high location coefficient	2	2		2	1	2	2	2	**13**
	B5	Number of regional clusters		2	1	2	2	1	2		**10**
	B6a	% SME with international business			1	1	2	1	2		**7**
	B9	Business incubators	1	2	2	2	2	3	2	4	**18**
Social capital	S2b	% reading newspapers daily	3	1			2	2	1	1	**10**
	S5a	Attachment to town/village	2	1	1	2	1	1		2	**10**
	S5b	Attachment to region	1	2	1	1	2	1	4		**12**
	S8g	Combined political interest indicator	4	2	2	3	3	1	3	1	**19**
	S10	% trust in other persons	3	3	3	3	4	2	1	3	**22**
	S17	Political discussion		1					2	1	**4**
	S18	Openness to foreigner	1	1		1	1	1			**5**
	S19	Social more important than economic		2			1		2		**5**
	S20	Voluntary engagement	1	1	2	2	2		2	1	**11**
	S21	Membership				1	2	1		3	**7**

Table 5.2: Frequency of representation of AsP variables in regressions (continued)

			Number of regressions								
			GDP in agriculture	GDP in manufacturing	GDP in construction	GDP in trade, transport, tourism	GDP in financial services	GDP in other services	Total GDP	Residual GDP/accessibility	**Total**
Governance	G1b	Political stability index	2		1	2	1	1	3	1	**11**
	G8b	Regulatory quality index	1	2	1	1	1	2		1	**9**
	G9b	Government efficiency index	1	2	2	2	1	1	1		**10**
	G12a	Trust in institutions: Justice	2		1	1					**4**
	G12b	Trust in institutions: Police	1	1	1	3	2		2	1	**11**
	G12c	Trust in institutions: Civil service	3	1	1			1			**6**
	G14b	Control of corruption index	2	1		1	1	1			**6**
	G15	Influence of citizens on government					1				**1**
	G16	Satisfaction with democracy	2	2	1	1	2				**8**
	G18	Voter turnout at national elections	2	4	2	2	3	3	2	2	**20**
	G19	Voter turnout at regional elections			1		1	1			**3**
Tourism	T1	Annual solar radiation	3	2	2	2	1	1		1	**12**
	T2	Elevation difference		1		1	1		3		**6**
	T3	Slope gradient								1	**1**
	T4	Coastline		2	1	1	1	1	1	1	**8**
	T5	Attractive towns	2	1	1	2	1	1	2		**10**
	T11	Hotel beds per capita	2	2		2	2		1		**9**
	T17	Overnight stays per capita	3	2	4	4	4	4	4	3	**28**
	T19	Lakefront									**0**
	T20	Riverfront	1	2	2	1	1	2	1	2	**12**
	T21	% Mountain areas	2		1	1	2	1		1	**8**

Table 5.3: Frequency of representation of 'hard' variables in regressions

			Number of regressions								
			GDP in agriculture	GDP in manufacturing	GDP in construction	GDP in trade, transport, tourism	GDP in financial services	GDP in other services	Total GDP	Residual GDP/accessibility	**Total**
Economy	shag1	% GDP of in agriculture	4	3	3	3	3	3	3		**22**
	shag2	% GDP in manufacturing		4			1		1	1	**7**
	shag3	% GDP in construction	4	4	4	4	4	4	4	4	**32**
	shag4	% GDP in trade, transport, tourism	1	1	1	4	1	1	1	1	**11**
	shag5	% GDP in financial services	1	2	2	2	4	3	1	3	**18**
	shag6	% GDP in other services	3	2	4	4	2	4	3	3	**25**
Accessibility	acc91	Accessibility, road/rail, travel	2	2	3	3	3	2	1		**16**
	acc92	Accessibility, road/rail/air, travel							1		**1**
	acc93	Accessibility, road/rail, travel/freight	2	2	3	3	3	2			**15**
	acc94	Accessibility, road, freight	2	1			2	1	1	1	**8**
	acc95	Accessibility to regional labour	2	1	1	2	2	1	1		**10**
	L1	Baseline peripherality indicator		1	1	1		1	2	4	**10**
	L2	National peripherality indicator							1		**1**
Endowment	soilq	Soil quality	1	1	2	2	1	1			**8**
	pdens	Population density	2	2	2	2	2	2	3	2	**17**
	devld	% developable land		2	2	2	1	1	2	2	**12**
	rdinv	R&D investment (% of GDP)			1			1	2	1	**5**
	eduhi	% higher education	2	1	2	2	1	1	3	3	**15**
Subsidy	subag	Agricultural subsidies (Euro/capita)								1	**1**
	subeu	European subsidies (Euro/capita)	3	3	2	3	2	3	3	3	**20**
	subna	National subsidies (Euro/capita)		1	2	1		1	2	1	**8**

5.3 Summary

In this chapter a subset of the AsP indicators presented in Chapter 3 and analysed theme by theme in the previous chapter were examined with respect to their joint explanatory power with respect to regional economic performance. The results of the examination can be summarised as follows:

The AsP variables alone explain about one third of the variance in regional economic performance if all regions in the European Union are considered, and about sixty percent, if only rural regions are taken into account. Traditional 'hard' location factors explain between sixty and eight-five percent of the variance in regional performance. If AsP indicators and traditional location factors are applied together, AsP indicators improve the explanatory power of the model by about ten percent.

VI CONCLUSIONS

The objective of Deliverable 28 was to analyse both the spatial patterns of aspatial peripherality and the linkages between different factors of aspatial peripherality and key economic indicators. This chapter concludes the report with the main findings.

Spatial peripherality only partly explains the success or failure of rural regions

The report has demonstrated a relatively low correlation of traditional indicators of peripherality such as the AsPIRE Baseline Peripherality Index with regional GDP per capita. This supports the view that accessibility is only one of several, transport and non-transport, factors determining regional economic performance. The residual maps developed show the differences between regional economic performance suggested by the location of a region and its real economic performance based also on other hard or soft factors. These results confirm one of the basic hypotheses of the AsPIRE project that there are regions that appear to be performing relatively well despite a peripheral location and thus are exhibiting "low Aspatial Peripherality (AsP)" and other regions that seem to be under-performing in relation to their location and thus can be described as having "high AsP".

Soft location factors have a spatial dimension

In a situation where relative location can explain only part of regional economic performance, non-spatial issues and soft location factors come into play. Within the AsPIRE project these factors are called aspatial peripherality (AsP) factors as they seem not to vary systematically across space. A wide range of indicators for the AsP factors have been collected and have been presented in a set of unique maps showing the spatial distribution of AsP variables across Europe. The maps demonstrate that the AsP location factors do indeed have a spatial dimension, however, the spatial distribution depends very much on the AsP theme and the AsP indicators considered.

Urban regions benefit from a slightly lower “aspatial peripherality”

The cartographic analysis of the factors constituting “aspatial peripherality” has revealed that urban areas are mostly ahead concerning the endowment with “soft factors”. The majority of indicators show that the provision with ICT, business networks, governance and social capital is lower in rural areas. The only exceptions were business network indicators, many of them directly or indirectly reflected on government policies, though, which may be specifically targeted at rural regions, and tourism related indicators which show in general higher values for rural areas.

Rural regions show a higher diversity in AsP factor endowment

The standard deviations in AsP factors endowment are generally higher for rural regions than for the EU regions in total. This implies that in terms of AsP rural regions are more heterogeneous than their urban counterparts.

Southern Europe is marked by a higher degree of "aspatial peripherality"

As regards spatial distributions of AsP indicators, the prevailing pattern show high values for northern and central Europe and lower values for southern (and western) Europe. However, while this north-south decline is the dominant pattern, often there are complex variations and deviations from this general distribution.

AsP factors are best suited to explain economic disparities in rural regions

The explanatory power of the five AsP themes ICT, business networks, governance, social capital and tourism varies significantly according to the chosen economic output variable and the sample taken into consideration. If the regressions on the explanatory power of AsP factors are conducted not for all 1,085 NUTS-3 regions of the European Union but only for the 442 regions classified as rural in AsPIRE, the estimation results improve.

The explanatory power of the five AsP factors shows distinctive differences.

Out of the five AsP themes, the ICT variables display the highest positive correlations with regional GDP. On average, they explain about 30% of the variance in regional GDP across all 1,085 EU NUTS-3 regions. In comparison, the governance variables attain coefficients of determination of about 20 to 30 percent, while the ones achieved by social capital, business networks and tourism factors rank between 15 and 20 percent only.

Some differences in AsP endowment are rather national than rural.

The explanatory power of the single indicators is only partly influenced by the spatial level at which the data are available. The example of the Governance variables reveals that even indices available only at the national level can attain high shares of explained variance in regional GDP. Apparently, some of the differences in AsP endowments, namely the governance structures, vary rather between European countries than between regions.

AsP factors explain up to 60 % of the total variation in GDP in rural areas.

The final exercise was to integrate the AsP variables of all themes and to link them also with traditional 'hard' location factors. The AsP variables alone explain about one third of the variance in regional economic performance, if all regions in the European Union are considered, and about sixty percent, if only rural regions are taken into account.

Traditional 'hard' location factors are more relevant than soft “aspatial factors”.

Traditional 'hard' location factors such as the existing economic structure in the regions as well as regional accessibility, educational attainment of the population or national and European subsidies explain between sixty and eight-five percent of the variance in regional performance.

AsP-factors clearly improve the predictive power of regional economic models.

If AsP indicators and traditional location factors are considered together, a larger share of the traditional location factors entered into the regressions are selected than of the AsP variables. However, the AsP indicators improve the explanatory power of the model by more than ten percent resulting in very high coefficients of determination (r^2) between 0.7 and 0.91 for sectoral GDP for all regions of the EU and between 0.80 and 0.93 for the rural regions only. This confirmation of the basic hypothesis of the AsPIRE project that soft location factors matter, is the final result of the Deliverable.

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