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The IASON Common Spatial Database

Deliverable 3 of the project IASON (Integrated Appraisal of Spatial Economic and Network Effects of Transport Investments and Policies) of the 5th RTD Framework Programme of the European Commission

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1 Introduction

The goal of the IASON project is to improve the understanding of the impact of transportation policies on short- and long-term spatial development in the EU by developing a *unified assessment framework* for transport project and transport policies at the European level integrating network, regional economic and macro-economic impacts.

The project responds to Subtasks 2, 4 and 5 of Task 2.1.2/4 of the Cluster 'Socio-economic Impacts of Transport Investments and Policy and Network Effects' of Key Action 2 'Sustainable Mobility and Intermodality' of Objective 2.1: 'Socio-Economic Scenarios for Mobility of People and Goods' of the Thematic Programme 'Promoting Competitive and Sustainable Growth' of the 5th Framework Programme for Research and Technology Development of the European Union. At the heart of the IASON project lie the following activities:

- improvement of existing assessment frameworks by ensuring that direct and indirect impacts are clearly distinguished within the appraisal, and that the incidence of benefits and costs and sources of additionality and/or double-counting are transparent;
- a systematic and quantitative analysis of the network, spatial and socio-economic impacts of transport investments and policies by refining existing EU-level models and carrying out scenario simulations;
- building up and maintaining a discussion platform for the cluster in order to facilitate interactions between Subtask 5, the other subtasks of the cluster and the scientific community;
- building guidelines and recommendations for project analysis of transport investments and policies and for the development of supporting tools and databases in order to improve the applicability of the outputs of the project in policy analysis.

The main innovations of the IASON project lie in the field of the methodological research on project assessment, its further development in order to allow applications at the EU level and the proposed modelling approach, which has not yet been applied in this conjunction before. Based upon this structure, at the end of the project an effective tool to evaluate in a coherent way the aspects of sustainability, cohesion, environmental-friendliness and efficiency of transport policies and projects will exist.

The consortium of IASON consists of partners from six countries: Christian-Albrechts University of Kiel (D), University of Dortmund (D), University of Karlsruhe (D), NETR (F), VTT (FIN), TRANSMAN (H), NEA (NL), Free University of Amsterdam (NL), University of Groningen (NL), ME&P (UK) and University of Leeds (UK) under the co-ordination of TNO Inro (NL).

Objectives of Work Package 2

The goal of Work Package 2 of IASON is to perform a systematic and quantitative analysis of the spatial, network and socio-economic impacts of transport investments and policies by refining two existing EU-level models and carrying out scenario simulations for a systematic, quantitative analysis of the spatial and socio-economic impacts of transport investments and policies regarding trans-European transport networks in the regions of the EU.

The two models are the extended SASI model developed in the 4th RTD Framework project *Socio-Economic and Spatial Impacts of Transport Infrastructure Investments and Transport System Improvements* (SASI) and the CGEurope model developed at the Institute of Regional Research of the Christian-Albrecht University of Kiel in recent research on a new generation of EU-level spatial economic models with a microeconomic theoretical foundation.

The objective of this Deliverable D3 of IASON is to describe the work of Task 2.2 of Work Package 2 to implement the *Common Spatial Database* to be used by the two models based on their data requirements specified in Deliverable 2 *Methodology for the Assessment of Spatial Economic Impacts of Transport Projects and Policies*. The objectives of Task 2.2 were:

1. Exploration of data sources and collection of data in the fields of GDP, value added and employment by sector, international trade by commodity groups, interregional flows of goods and passengers, passenger travel demand by firms and households, national accounts including input-output information, population and labour force and indicators of regional attractiveness for NUTS-3 regions in the EU and equivalent regions in the candidate countries and other European countries including Norway and Switzerland.

2. Estimation of proxies of data in the above fields where data at NUTS-3 level are not available by using interpolation techniques or disaggregation from higher spatial levels or from other regions with similar character.

3. Refinement, extension and updating of IRPUD trans-European road, rail, air and inland waterway networks to connect NUTS-3 regions and equivalent regions in the candidate and other countries and incorporate the projects of the TEN and TINA masterplans.

Output of the modelling work in Work Package 2 will be numerical results on welfare effects, accessibility and location change in the European Union and in the candidate accession countries in central and eastern Europe as well as in Norway and Switzerland. The spatial resolution and sectoral detail will be sufficiently refined for integrating the results into a European system of spatial monitoring and Common Transport Policy of the European Union.

Position of Work Package 2 within IASON

The modelling of Work Package 2 work will be based on the Common Spatial Database described in this Deliverable. The regional data contained in the database are partly based on data retrieved from databases generated in the 4th RTD Framework projects SCENES and in the ETIS projects BRIDGES and CONCERTO. Work Package 2 will provide material for the completion of the ETIS database, e.g. road, rail and air accessibility indicators.

The simulation results of both models are, on the one hand, input for the CBA performed in other work packages of the IASON project (as contributions to Task 3.1 in Work Package 3 “Network Effects” and to Work Package 5 “Synthesis of Findings and Recommendations”). On the other hand they are compared against each other to assess the impacts of transport policy scenarios on regional welfare (Task 2.5 in Work Package 2 as contribution to D6) and evaluate the case study results (Task 2.6 in Work Package 2 as contribution to D6).

Structure of the Report

According to the objectives of Task 2.2, the structure of this Deliverable D3 of IASON is as follows:

The following chapter presents the spatial, temporal and substantive and resolution of the Common Spatial Database. It specifies the system of regions and the base year and temporal dimension of the two models. It explains for which purposes the data of the database will be used: for the model simulations themselves or for calibration and validation. It then presents the spatial levels, the data groups and the classification of the data of each data group of the database.

Chapter 3 deals with data at the European level. There are two kinds of European data, socio-economic and network data. Socio-economic data are about the performance of the European economy, about international migration and about supra-national transfers, such as the Structural Funds. These data provide the framework for the simulations by the two models. They are therefore required partly as empirical data (for calibration/validation) or as assumptions about future developments (for forecasts). Network data present the European network database consisting of strategic road, rail, air and inland waterway networks, including assumptions on transport costs and material and immaterial barriers, as well as assumptions about their future development in various network scenarios.

Chapter 4 presents national data. National economic data consist of national accounts, input-output tables and information on international trade and passenger flows used by the new CGEurope model. National demographic data on fertility, mortality and migration are used by the extended SASI model.

Chapter 5 presents the data collected at the regional level, i.e. for NUTS-3 or NUTS-2 regions in the EU Member States or for equivalent regions in the candidate and other countries. The main data categories are economic data, population data and indicators of regional attractiveness.

Chapter 6 contains conclusions about the problems encountered during the implementation of the database and about further research needed.

Annex I contains a description of the database on the CD-ROM which will contain the IASON Common Spatial Database. Annex II contains sectoral aggregation schemes and country-specific details about the computation of the input-output tables. Annex III lists the regions of the IASON system of regions.

The report is the joint work of the IASON teams at the Institute of Regional Research of the Christian-Albrechts University of Kiel (IfR), the Department of Economics of the Rijks University of Groningen (RUG) and the Institute of Spatial Planning of the University of Dortmund (IRPUD). Valuable input on the availability of data in the east European countries was received by the Stanisław Leszczycki Institute of Geography and Spatial Organization of the Polish Academy of Sciences (IGiPZ PAN)

2 Space, Time and Data Categories

This section presents the framework for the IASON Common Spatial Database to be used by both the extended SASI and the CGEurope models: the spatial and temporal dimensions and the main data categories used by the two models.

2.1 IASON Regions

The system of regions defined is based on Level 3 of the Nomenclature of Territorial Units for Statistics (NUTS) for EU member states (Eurostat, 1999a) and equivalent regions for the candidate countries and Liechtenstein, Norway and Switzerland (Eurostat, 1999b).

The 1,083 regions defined for the EU member states, the 162 regions located in candidate accession countries in central, eastern and southern Europe and the 46 regions in Liechtenstein, Norway and Switzerland are the 1,291 'internal' regions of the IASON Common Spatial Database. The 50 regions in the rest of Europe and the region representing the 'rest of the world' are the 51 'external' regions. Altogether, 1,342 regions were defined. Table AIII.1 in Annex III gives a full description of these regions including their main economic centres.

Internal Regions

The NUTS-3 regions in the European Union are of approximately similar size with a mean population of about 346,000. However, in Austria, Belgium, Finland, Germany and Greece the average size of NUTS-3 regions is much smaller. In Germany, where NUTS-3 regions are equivalent to counties, the average population of NUTS-3 regions is only about 186,000.

Because the spatial effects of the enlargement of the European Union are of special interest, the regions in the candidate accession countries in central, eastern and southern Europe are subdivided with only slightly less spatial resolution, with an average regional population of about 653,000. Because for Poland negotiation on the NUTS-3 level regions are still pending, NUTS-2 regions (voivodships) are used because, even if NUTS-3 regions will be determined in the future, data for these regions will be extremely scarce.

Because of their spatial contiguity with the territory of the European Union, Liechtenstein, Norway and Switzerland were included in the internal regions. The average population of the regions in these countries is about 253,000.

Altogether, the internal regions comprise a population of 492 million in 1,291 regions with an average regional population of about 381,000.

External Regions

Compared with the internal regions, the external regions are significantly larger, which can be explained by the spatial focus of the modelling work on the EU and the candidate countries, but also by the variations in spatial detail at which relevant data can be assembled.

However, the original IASON system of regions presented in Deliverable D2 was amended to take account of important regional differences in three east European countries (Korcelli and Komornicki, 2002a):

- *Ukraine*. In the Ukraine, the Kiev region was subdivided into two regions in order to take account of the different transport orientation of the city of Lvov.

- *Yugoslavia*. Yugoslavia was subdivided into the four regions Serbia, Voivodina, Montenegro and Kosovo because of their different political status, as well as economic and demographic characteristics.

- *Croatia*. Croatia was subdivided into the two regions Zagreb and Dalmacija, which display specific historical and geographical characteristics.

Altogether, the external regions (excluding the region representing the rest of the world) comprise a population of about 299 million in 50 regions with an average population of 598,000. Table 2.1 and Figure 2.1 show the IASON system of regions.

Model Regions

The above system of regions represents the Common Spatial Database of IASON. However, they are not necessarily identical to the model regions used in the two models, the extended SASI model and the CGEurope model.

Both models forecast welfare effects, accessibility and locational changes for the territory covered by the 1,291 internal regions. However, the two models differ in the way the deal with the external regions:

- The extended SASI model makes forecasts only for the territory covered by the 1,291 internal regions. The external regions (excluding the region representing the rest of the world) are used as locations of activities for the calculation of accessibility indicators. This implies that exogenous assumptions for the development of population and economic activities in the external regions have to be made.

- The new CGEurope model makes no distinction between internal and external regions, i.e. it makes forecasts for the territory covered by all regions of the IASON system of regions (except the region representing the rest of the world).

As far as possible, all data of the IASON Common Spatial Database were collected for the 1,341 NUTS-3 regions excluding the region representing the rest of the world.

However, each modelling team will decide during the model calibration whether to use as model regions aggregates of two or more NUTS-3 regions in countries in which NUTS-3 regions are considerably smaller than in other countries.

Table 2.1. Number of regions

Region	Country	No. of regions	Population 1997	Ø population
EU member states	Austria	35	8,072,113	230,632
	Belgium	43	10,181,253	237,773
	Denmark	15	5,283,643	352,176
	Finland	20	5,135,550	256,778
	France	96	58,627,229	610,700
	Germany	441	82,096,931	186,161
	Greece	51	10,533,191	206,533
	Ireland	8	3,669,210	458,651
	Italy	103	57,431,131	557,584
	Luxembourg	1	421,137	421,137
	Netherlands	40	15,613,005	390,325
	Portugal	28	9,994,921	356,961
	Spain	48	39,863,129	830,482
	Sweden	21	8,864,519	422,120
	United Kingdom	133	59,006,721	443,660
		1,083	*374,793,683*	*346,070*
EU candidate countries	Bulgaria	28	8,084,518	288,733
	Cyprus	1	743,728	743,728
	Czech Republic	14	10,301,459	735,819
	Estonia	5	1,458,065	291,613
	Hungary	20	10,244,682	512,234
	Latvia	5	2,470,454	494,091
	Lithuania	10	3,651,923	365,192
	Malta	1	382,920	382,920
	Poland	16	38,655,842	241,599
	Romania	42	22,562,461	537,201
	Slovakia	12	5,383,577	448,631
	Slovenia	8	1,917,851	239,731
		162	*105,857,480*	*653,441*
Other countries in central Europe	Liechtenstein	1	31,296	31,296
	Norway	19	4,405,648	231,876
	Switzerland	26	7,212,605	277,408
		46	*11,649,549*	*253,251*
Internal regions		***1,291***	***492,300,712***	***381,333***
Rest of Europe	Albania	1	3,317,861	3,317,861
	Belarus	6	10,404,210	173,404
	Bosnia and Herzegovina	1	3,334,638	3,334,638
	Croatia	2	4,319,632	215,982
	Iceland	1	271,146	271,146
	Macedonia	1	2,001,880	2,001,880
	Moldova	1	4,441,779	4,441,779
	Russia	28	147,363,717	5,262,990
	Turkey	1	63,047,647	63,047,647
	Ukraine	4	50,423,383	12,605,845
	Yugoslavia	4	10,170,033	2,542,508
		50	*299,095,926*	*598,192*
Rest of world	*All other countries*	*1*		
External regions		***51***		
All regions		***1,342***		

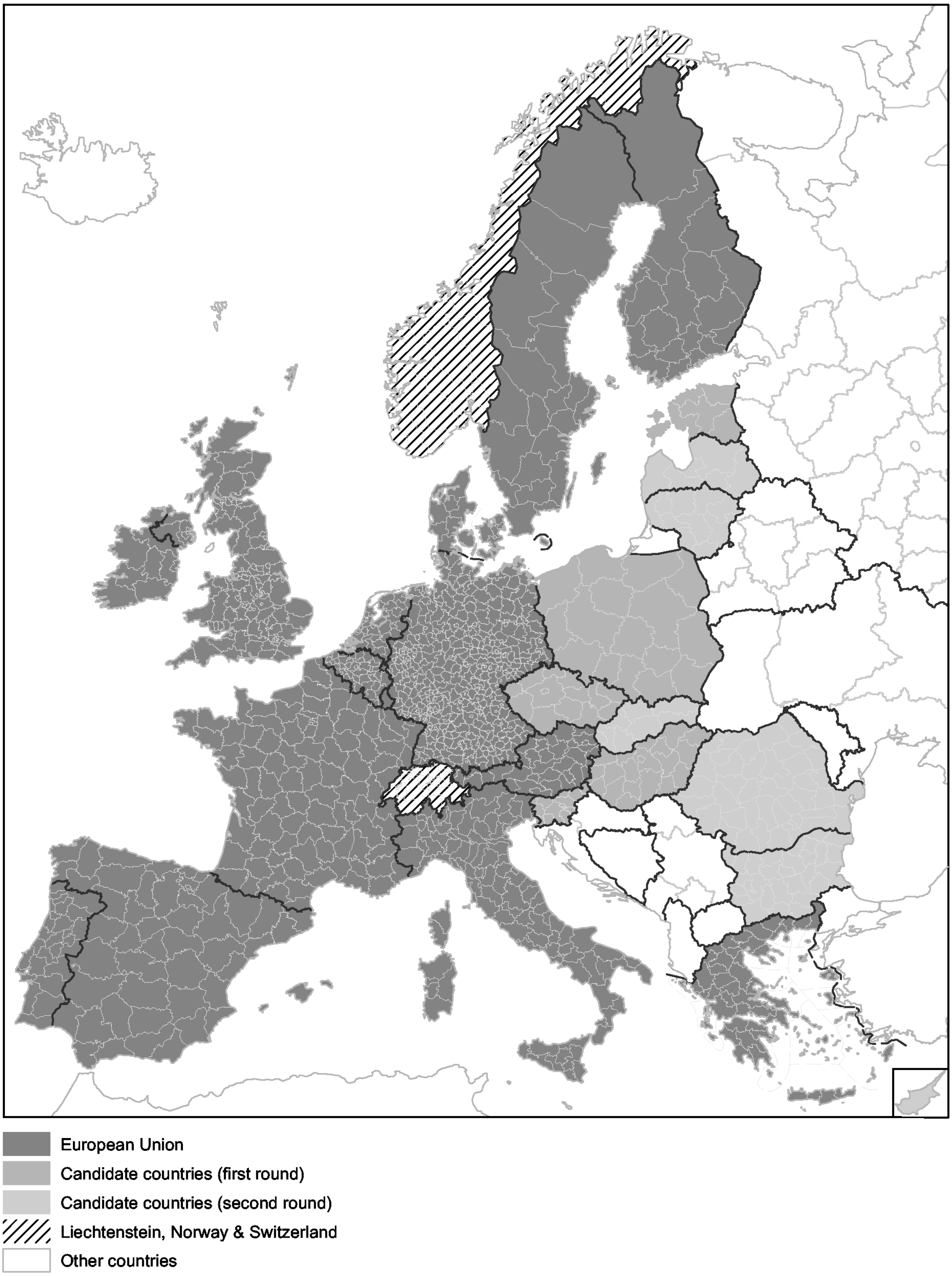

Figure 2.1. IASON regions

2.2 Temporal Dimension

The *common benchmark year* of the two models is 1997, the most recent year for which the required economic data are available. The *common target year* for which model results will be compared is 2020.

In addition, the extended SASI model will be run from 1981 (SASI 'historical' base year) to the present to demonstrate that it is able to reproduce the main trends of spatial development in Europe over a significant time period of the past with satisfactory accuracy. The forecasting horizon of the extended SASI model is 2021. This allows twenty years of backcasting and twenty years of forecasting. The simulation period of the extended SASI model is one year. This makes it possible to output results for the *common benchmark year* 1997 and the *common target year* 2020 for comparisons with the CGEurope model or to start model runs from the common benchmark year 1997 with data of that year.

2.3 Data Categories

This section introduces the main categories of data used by the two models. The first distinction is by the purpose for which the data are used. Here data used for the simulation runs and data used for calibration and validation of the models are distinguished. Next the different spatial levels for which data were collected are explained. Third, the main groups of data, such as economic and population data, are defined. Finally, the level of substantive disaggregation, i.e. classification of the different groups of data, is presented.

2.3.1 Simulation, Calibration and Validation Data

Two major groups of data are distinguished: data required for running the models (simulation data) and data needed for their calibration or validation. In each of these categories, the data can be classified by spatial and temporal reference.

Simulation Data

Simulation data are the data required to perform simulation runs. They can be grouped into *base-year* data and *time-series* data.

- *Base-year* data describe the state of the regions and the strategic transport networks in the historical base year 1981 of the extended SASI model or in the common benchmark year 1997.

- *Time-series* data describe exogenous developments or policies defined to control or constrain the simulation. They are either collected or estimated from actual events for the time between the historical base year 1981 and the present (in the case of the extended SASI model) or are assumptions or policies for the future (both models). If possible, time-series data were collected in five-year increments, however; if data were not available, other years were used, since the extended SASI model is able to perform the appropriate interpolations.

Calibration/Validation Data

Calibration data are data needed for calibrating the functions of the two models. Validation data are reference data with which the model results in the period between the base year and the present are compared to assess the validity of the models. Validation is preferable over calibration where processes simulated in the models are unobservable or unobserved because of lack of data. Validation can be used to experimentally adjust model parameters that cannot be calibrated until the model results match available data.

2.3.2 Spatial Levels

There are three main spatial levels at which data were collected: *European data*, *national data* and *regional data*. Regional data were in general collected for NUTS-3 regions. However, where data for NUTS-3 regions were not available, data for NUTS-2 or NUTS-1 regions were collected and disaggregated to NUTS-3 regions. For some data categories, only national data could be collected. These include economic data (social account matrices, input-output tables and international trade) and demographic data (fertility, mortality, migration). These data were not disaggregated to the regional level but were assumed to be valid for all regions or are used as national controls. European data were collected as time series projections for future developments in the form of assumptions for future years to be used as control totals to feed scenarios.

2.3.3 Data Groups

At the European level, two main groups of data were collected, socio-economic and network data:

- *European socio-economic data* include data on the socio-economic development of the entire study region, i.e. the European Union, the candidate countries and Liechtenstein, Norway and Switzerland, such as data on total European economic development, total immigration to the EU, total EU transfer payments and trans-European transport policies.

- *European network data* include data on the evolution of the trans-European road, rail, air and inland waterway networks including transport costs, border waiting times and political and cultural barriers, as well as base information needed to specify transport policy scenarios.

At the national level, the main data groups are economic and demographic data, again as empirical data for the past and in the form of assumptions for future years:

- *National economic data* collected for the EU member states, the candidate countries and Liechtenstein, Norway and Switzerland include national accounts, input-output tables and international trade by commodity groups.

- *National demographic data* include data on fertility and mortality and on immigration and outmigration and international migration flows.

At the regional level, the main data groups are economic data, population data and data on regional attractiveness:

- *Regional economic data* include GDP and GVA by sector, employment and unemployment, interregional commodity and passenger flows and regional transfers.

- *Regional population data* include population, educational attainment and labour force participation.

- *Regional attractiveness data* include indicators of quality of life.

European and national data were collected for the years between the SASI historical base year 1981and the common benchmark year 1997 and as assumptions for the time between the common benchmark year 1997 and the forecasting horizon 2021. Regional data were collected for the time between the SASI historical base year 1981and the common benchmark year 1997.

2.3.4 Classifications

The above data groups were disaggregated in substantive terms depending on spatial level and data group as follows:

Economic Sectors

An important feature of the common database is the use of a standard sectoral classification to facilitate comparisons between the results of the extended SASI and CGEurope models. In addition to considerations of availability, the following criteria were applied to define economic sectors:

- The sector is important to the national economy and in particular in its contribution to national GDP.

- The sector has been, or might become, the subject of changes in economic rules induced by transport-related policies.

- The sector is one with significant transport flows in both volume and financial terms and is experiencing changes in transport flows.

- The sector is one where one might expect, a priori, that there are important substitution effects attributable to transport-related policies.

Hence, the sectoral classification was designed to provide the two models with enough sectoral detail to focus on transport- and/or shipping-intensive industries while taking into consideration general data availability across countries based on recent experience. Sectoral information coverage for each country depended on: (i) whether national statistical offices compile the information by economic activity in the context of regional accounts; (ii) the extent of updating by national statistical offices after the recent widespread revisions of national accounts; (iii) finally, availability of regional socio-economic data at the NUTS-2 and NUTS-3 levels for the considered sectors. The trade-off between sectoral and regional disaggregation was solved in favour of a more detailed sectoral differentiation. Accordingly, based on the information gathered from individual national statistical offices as well as from the New Cronos database of Eurostat, the six sectors outlined in Table 2.2, which are equivalent to the NACE Rev.1 TA6 classification defined by Eurostat, will be used in the model calculations.[1]

Table 2.2. IASON Economic sectors

NACE Rev.1	Codes TA6	Codes TA17	Labels
1	A_B	A	Agriculture, hunting and forestry
		B	Fishing
2	C_E		Industry, including energy
		C	Mining and quarrying
		D	Manufacturing
		E	Electricity, gas and water supply
3	F	F	Construction
4	G_I		Wholesale and retail trade, repair of motor vehicles and household goods, hotels and restaurants; transport and communication
		G	Wholesale and retail trade, repair of motor vehicles and personal household goods
		H	Hotels and restaurants
		I	Transport, storage and communication
5	J_K		Financial, real estate, renting and other business activities
		J	Financial intermediation
		K	Real estate, renting and business activities
6	L_P		Other service activities
		L	Public administration and defence, compulsory social security
		M	Education
		N	Health and social work
		O	Other community, social and personal service activities
		P	Private households with employed persons

This sectoral classification can also be used for the east European countries, for which in general the available data allow for only three sectors. Two exceptions were made: For Estonia financial intermediation, renting and business activities, wholesale, retail trade, transport and communication are included in one sector (corresponding to NACE Rev.1 sector G_K) and in Lithuania market services, repair, trade, lodging and catering services, transport and communication, services of credit and insurance institutions, other market services as well as non-market services make up one sector (corresponding to NACE Rev.1 sector G_P).

Section 5.1.1 gives a detailed overview about the different data sources used for sectoral activity indicators at the sub-national level of different countries. Country-specific issues are also addressed in that section.

[1] In most countries sectoral data is compiled according to the NACE or NACE-CLIO classifications. Whenever any other international or national classification is used, the corresponding aggregations were made.

Population Cohorts

The *Regional Population* submodel of the extended SASI model forecasts regional population by five-year age groups and sex through natural change (fertility, mortality) and migration. Population forecasts are needed to represent the demand side of regional labour markets. The extended SASI model therefore requires population data by age group and sex for the 1,291 internal regions of the study area in the historical base year 1981 and the common benchmark year 1997. Age groups are five-year age groups between 0 and 100 years of age. Where these data are not available, data from NUTS-2 regions or national data or data with a more aggregate age-group classification can be used. Section 5.2.1 describes the data sources for population data and how regional population data were estimated where required.

Labour Force

Labour force, or economically active population, represents the supply side of regional labour markets. Regional labour force is derived from regional population and regional labour force participation rates. Labour force data are classified by sex only. Therefore, in the extended SASI model, labour force is disaggregated by skill level using educational attainment as ancillary information (see Sections 5.2.2 and 5.2.3).

3. European Data

This chapter presents the data of the Common Spatial Database which were collected for the whole study area, i.e. for the current European Union plus the 12 candidate countries plus Liechtenstein, Norway and Switzerland. There are two kinds of European data in the database. Socio-economic data specify the socio-economic development of the study area as a whole for each year of the simulation in the extended SASI model in terms of GDP, migration and supra-national transfer policies. Transport network data represent the evolution of the trans-European road, rail, air and inland waterway networks and related data, such as monetary transport cost functions, border waiting times and political and cultural barriers as well as information necessary to specify transport policy scenarios.

3.1 European Developments

In the extended SASI model, European development data represent the socio-economic development of the study area as a whole between the historical base year 1981 and the common benchmark year 1997 and its expected development until the simulation horizon 2021.

For each simulation period the extended SASI model requires the following assumptions about European developments:

(1) *Assumptions about the performance of the European economy as a whole*. The performance of the European economy is represented by observed (or estimated) values of sectoral GDP for the whole study area, i.e. the European Union plus the 12 candidate countries plus Liechtenstein, Norway and Switzerland for the years 1981 to 1997 and forecasts for the years 1998 to 2021 (see Section 3.1.1).

(2) *Assumptions about immigration and outmigration across Europe's borders*. European migration trends are represented by observed annual immigration and outmigration to and from the 15+12+3 countries of the study area for selected years between 1981 and 1997 and of forecasts for the years 1998 to 2021 (see Section 3.1.2).

These two groups of assumptions serve as constraints to ensure that the regional forecasts of economic development and population of the extended SASI model remain consistent with external developments not modelled. To keep the total economic development exogenous to the model means that the model is prevented from making forecasts about the general increase in production through transport infrastructure investments, although in principle its parameters are estimated in a way that makes it capable of doing that. Alternatively, it is possible to let the model determine the total level of annual GDP and to use the observed values of the period from 1981 to 1997 to validate these forecasts.

(3) *Assumptions about total transfer payments by the European Union via the Structural Funds and the Common Agricultural Policy.* European and national transfer payments are taken into account by annual transfers (in Euro of 1997) during the period 1981 to 1997 and forecasts for the period 1998 to 2021 (see Section 3.1.3).

The data for these three types of assumptions do not need to be provided for each year nor for time intervals of equal length as the model performs the required interpolations for the years in between.

(4) *Assumptions about the development of trans-European transport networks (TEN-T and TINA).* The European road, rail, inland waterway and air networks are backcast for the period between 1981 and 1996 and, based on assumptions on the development of trans-European networks, forecast until the year 2021, both in five-year increments (see Sections 3.2.1 to 3.2.5).

(5) *Assumptions about transport policy decisions*. Besides the base or reference (or business-as-usual) scenario so defined, there will most likely be three policy scenarios based on TIPMAC scenarios and three or more IASON-specific scenarios (see Section 3.2.6).

3.1.1 European GDP

Economic forecasts have large margins of uncertainty, since they are often influenced by unanticipated events. Most forecasts are therefore usually short-term or medium-term. In the light of the uncertainties associated with long-term forecasts, they can only be seen as one scenario out of many possible developments. The approach adopted here is based on an extrapolation of trends observed since 1980, which is combined with scenarios of low and high growth to assess likely developments of the European economy until 2021. The projections serve as constraints in the extended SASI model to ensure that the regional forecasts for economic development are consistent with external developments not modelled.

European Union GDP

Growth in gross domestic product (GDP) of the European Union since 1981 has been steady (Figure 3.1), with the only exception of 1993. After severe tensions in currency markets and the collapse of the European Monetary System, the European economy slid into recession at the end of 1992. It then shrank in the following months so that the growth rate of GDP was negative in 1993.

It can be seen that the average annual growth rate of GDP in the European Union has been lower in the first half of the 1990s than during the 1980s. Average GDP growth was about two percent between 1981 and 1986 and three percent in the second half of the 1980s, whereas in the first half of the 1990s average growth rates went down to only 1.5 percent.

The observed development of GDP by economic sector reflects the fact that the European economy continues to transform from what was fundamentally an industrial economy to a service economy sometimes characterised as 'post-industrial'. Services now dominate the EU economy not only in terms of output but also in terms of employment. The service sector accounts for well over 60 percent of GDP in all member states, with the exception of Finland and Ireland. Although the shares of the economic sectors differ considerably across the European Union, the trend of sectoral change has been observed in all member states over the last fifteen years. There has been a continuing steady decline of the shares of agriculture and manufacturing in total output (Quah, 1997).

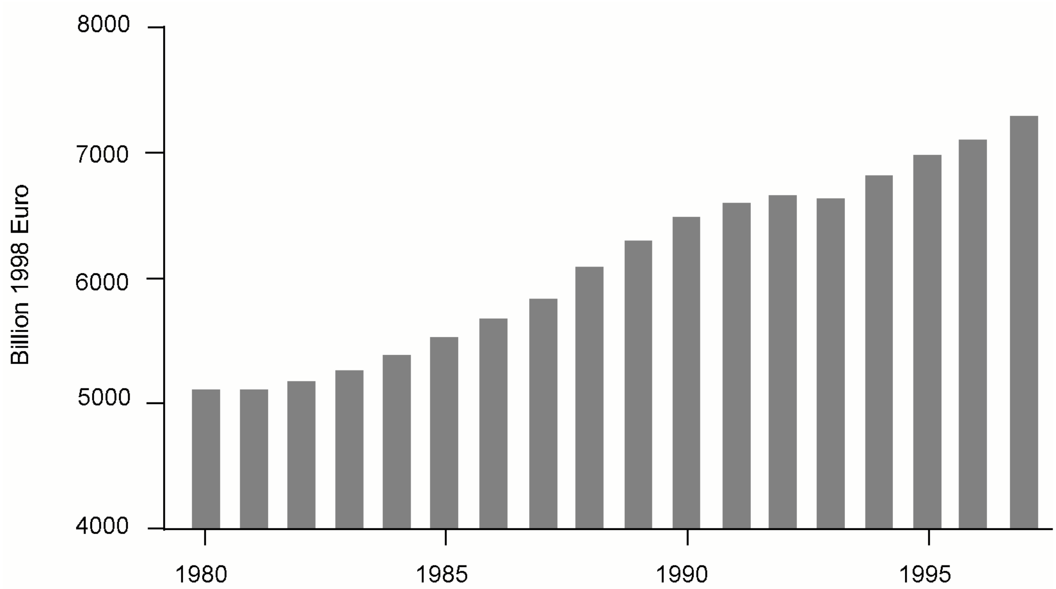

Figure 3.1. GDP in the European Union 1980-1997 in 1998 Euro (Eurostat, 1998c)

For the prediction of future GDP development, GDP projections published by the OECD (1997) are used. These projections are based on a sophisticated growth-accounting framework using structural equations for the main factors influencing factor productivity developments and economic policies (see Table 3.1).

Table 3.1. OECD scenarios for average annual GDP growth

	1995-2000		2000-2010		2010-2020	
	High	Low	High	Low	High	Low
Total OECD	2.7	2.7	3.1	2.4	2.8	1.7
European Union	2.4	2.4	2.8	2.0	2.3	1.3
Other OECD Europe[1]	3.6	3.6	3.8	3.2	4.3	3.4
Non OECD	6.8	5.0	7.2	4.2	6.6	4.4
World	4.4	3.6	5.0	3.2	4.9	2.8

Source: OECD, 1997
[1] Czech Republic, Hungary, Iceland, Norway, Poland, Switzerland and Turkey

The OECD high-growth scenario assumes continuing liberalisation of trade and investment policies, accompanied by structural reforms and fiscal consolidation. The scenario is based on assumptions of high rates of globalisation and international trade, leading to scale economies, higher capital productivity and a more efficient distribution of production world-wide. Following these assumptions, growth rates for all OECD countries rise significantly from those in the early 1990s to an average three percent per annum between 2000 and 2010 and decline slightly after 2010, largely as a result of demographic factors. Annual growth rates projected for the European Union are somewhat lower at 2.8 percent between 2000 and 2010 and at 2.3 percent thereafter.

Forecasting the sectoral composition of GDP is not as straightforward as the prediction of total GDP. While some experts suggest that past shifts in sectoral shares will sustain their dynamics in the future, others maintain that the sectoral composition of GDP is bound to settle at approximately current levels in the near future. For IASON a third in-between scenario was chosen, which combines different estimates by assigning likelihood values to each of them thus arriving at aggregate values for the future sectoral composition of GDP. As with overall GDP development, sectoral composition is contingent on a number of largely unpredictable factors ranging from EU transfer policies, such as the Common Agricultural Policy, to economic structures and trade patterns of future member states (OECD, 1997; Boin and O'Connor, 1997). The GDP projection used in the extended SASI model therefore represents rather moderate assumptions about future developments.

Non-EU Countries

The 12 candidate countries and the 14 other European countries of the IASON system of regions vary widely in their economic and political situation. The most significant difference exists between the advanced economies of the EFTA and EEA members Iceland, Norway and Switzerland and the rest of the European non-EU countries. However, even the transition economies of central and eastern Europe exhibit great disparities in economic performance. The prediction of GDP development in these countries is hampered by large margins of uncertainty related to political, social and economic changes. Previous GDP forecasts had to be amended several times in the light of new developments. Because of these uncertainties, several sources were compared for compiling GDP data for these countries from 1981 to 2016 (United Nations, OECD, World Bank, IMF, Eurostat and European Commission). In addition, individual adjustments were made based on estimations of the effect of political events such as continued tensions and military conflicts in ex-Yugoslavia.

3.1.2 European Migration Policies

Demographic trends play an important role for regional development. Since birth rates are continuously declining and are presently below replacement level in the European Union, interregional migration flows gain importance as a balancing factor for demographic development (Eurostat, 1998c). International migration contributes about two thirds to population growth in Europe. Developments of future net migration as the principal component of demographic change in Europe will therefore be of particular importance.

Despite the fact that Europe now largely consists of countries with a positive migration balance, it is far from being a continent of immigration (Münz, 1996). As data from Eurostat (1998c) show, in 1995 only around 5 percent of the total EU population were foreign nationals, of which almost one third were EU citizens living in another EU country. Less than one third were from the rest of Europe including the former Soviet Union.

However, the scenarios of mass migration initially envisaged after the fall of the Iron Curtain turned out to be exaggerated (Thränhardt, 1996). East-West migration has been less intensive than anticipated, and many of the migrants came at the invitation of western governments, namely ethnic migrants to Germany and Greece. In the case of asylum seekers, as their number grew, regulations were generally tightened. From 1992 onwards a steep fall of the numbers of immigrants could be observed, with EU net migration declining to about 0.8 million persons in 1994 and 1995, mainly as a result of the drop in the number of asylum-seekers and a decrease in refugees from former Yugoslavia (Salt, 1996).

Besides migration flows to the 'traditional' immigration countries of western and northern Europe, immigration into southern European countries is a relatively new, yet substantial phenomenon. The flows consist of three components, i.e. net inflows of returning nationals, retirement migration (see Section 5.3.1 'Quality of Life') and attraction of labour immigrants especially from North Africa (Salt et al., 1994), all of which are spurred by sustained upswings in southern European economies in the last two decades.

A still more recent question is the degree to which the enlargement of the European Union will trigger a new wave of mass migration from the new member states to the older, more affluent west European countries. Several policy options to keep these movements under control are under discussion, the most likely being a moratorium for free movement of labour for several years after accession. These and other policy options are decided on at the European level, and it is important to forecast the likely impacts of such policies in advance. In the extended SASI model it will therefore be possible to specify a global cap on net annual immigration to the EU.

With this exception, migration policy is a matter of national governments. In many EU member states legislation on immigration has recently been reviewed or is currently under review. The general trend is to put tighter control on immigration procedures in order to prevent illegal immigration and to restrict immigration to skilled persons who are a benefit and not a burden for the domestic labour markets. It can therefore be concluded that the pattern of future immigration into EU member states will less and less be the outcome of market forces but largely be determined by national immigration limits. Because data collection on migration and assumptions on future immigration limits will be at the national level, these will be discussed in Section 4.2.

3.1.3 European Transfer Policies

The level of economic performance of a region is affected not only by its physical and human capital endowment and accessibility but also by transfer payments and subsidies by the European Union and by national governments. To promote the goal of equal standards of living and regional economic cohesion, the European Union and its member states provide funds for less developed and economically ailing regions.

In this context, two categories of support payments relevant for the calculation of regional economic performance have to be distinguished:

- *Subsidies*. The first category comprises subsidies which are paid to producers, typically per unit or quantity of goods or services. Usually this type of subsidies is paid to offset the difference between the market price and a politically defined target price (Commission of the European Communities et al., 1993). This category, which will be referred to as 'subsidies' here, is excluded from the calculation of the GDP at market prices.

- *Transfer payments*. The second category comprises payments by public institutions to private enterprises or public institutions which are not targeted at securing pre-defined price levels but serve to enhance the endowment with and the quality of production factors in private or public institutions or entire regions in order to promote regional economic development. These are referred to as 'transfer payments' here. Transfer payments are included in the calculation of GDP at market prices.

As transfer payments make a significant contribution to the GDP in particular of peripheral regions, and as this will become even more relevant with the accession of the east European candidate countries, they are included in the GDP forecasts of the extended SASI model. Therefore, data on transfer payments in the past had to be collected, and assumptions about future transfer payments need to be made.

Decisions about transfer policies by the European Union are made at the European level, and decision about national transfer payments are made by national governments. Therefore data about transfer payments might be collected at the European and national level. However, as practically all transfer payments are targeted to specific regions, they will be dealt with together at the regional level in Section 5.1.4.

Nevertheless it may be desirable to run scenarios with global policy changes at the European level which affect transfer payments of a certain kind to all or a certain group of regions. Examples of such changes are possible future reforms of the Structural Funds which reallocate the proportion between funds addressing specific objectives (see Section 5.1.4), or the envisaged reorganisation of the Common Agricultural Policy which takes account of the large share of agriculture in the economices of the east European candidate countries.

For this purpose it will be possible in the extended SASI model to specify totals for specific types of EU transfer payments to all regions or to regions in specific groups of countries for specific years or periods of years.

3.2 Transport Networks

The spatial dimension of the system of regions is established by their connection via networks. The economic centres of the regions are connected to the network by so-called access links. The 'strategic' road, rail and inland waterways networks defined are subsets of the pan-European network database developed by IRPUD (2001), comprising the trans-European networks specified in Decision 1692/96/EC of the European Parliament and of the Council (European Communities, 1996) and specified in the TEN implementation report (European Commission, 1998) and latest revisions of the TEN guidelines provided by the European Commission (1999a; 2002c), the TINA networks as identified and further promoted by the TINA Secretariat (1999, 2002), the Helsinki Corridors as well as selected additional links in eastern Europe and other links to guarantee connectivity of NUTS-3 level regions. The strategic air network is based on the TEN and TINA airports and other important airports in the remaining countries and contains all flights between these airports.

The networks are used to calculate travel times and travel costs between regions and regional accessibility. For that the historical and future developments of the networks are required as input information. The development of the networks over time is reflected in intervals of five years in the database, i.e. the established network database contains information for all modes for the years 1981 (the historical base year for the extended SASI model), 1986, 1991, 1996, 2001, 2006, 2011 and 2016 (as the envisaged completion year of all TEN and TINA projects). The way the historical and future dimensions of the networks are established in the transport network database was described in the SASI project (Fürst et al., 1999, 30).

Technically, each transport network is stored as a separate layer of the geographical information system ArcInfo. For calculating travel time matrices and travel cost matrices for the CGEurope model and accessibility indicators for the SASI model, tools were developed to extract the links relevant for a certain policy scenario from the GIS database and to convert them to ASCII text files for further processing in the models.

3.2.1 Strategic Road Networks

The strategic road network contains all existing and planned motorways, dual-carriageway roads and other expressways, E-roads and main international traffic arteries identified by the United Nations (1995), the most important national roads and car ferries, the Eurotunnel and additional motorail links (road/rail interchange points for Alps crossings), as well as additional minor or secondary roads to guarantee connectivity of NUTS-3 regions (see Figure 3.2). The road network database contains information on the type of road ('link category'), inclusion in the TEN and TINA programmes, time penalties in agglomeration areas to take account of congestion and slope gradients in hilly areas, car ferry timetable travel times, road tolls, national speed limits and border delays (see Section 8.2.3 in Annex I).

Link categories of past road networks were compiled from Shell (1981; 1992), ADAC (1987; 1991), Reise- und Verkehrsverlag (1987) and Michelin (1992a; 1992b). Link categories of future networks were mainly based on the TEN implementation report (European Commission, 1998) and the TINA status report (TINA, 2002), but also on information provided by transport outline plans of national transport ministries.

National speed limits and information on tolls were derived from ADAC (2000; 2001) and International Road Union (2000), and assumptions on border waiting times are based on International Road Union (2002) (see also Fürst et al., 1999; Schürmann and Talaat, 2000a; 2000b).

Car ferries are included to connect islands and to represent major European road travel routes, e.g. to Scandinavia, the United Kingdom or Greece. For car ferries, real travel times compiled from timetables or maps were used. A terminal time of 60 minutes (‘bording time’) was added to each ferry link.

Road Network Development over Time

Historical and future development of the road network over time forms the core of the network database. The development is reflected in intervals of five years in the database, i.e. the established database contains information for the years 1981 (the historical base year of the extended SASI model), 1986, 1991, 1996, 2001, 2006, 2011 and 2016 (the envisaged completion year for all TEN and TINA projects).

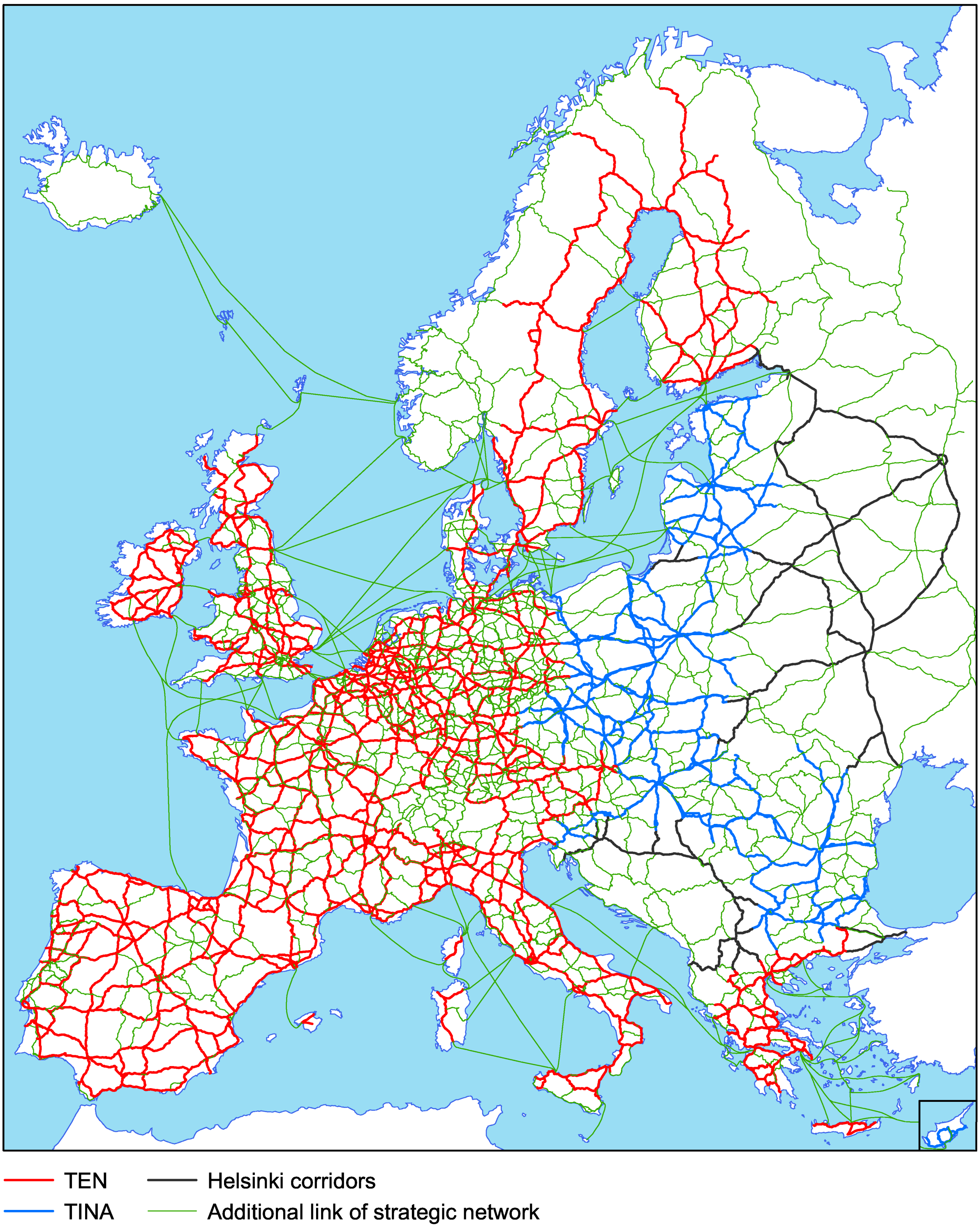

Figure 3.2. IASON road network by link category in 2001

The definition of the strategic road network started with the extraction of the 2001 strategic network from the IRPUD network database. The historical networks for 1981, 1986, 1991 and 1996 were derived from the 2001 network. The principle was to have the same connectivity in the past networks as in the 2001 network. In general, two cases were distinguished:

- A link was upgraded in the past, e.g. from a national road to a motorway, but the alignment did not change. In that case the link category was altered appropriately.

- A new link was constructed with new alignment (e.g. a new motorway). In that case, the new link became part of the road network in the year in which it was opened. In order to have the same connectivity also in former years, an appropriate link of the base network was put into the strategic network for the previous years. This link usually belonged to a lower link category.

Once a link became a part of the strategic network, it was also a part of the strategic networks of the following years. This resulted in increasing total network length over time.

The generation of the future strategic road networks was based on the same principles as described above. For each TEN/TINA project, the network database contains detailed link-by-link information on the current status of the project (under construction, completed, planned or under study), the type of the project (motorway or high-quality road, number of lanes, new construction or upgrading) and the estimated year(s) of completion. All TEN/TINA road links already completed by 2001 or currently under construction were included in the base scenario; links that are planned or are under study will be used in certain infrastructure scenarios (see Section 3.2.6).

Additional information for future road network developments for the European Union was compiled from ARAL (1997) and from other national sources for Belgium (Road Directorate Belgium, 1998), Germany (Bundesministerium für Verkehr, 1992; 1997a; 1997b; DEGES, 1995; 1996; 1998), Denmark (Road Directorate Denmark, 1998), Spain (Direccion General de Trafico, 1998), Finland (Finnish Road Administration, 1998), Sweden (Vägverket, 1997; 1998) and the United Kingdom (Department of the Environment, Transport and the Regions, 1997; Highway Agency, 1998a; 1998b; National Roads Directorate, 1998).

These sources give additional useful information on the construction of links that are included in the strategic road network but are not part of the TEN programme.

If no information was available for a link, it was assumed that no change will take place and the 2001 link category and alignment will remain the same in the future. Depending on the supposed opening years of the links, link attributes were changed or new links were included in the 2006, 2011 or 2016 networks.

Table 3.2 shows that the total length of the strategic road network is constantly increasing over time. There is a shift in link categories from roads to dual carriageways and motorways. While the length of regular roads is decreasing, the length of motorways is increasing by approximately 5,400 km every five years.

Table 3.2. Road network length 1981-2016 by link category (in km)

Link category	1981	1986	1991	1996	2001	2006	2011	2016
Motorways	32,488	34,746	37,062	41,253	48,114	52,306	56,082	59,712
Dual carriageways	8,898	12,010	15,482	19,153	19,830	21,330	22,661	24,642
Other roads	153,264	149,338	145,501	141,269	137,443	135,158	133,247	131,588
Total	194,650	196,094	198,045	201,675	205,387	208,794	211,990	215,942

Altogether, some 24,200 kilometres of TEN and TINA roads are planned by new construction or upgrading of existing roads. (Figure 3.3).

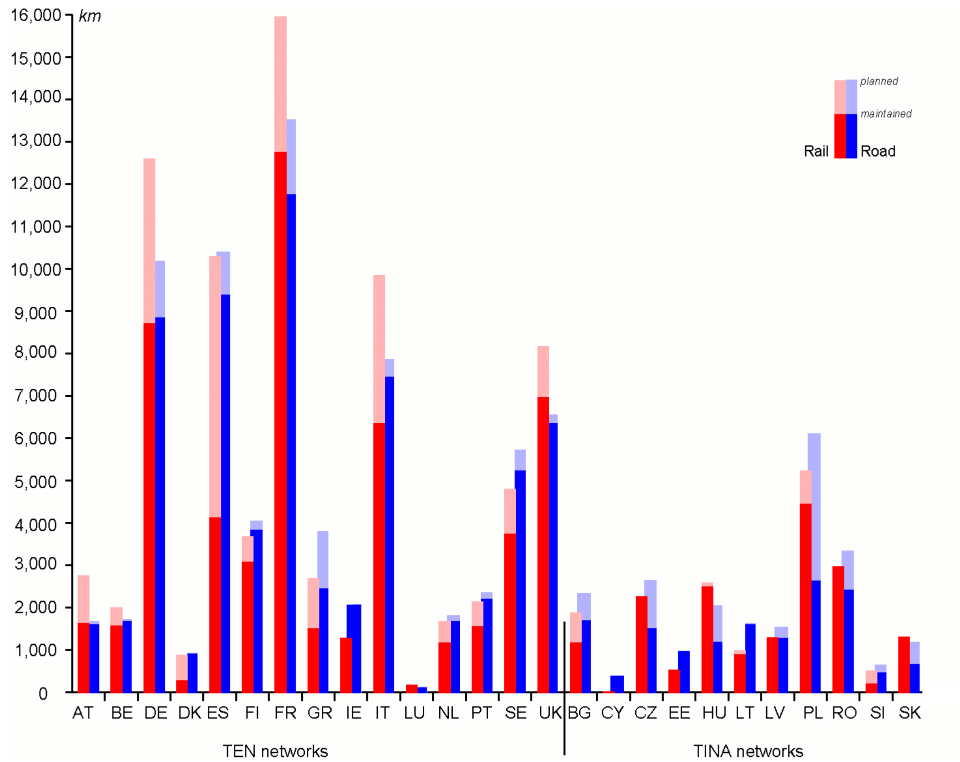

Figure 3.3. Maintained and planned TEN/TINA railways and roads

The following maps show different representations of the road network database. Figure 3.4 contrasts the state of the TEN and TINA road networks in 1981 and 2001. Figure 3.5 shows the TEN priority road projects, followed by Figure 3.6 representing tolls on road segments. Finally, Figure 3.7 illustrates the future evolution of the road network until the year 2016 according to the envisaged completion and opening years of the road projects.

Figure 3.4. TEN/TINA road networks in 1981 and 2001

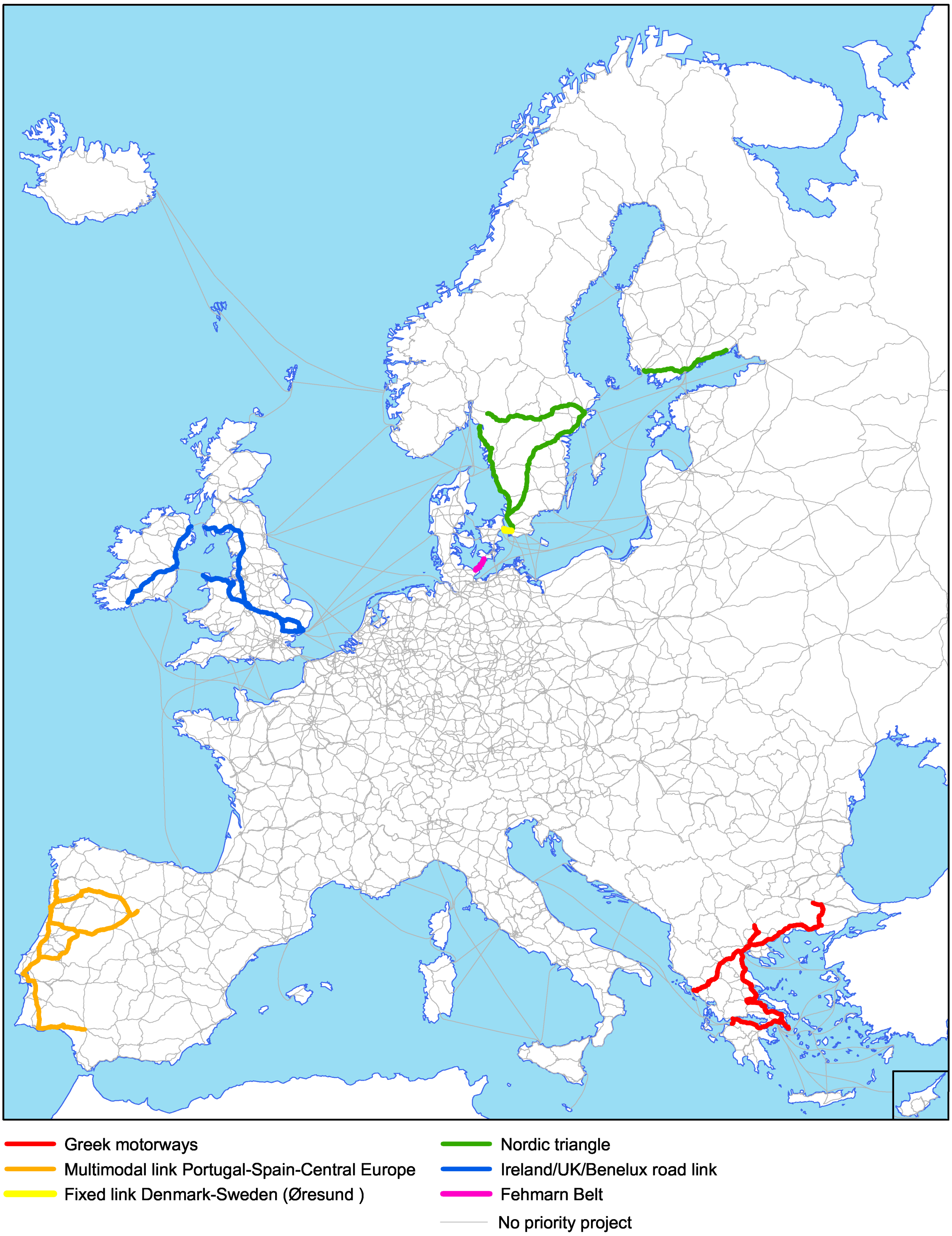

Figure 3.5. TEN priority road projects

Figure 3.6. TEN/TINA road network and toll charges

Figure 3.7. Road projects according to TEN/TINA outline plans

3.2.2 Strategic Railway Networks

The strategic rail network contains all existing and planned high-speed rail lines, upgraded high-speed rail lines and the most important conventional lines as well as some rail ferry and other minor or secondary rail lines to guarantee connectivity of NUTS-3 regions (see Figure 3.8).

The rail network database contains information on the link category (number of tracks, electrification, suitability for high speed), length, inclusion in the TEN and TINA programmes including priority projects (Figure 3.9), designation as freight corridors, and travel times (see Section 8.2.3 in Annex I).

The travel times are not based on average speeds as in the road network but on real link travel times for 1981 and 1996 extracted from rail travel timetables (Thomas Cook, 1981; 1996; Deutsche Bahn, 1996). Rail travel times for 1986 and 1991 were generated by interpolating the travel times of 1981 and 1996. Only for new high-speed rail lines (e.g. TGV lines in France or ICE lines in Germany) travel times were not interpolated but taken from timetables.

Railway Development over Time

The generation of the past strategic rail networks differed from the method used for the road network. It was first checked which rail lines existed already in 1981, 1986 and 1991 and which not. For example, most of the current links existed already in 1981 with the exception of the new high-speed lines (Fürst et al., 1999). In order to include the connectivity of the current high-speed lines in the 1981 network, corresponding conventional links were incorporated in the 1981 strategic rail network. The new high-speed links were introduced into the strategic networks of 1986, 1991 or 1996 according to their opening year. For the remaining lines, assumptions about the general increase of timetable travel times due to improvements in signalling techniques were made.

The definition of the future base scenario rail network again followed the connectivity principle. The main source for the future development of the rail network was the TEN-T implementation report of the European Commission (1998). It contains detailed link-by-link information on the current status of the project (under construction, completed, planned or under study), the type of the project (upgrading or new construction, conventional or high-speed link) and the estimated year of completion (Figure 3.10). If new railway links are planned to be constructed, they were introduced into the network according to their estimated completion year as indicated in the TEN-T implementation report (European Commission, 1998) or TINA status report (TINA, 2002). If already existing links are planned to be upgraded, the link travel times are adjusted according to the type of the project.

This information was then used to make assumptions for speed and travel time changes in each country with respect to the new link categories. In some cases published future travel times for railway sections were used. If no upgrading is planned for a link, a modest acceleration of ten percent was assumed which reflects improvements in signalling systems, carriage technology and railway construction.

Figure 3.8. IASON rail network by link category in 2001

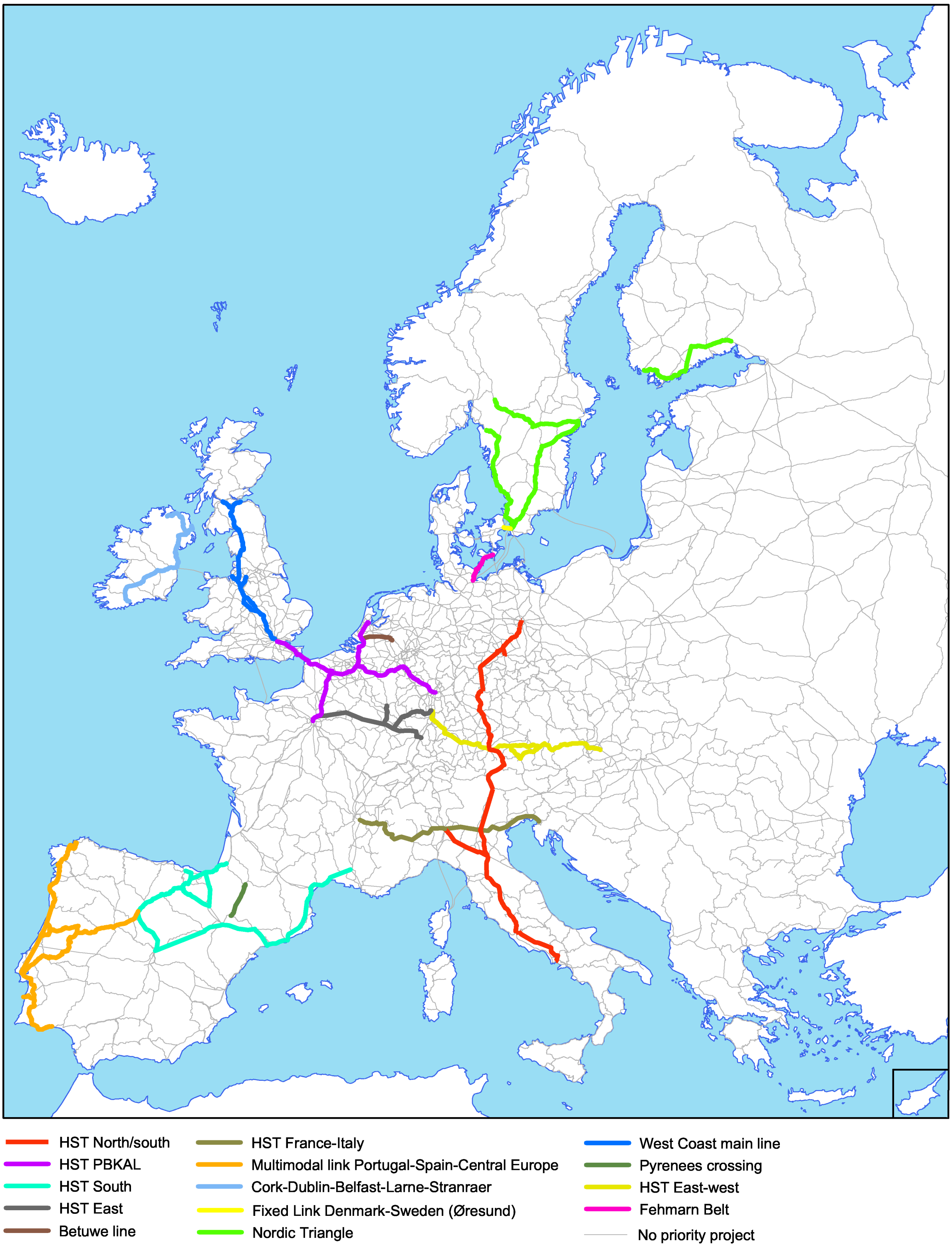

Figure 3.9. TEN priority railway projects

Figure 3.10. Railway projects according to TEN/TINA outline plans

Additional information from national sources was also compiled for Belgium (Federal Ministry of Communications and Infrastructure, 1998), Denmark (Øresundskonsortiet, 1999), Germany (Bundesministerium für Verkehr, 1992; 1996; 1997c; Deutsche Bahn, 1999), Hungary (IMAV, 1998) and Sweden (Banverket, 1999; Øresundskonsortiet, 1999; Malmö City Tunnel Project, 1999). The national sources give information on the construction of links that are included in the strategic rail network but are not part of the TEN programme. If no information was available for a link, it was assumed that no change will take place and that the 2001 link category and alignment remain the same in the future.

3.2.3 Strategic Air Networks

The generation of the strategic air network had to be different from the generation of the road and rail networks (Fürst et al., 1999), because air networks do not consist of physical link infrastructure. The only physical infrastructure are the airports. Therefore, the generation of the strategic air network started with the definition of airports of strategic interest.

The airports of the strategic air network are all airports contained in the TEN and TINA programmes. In addition, important airports in eastern Europe and other non-EU countries were included to guarantee connectivity of these regions (see Figure 3.11).

The criterion for an airport to be a node in the strategic air network is that it has at least one regular daily flight. Eight smaller airports (according to the TEN nomenclatures so-called 'Regional and Accessibility Points') have only charter flights or flights on demand and were excluded from the strategic network.

The airport systems in London, Paris, Berlin, Milan, Stockholm and Bucharest consisting of two or more airports are treated as one single airport each. So all flight connections to and from these cities are focused on one airport (i.e. London Heathrow, Paris Charles de Gaulle, Berlin Tegel, Milano Linate, Stockholm Arlanda, Bucharest International Airport).

All in all there are about 460 airports in the strategic air network. All regular flight connections between these airports form the 2001 air network. The flight network for 2001 was generated as follows: Information extracted from the *Air Traffic Databank* produced and maintained by MKmetric (1998) for 1996 for EU member states form the core of the network; this information was updated using actual airline information provided in the internet (CEDION, 2002; Expedia, 2002), to derive a reasonable 2001 flight network for the whole of Europe. The flight network provided by MKmetric was updated with respect to (i) its spatial scope to include also non-EU countries, with respect to (ii) the number of flight relations, and with respect to (iii) the reference year.

The defined air network contains only non-stop relations between two airports. This means, for example, that a flight from Madrid to Berlin via Frankfurt is divided into two flights, the first one from Madrid to Frankfurt and the second one from Frankfurt to Berlin. Outbound and return flights are stored as two separate relations. Charter flights, non-regular flights or tourist flights are not included.

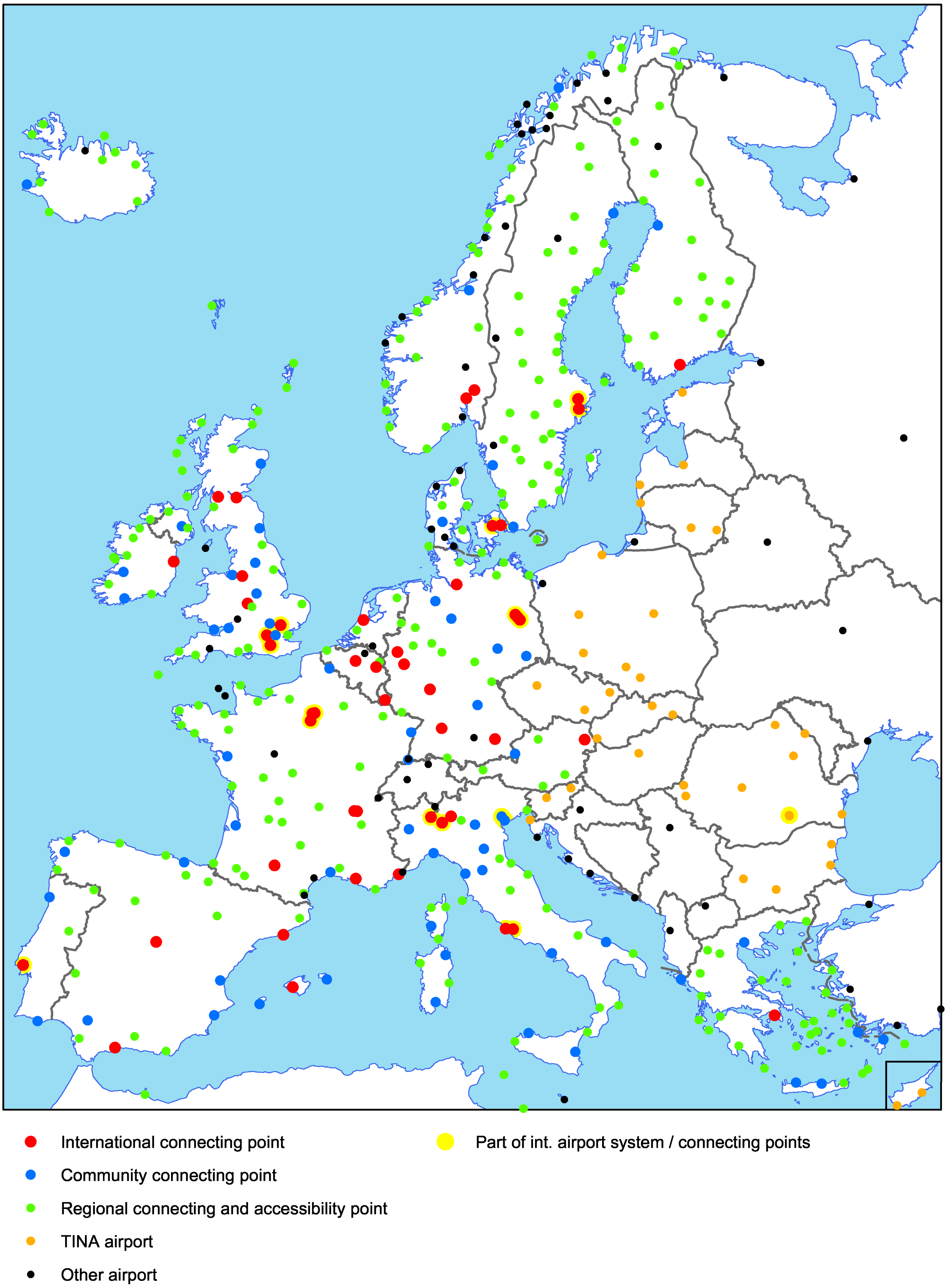

Figure 3.11. Airports by international importance

Average Air Travel Times

Air travel times are based on scheduled flight times averaged over all flights, wind exposures and aircraft types of a relation. A terminal time of 60 minutes was added to each flight. Another important information is the number of flights on each relation. Because even regular flights show a great variation in the number of flights over the year, it is difficult to determine a single value for the number of daily flights. Therefore a frequency index was used as measure for the quality of a relation. Lower frequencies are transformed into additional time penalties for flights on that relation. The penalties are to be seen as an approximation of reduced opportunities to travel along that link and, in particular, for reduced possibilities to reach connecting flights:

- 180 minutes for relations without daily connection with one flight per day,
- 60 minutes for relations without daily connection but several flights per day,
- 120 minutes for relations with daily connection with one flight per day,
- no time penalty for relations with daily connections with several flights per day.

Air Networks for Different Points in Time

The creation of past air networks was a difficult task. A comprehensive data source with information on past air networks in Europe is not available. Therefore, based on the modified MKMetric flight network for 1996, simple assumptions had to be made about the air networks for 1981, 1986 and 1991. The basic assumption was that regional airports played a minor or no role at all in the beginning of the 1980s. This was reflected by adding a time penalty on 1996 air travel times for flights going from or to regional airports: the time penalty was 30 percent for 1981, 20 percent for 1986 and 10 percent for 1991. Moreover, some of the regional airports and the flight relations to or from these airports were dropped from the past networks.

The generation of the future air network turned out to be a difficult task as well. Because airlines design their own flight connections based on the availability of airport slots and market demand, there are no public plans or planning policies or planning authorities for the development of air travel.

For this reason it was assumed that the future air networks will be the same as the current air network for 2002, i.e. that no changes will be implemented with the exception of different assumptions about terminal times.

3.2.4 Inland Waterway Networks

The waterway network contains all navigable rivers, canalised rivers and canals and about 400 inland and coastal ports. For central Europe all lock facilities are included, whereas for eastern and southern Europe only some important locks could be included. Besides inland waterways, also the most important sea waterways between coastal ports are incorporated.

In addition to the currently existing waterways, all inland waterway projects of the trans-European transport network programme of the European Union as specified in Decision 1692/96/EC of the European Parliament and of the Council were included in the database.

The waterway network database contains information on the type of the waterway (free flowing river, canalised river, canal, see Figure 3.12), on the inclusion into the TEN and TINA programmes, on the waterway class, and on the lock dimensions (i.e. number and location of lock chambers) (see Section 8.2.3 in Annex I).

Via the waterway classes and lock dimensions, additional information on maximal permitted ship dimensions (height, width, length and draught) can be linked to the network (see Table 3.3). Information on waterway classes and lock dimensions were taken from Binnenschiffahrts-Verlag (1995; 1997) for central Europe and from United Nations (1994) for the rest of Europe.

Table 3.3. Waterway classes and maximal permitted ship dimensions

Waterway class	Length (m)	Beam (m)	Draught (m)	Tonnage (t)
Motor vessels and barges				
I (west of Elbe)	38-50	5.05	1.80-2.20	250-400
II (west of Elbe)	50-55	6.60	2.50	400-650
III (west of Elbe)	67-80	8.20	2.50	650-1,000
I (east of Elbe)	41	4.70	1.40	180
II (east of Elbe)	57	7.50-9.00	1.60	500-630
III (east of Elbe)	61-70	8.20-9.00	1.60-2.00	470-700
IV	80-85	9.50	2.50	1,000-1,500
Va	95-110	11.40	2.50-2.80	---
Vb	---	---	---	---
VIa	---	---	---	---
VIb	140.00	15.00	3.90	---
VIc	---	---	---	---
VII	---	---	---	---
Pushed convoys				
III (east of Elbe)	118-132	8.20-9.00	1.60-2.00	1,000-1,200
IV	85	9.50	2.50-2.80	1,250-1,450
Va	95-110	11.40	2.50-4.50	1,600-3,000
Vb	172-185	11.40	2.50-4.50	3,200-6,000
VIa	95-110	22.80	2.50-4.50	3,200-6,000
VIb	185-195	22.80	2.50-4.50	6,400-12,000
VIc	270-280	22.80	2.50-4.50	9,600-18,000
	195-200	33.00-34.20		
VII	285	33.00-34.20	2.50-4.50	14,500-27,000

Source: UN, 1994

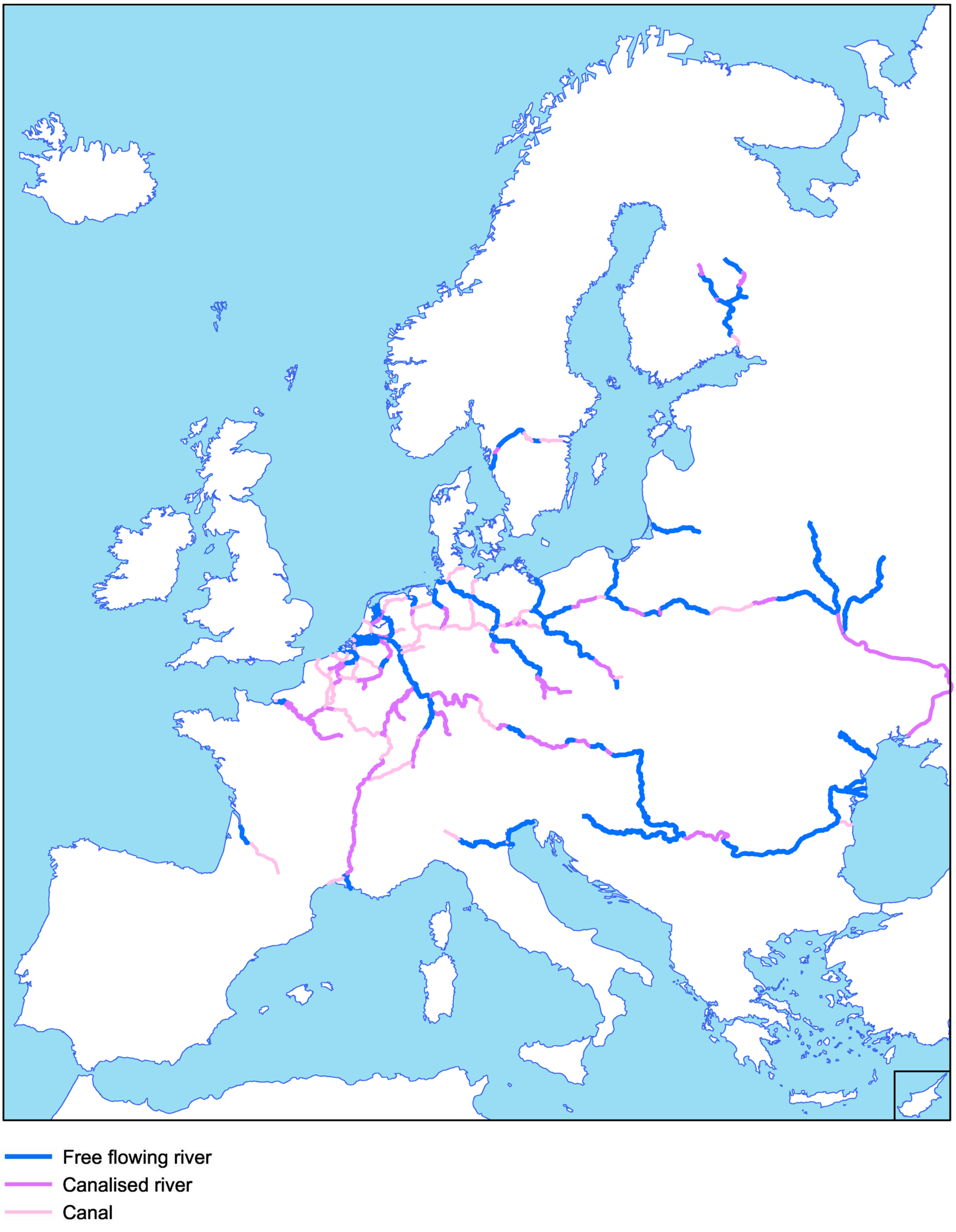

Figure 3.12 Inland waterways by type of waterway

Development Over Time

Since only a very limited number of new inland waterways were built in the past and will be built in the future, the evolution of the inland waterway network mainly consists of upgrading of rivers and canals with respect to waterway classes and lock capacities. For the past it was checked which waterway class was assigned to a certain river or canal segment, and how the lock dimensions had changed over time. Expected future improvements, such as projects for upgrading rivers and locks as laid down in the TEN implementation report, were assigned to the database.

3.2.5 Other Network-Related Data

In order to calculate travel times and travel costs between regions, the following additional aspects not directly linked to individual network links were included: monetary transport costs, waiting times at road borders and political and cultural barriers.

Monetary Transport Costs

The main driving forces for regional development of interest in the extended SASI and CGEurope models are changes in the transport system, i.e. in the relative locational advantage of regions. In both models, locational advantage is expressed as accessibility in terms of travel time, travel cost or generalised cost combining both.

Rail travel times are timetable travel times; road travel times are calculated from road-type specific travel speeds plus border waiting times plus penalties representing congestion in agglomerations or slope gradients in hilly areas; air travel times are based on average flight times plus terminal times; and inland waterway travel times are calculated from waterway-specific travel speeds plus time penalties at locks. In addition, travel times between two regions for all modes are increased by political and cultural barriers (see below).

Based on travel time matrices, monetary travel costs are calculated from mode, link-type and country-specific cost parameters which take account of different levels of fuel consumption, different fuel prices or different railway or airline fares and different values of time. Values of time by country are taken from the EUNET project (see EUNET Deliverable 9, 1998, or IASON Deliverable 4 (Kiel et al., 2002)).

The cost functions to calculate generalised costs will be provided by the SCENES project based on SCENES (2000), and will include the monetary transport costs as well as the monetary costs of travel times, border waiting times and cultural and political barriers.

Border Waiting Times

Border waiting times are a major concern for road traffic (in particular for freight transport) and, despite of the progress made after the *Shengen Agreement*, will continue to be an issue for some European countries in the future. In the road network, border crossings are introduced as border links to which border waiting times were assigned. Because there have been both reductions and increases of waiting times during the last years, a dataset was prepared which contains border delays between neighbouring countries for the years 1981, 1986, 1991, 1996 and as assumptions for the years 2001, 2006, 2011 and 2016. The fact that some countries were divided (e.g. the former USSR) or disturbed by armed conflicts (e.g. former Yugoslavia) was taken into account. The waiting times were distinguished by trip direction because these differ substantially between EU and non-EU countries. Waiting times for all border crossings between two neighbouring countries were assumed to be equal and not to differ by link category or local circumstances. Border delays for eastern Europe are compiled from International Road Union (2002) as the average waiting time in March 2002. Because this source gives waiting times for lorries and heavy trucks only, it was assumed that the waiting times for passenger cars amount to only one fourth of the lorry waiting times. Waiting times between EU member states were based on plausible assumptions.

Table 3.4 gives an extract of the border waiting time data produced for the time period 1981 to 2016. Waiting times between countries that formed a single state in former years (e.g. the former USSR) have a zero value for past years in which they still formed a unified state. In contrast, waiting times within a state or between two states with armed conflicts were assumed to increase significantly. Waiting times between EU member states were assumed to decrease to zero in 2001. For those candidate countries, which are likely to join the EU until 2006, waiting times were assumed to slowly decrease over the next years.

Table 3.4. Examples of waiting times at road border crossings

Countries	Waiting times (minutes)							
	1981	1986	1991	1996	2001	2006	2011	2016
AT-DE	15	15	10	5	0	0	0	0
BA-HR	0	0	15	25	10	10	5	5
DE-PL	120	120	100	110	90	15	10	10
PL-DE	110	110	80	90	60	20	15	10
DE-BE	15	15	10	5	0	0	0	0

The border delays represent waiting times at checkpoints only. Other cost factors associated with border traffic, such as tolls, trade restrictions or psychological barriers, are not represented by these waiting times. These obstacles are represented by the political and cultural barriers (see below).

Political and Cultural Barriers

Link travel times are directly associated with links in the transport network database. However, link-based travel times neglect an important locational aspect for regional development, political and cultural barriers between countries. It can be argued that the decision to make a cross-border trip, to establish international trade relationships or to move or to establish a firm or a household permanently in a different country is not only influenced by accessibility but also by less tangible factors. Different political systems, bureaucracies and legislation, different languages, different cultural or historical backgrounds, and also tolls, trade restrictions or psychological barriers influence all kinds of cross-border spatial interactions. In other words, there are additional costs that do not play a role in intra-national interactions that have to be considered for international spatial interactions.

According to earlier studies of Bröcker (1996) such barriers can have significant effects. Expressed in physical distance, in 1970 the trade barriers between EU countries were equivalent to a distance of 375 km and equivalent to 600 km between EU and non-EU-countries.

Because of their great importance, political and cultural barriers and their development over time were included in the calculation of travel time matrices. Political and cultural barriers were introduced as additional time penalties. The travel time then comprises two elements, the pure travel time between two regions by a particular transport mode and an additional time penalty taking account of the political and cultural diversity between the two countries to which the two regions belong. Barrier time penalties are expressed in minutes, i.e. can be considered an additional burden for spatial interactions between two regions.

In order to reflect different aspects of cultural and political barriers, the time penalty comprises three components: an *European integration factor* reflecting in which supranational structures the two countries are embedded, i.e. which political and economic relationship exists between them, a *language factor* describing the grade of similarity of the mother language(s) spoken in the two countries and a *cultural similarity factor* reflecting how similar the cultural attitudes of the two countries are considering also the historical relationships between two countries. The three factors are operationalised in the following way:

The *European integration factor* reflects the economic and political relationship between two countries. It takes account of the different supranational structures countries are integrated in and also of political instabilities and armed conflicts such as in former Yugoslavia. Changes over time are incorporated to take account of the past and likely future economic and political integration of Europe, in particular the expected accession of the candidate countries in eastern Europe.

All European countries were classified for each year of the period 1981-2016 with respect to their integration in supranational structures (member of the European Union, non-EU country in western Europe, east-European country partly westwards oriented, east-European country or isolated country).

The indication of future members of the European Union was based on current negotiations with the candidate countries as defined in Table 2.1 and shown in Figure 2.1:

- It was assumed that Hungary, Poland, Estonia, the Czech Republic and Slovenia will become EU members and that the full integration effect will become effective in 2006.

- It was assumed that Bulgaria, Lithuania, Latvia, Romania and Slovakia will eventually become EU members and that the integration effect will appear in 2011.

It was assumed that Turkey will in the long run become an EU member and that most of the countries in eastern Europe will orient themselves more towards western Europe and that armed conflicts will be stopped.

Table 3.5 presents the translation of the country classification into a European integration factor:

Table 3.5. European integration factor, 1981-2016

Countries	Time penalty (minutes)							
	1981	1986	1991	1996	2001	2006	2011	2016
EU-EU	90	60	40	30	20	10	10	10
EU-NEU	120	120	90	60	30	30	20	20
EU-EEW	180	180	120	120	90	60	60	60
EU-EE	240	240	180	180	180	120	120	120
NEU-NEU	120	120	90	60	30	30	20	20
NEU-EEW	180	180	120	120	90	60	60	60
NEU-EE	240	240	180	180	180	120	120	120
EEW-EEW	120	120	120	120	90	90	90	90
EEW-EE	120	120	120	120	90	90	90	90
EE-EE	120	120	120	120	90	90	90	90
all-IC	300	300	300	300	300	300	300	300

EU *Member of the European Union,* *NEU* *Non-EU country in western Europe*
EEW *East-European country, partly westwards oriented* *EE* *East-European country*
IC *Isolated country*

A time penalty in minutes has been assigned to all possible combinations of relationships between two countries. The developments over time, i.e. the decreasing time penalties, reflect integration processes such as the Single European Market and the Monetary Union, the European Economic Area and the opening of eastern Europe. Very high time penalties for isolated countries reflect that these countries are not accessible. The European integration factor for countries that together formed a single country in earlier years (e.g. the former USSR) is set to zero for those years.

The *language factor* forms an important component of the barrier effect. Language has practical implications but works also as a psychological obstacle. The language factor is kept constant over years, i.e. does not reflect that because of improved education and migration the general knowledge of foreign languages may increase over time – or may even decrease because of declining daily use of former official languages, such as for instance Russian in the Baltic states.

Four cases describing the language relationship between two countries are distinguished (see Table 3.6). The language factor was assigned to the full matrix of relationships between countries. However, there is no differentiation by direction, i.e. it is neglected that the inhabitants of one country may speak the language of another country well but not vice versa, as it is the case between the Netherlands and Germany.

Table 3.6. Language factor

Language relationship	Language factor	Time penalty (minutes)
Same language in both countries, e.g. Germany-Austria	1	0
Good knowledge of other country's language, partly because of close linguistic relationship between languages, e.g. Italy-Spain	2	20
Some knowledge of other country's language or good knowledge of third language, e.g. Netherlands-Denmark	3	40
No language widely available to communicate, e.g. Spain-Netherlands	4	60

The *cultural similarity factor* expresses the degree of cultural similarity, i.e. the way daily, political or business life is organised or whether there are particular historical relationships, as for instance between Finland and Estonia. Though there might be some convergence of cultures in Europe, the factor is kept constant over time. Four cases of increasing dissimilarity are distinguished (see Table 3.7):

Table 3.7. Cultural similarity factor

Cultural relationship	Cultural similarity factor	Time penalty (minutes)
Very high (e.g. Germany-Austria)	1	20
High (e.g. Germany-Denmark)	2	40
Medium (e.g. Germany-Italy)	3	60
Low (e.g. Germany-Portugal)	4	80

The results of the estimation of political and cultural barriers are eight matrices of time penalties between two countries, one for each year. To illustrate the combined working of the three factors a few examples for selected countries are given in Table 3.8:

Table 3.8. Examples of the time penalty for cultural and political differences

Countries	Formula	Time penalty (minutes)							
		1981	1986	1991	1996	2001	2006	2011	2016
DE-NL	$e(t)$+20+40	150	120	100	90	80	70	70	70
DE-ES	$e(t)$+60+60	240	180	160	150	140	130	130	130
DE-PL	$e(t)$+40+60	280	280	220	220	190	110	110	110
IT-NL	$e(t)$+60+60	210	180	160	150	140	130	130	130
IT-ES	e(t)+20+40	180	120	100	90	80	70	70	70
IT-PL	$e(t)$+60+80	320	320	260	260	220	150	150	150

$e(t)$ = *European integration factor* in year t.

Two out of the three factors, the language and the cultural similarity factor, are kept constant over time, i.e. the temporal dynamic is based only on the European integration factor. Time penalties for cultural and political barriers between countries shown in Table 3.8 range from 320 minutes for Italy and Poland in 1981 to only 50 minutes for Italy and Spain in 2016.

3.2.6 Transport Policy Scenarios

According to IASON Deliverable D2 (Bröcker et al., 2001, 64), a scenario in IASON is a time-sequenced programme consisting of a combination of policies in the fields of transport, economy and migration. In technical terms, a scenario is any combination of assumptions about the development of the trans-European network infrastructure, European/national transport policies, total European GDP, European/national transfer policies, total European migration and European/national migration policies.

There are two fundamental groups of scenarios: scenarios based on assumptions about socio-economic macro trends with respect to European GDP, European migration and European trans-national transfer policies, and scenarios based on policies affecting the European transport infrastructure and its use.

In IASON, only the latter kind of scenario, transport scenarios, will be investigated. According to the ongoing discussion with the Commission, there will most likely be one base or reference (or business-as-usual) scenario, three policy scenarios based on TIPMAC scenarios and three or more IASON-specific scenarios.

Transport scenarios can be subdivided into *pricing scenarios* and *network scenarios*:

- *Pricing scenarios* investigate different ways of levying social marginal costs of road transport from heavy goods vehicles, or alternatively from all modes, by a km-charge, by fuel tax or by a combination of both. Pricing scenarios are entered into the models by changing the monetary travel cost functions.

- *Network scenarios* investigate different time schedules of implementing the trans-European transport networks (TEN-T) and TINA networks. Suggested network scenarios include the following:
  - business as usual: TEN-T core projects in member states implemented as in the TEN-T outline plans, other TEN-T projects and TEN-T in candidate countries implemented by 2015;
  - faster implementation of TEN-T core projects in member states, other TEN-T and TINA projects in candidate countries implemented by 2010,
  - only one priority project implemented fast (see Annex III of 2001 proposal to revise TEN-T guidelines);
  - high-speed rail network implemented faster (see Annex I of 2001 proposal to revise the TEN-T guidelines);
  - dedicated rail freight network implemented.

Network scenarios are entered into the models by changing the underlying network databases. The extended SASI model has a network scenario generation software tool to accomplish this using the ArcInfo geographic information system.

In order to make the model results as comparable as possible, the extended SASI and the CGEurope models use the same network database, assume the same transport policies and apply the same cost functions to calculate generalised transport costs.

4 National Data

National data were collected where information applies to all regions of a country or where data for individual regions were not available or would have required a disproportionate effort to obtain. There are two groups of national data in the database: economic data, such as national accounts, input-output tables and data on international trade, and demographic data, such as data on fertility and mortality and migration.

4.1 Economic Data

Since neither national accounting identities, input-output-coefficients nor interregional trade data are available on a sub-national scale, the CGEurope model does not have the information required for building a regional social accounting matrix (SAM). Hence CGEurope assumes that production technologies of firms and household preferences do not depend on location, such that detailed social accounting information is only required on a national scale. The national economic data are organised in a matrix form as social accounting matrix. SAM is a table consisting of rows and columns representing sectors of the economy. These sectors correspond to five main accounts: production activities, factors of production, institutions, the rest of the world and capital (savings and investments) (see Isard et al., 1998).

The SAM described in this section combines information on national accounts for each country, including input-output information, with institutional flows of goods and services linking countries through international trade.

4.1.1 National Accounts

National accounts comprise main accounting identities of each economy and are based on a principle of double-entry book-keeping, which is required in the form of payments and receipts also by the SAM.[2] Hence, national accounts data serve key functions for constructing and balancing the SAM. Still, data required by a SAM will be more detailed than that which may suffice for the national accounts, since the decision to construct a SAM is based on the need for an analysis of distribution, which cannot be based solely on aggregate national accounts.

It is also generally preferable to separate accounts for commodities and the activities that produce them. The vast majority of the input-output tables collected, however, are of the industry-by-industry type that normally corresponds with the activity-by-activity block in a stan-

[2] The main difference between social accounting and national accounting is one of emphasis. The prime interest in national accounts has traditionally been to analyse the production of goods and services, their use for final and intermediate consumption, export and accumulation and the use of resources in the production process. On the other hand, in social accounting the emphasis has been on the distribution and redistribution of income generated by the production process. In practice now it is more and more recognised that the accounting system should provide for both purposes, see for example the SNA (UN, 1993). For a more detailed and technical overview about SAM, national accounts and input-output tables refer to Stone (1984).

dard SAM. As described below, also the large SAM dataset for eastern European countries that was used had a one-to-one mapping between activities and commodities which implies that as far as technology input coefficients are concerned, no differentiation is made between products (commodities) and industries (activities).[3] Hence the SAM used for IASON is equivalent to input-output tables.

Several sources of national accounts data were used for the compilation of the input-output tables. For the 15 EU countries the input-output tables are harmonised in accordance with the European System of Integrated National Accounts (ESA). Table construction is based on the EURO method developed by Beutel (1999), which uses official Eurostat macro statistics as targets for iteration. A large group of countries in central and eastern Europe is monitored by *Countries in Transition*, a yearly statistical series produced by the Vienna Institute for International Economic Studies (WIIW, 2002). These countries include Bulgaria, Croatia, the Czech Republic, Hungary, Macedonia, Poland, Romania, Russia, Slovakia, Slovenia, Ukraine and Yugoslavia. When needed for adjusting and updating of input-output tables, macroeconomic data for these countries were taken from this database. For Albania, Belarus, Bosnia and Herzegovina, Liechtenstein and Moldova national accounts were taken from the online database of the World Bank (2002). Finally, all accounts and input-output tables have been scaled to one uniform GDP source for the benchmark year 1997 in US dollars at current prices. Again, this macro GDP total was taken from the World Bank (2002). For building input-output tables not only national accounts data are needed but also supplementary information on input-output relations as well as on international trade flows.

4.1.2 Input-Output Tables

Besides economic activity data, input-output-coefficients are probably the most important information in transport project and policy evaluation. The statistical information on activity tables and uses characterise economic linkages of a base year. Industry use and make tables present differences in the sectoral factor productivity between countries. In the context of CGEurope, input-output-coefficients are also required for assigning interregional and international flows to sources and destinations by combining input-output-information with a gravity approach, which is derived from microeconomic foundation. For most of the countries, no accounting data are available showing input-output flows by sector and region.

The methodological focus of CGEurope is therefore on designing a multiregional and multisectoral SAM applicable to poor data environments, such as central, east and south European countries. Even national input-output information shows no complete social accounting matrix and is published only with long time lags, so that updating and filling of data gaps by plausible assumptions cannot be avoided. To overcome this shortcoming in the database, CGEurope has restricted the number of parameters such that all parameters except elasticities can be calibrated by national input-output data and by regional data showing no more than regional employment and other activity indicators by sector and regional factor prices.

[3] The one-to-one mapping implies that the off-diagonal elements in the activity-by-commodity block of the SAM are zero.

Main Data Sources

Since input-output tables are very strict systems with overall consistency, and because they need to be built upon many different data sources, their quality not only depends on the quality of these sources themselves, but also on the way these sources are integrated. The ideal situation of harmonised input-output accounts for large sets of countries is still far away, although recently substantial progress has been made within Eurostat and the OECD. For the 15 EU countries it was possible to use a very recent set of fully harmonised tables for 1995. This set was provided by Jörg Beutel of the Konstanz University of Applied Sciences, who built this dataset for Eurostat in co-operation with the OECD. This set, which is a new yet unpublished update of Beutel (1999), has been used as the starting point to which all non-member countries of the European Union in IASON have been added.

A second important data source used is the Global Trade Analysis Project (GTAP) of Purdue University, USA (Dimaranan and McDougall, 2002). GTAP is not primarily aimed at input-output analysis but its computable general equilibrium (CGE) modelling background needs the same kind of data as IASON. The GTAP Database Version 5 has been used for extracting missing input-output information and intercountry trade data for several individual countries. The GTAP database is subject to total overall consistency for the GTAP model that uses inter-country intersectoral trade flows at its base level of 65 countries or world regions and 56 sectors. In addition, the whole system is regularly updated to recent national accounts. This all inevitably puts a heavy pressure on the original separate national input-output datasets on which the system is built, and sometimes the documented national input-output tables used are hardly recognisable in finalised GTAP output.

The logical alternative of, instead of the Beutel set mentioned above, using GTAP as the starting point for adding input-output tables of non-GTAP countries was not chosen for various reasons. First, the Beutel set is more recent and more complete. In GTAP, out of the 15 EU country tables, two countries are missing (Greece and Luxembourg), six refer to years ranging from 1990 to 1993 and two go back as far as 1985 (Sweden) and 1983 (Austria) (van Leeuwen, 2001). Second, the extensive harmonising and updating in GTAP is documented (McDougal, 2001), but at the required low processing levels needed, it is difficult to judge the effects of further adjustments and harmonising with additional tables.

For a large group of 13 non-EU countries, mainly the former centrally planned economies in eastern Europe, Banse (2001) recently constructed a SAM database which uses the same sectoral structure as GTAP. The remaining tables were gathered from various channels, from the national statistical offices or sometimes through specific authors or institutes that have compiled the relevant national input-output table on their own. For the Former Soviet Union (FSU), however, no recent input-output tables could be gathered for Belarus and Ukraine. For these countries the FSU from GTAP had to be used as a proxy. For two small countries with missing data the simple choice was made to use the input-output table of the closest larger country as a proxy: Austria for Liechtenstein and Romania for Moldavia.

Finally, the remaining data gap to be closed was formed by Albania, the new Balkan states Bosnia, Macedonia and the remaining part of former Yugoslavia (Serbia including Kosovo and Montenegro). Clearly, the last input-output table constructed for former Yugoslavia from 1980 was no longer relevant. The Croatia table was used as a proxy for Bosnia, and the Bulgarian table for Albania and Macedonia. For Serbia, which is relatively more industrialised, the average of Hungary and Bulgaria was taken as a reference. More details on construction of input-output tables for individual countries are given in Annex II., Section 9.2. Table 4.1 gives an overview about the several sources used for building the input-output tables.

Aggregation Level and Base Year Scaling

Since the input-output tables had to be built from different data sources, a common level of aggregation had to be defined based on sectoral availability of each dataset used. In contrast to regional data, national information usually is provided on a more detailed sectoral classification. As regional data evaluation and computation of input-output tables had to be done simultaneously, based on national information input-output tables have been disaggregated at the highest level possible. Therefore, the resulting input-output tables cover nine sectors corresponding to the NACE-CLIO classification (given in Annex II, Section 9.2.1):

- agriculture, forestry and fishery products (abbreviated by: agriculture; corresponding to B01)
- energy, fuel, gas, water and power products (energy, B06)
- manufacturing, mining etc. (manufacturing; B30)
- construction (B53)
- wholesale and retail trade, recovery and repair services (trade)
- lodging and catering services and other market services (other market services; the last two sectors sum to B58 and B74)
- transport and telecommunication services (transtelcom; B60)
- credit and insurance services (financial services; B69)
- non-market services (non-market services; B86).

The exact aggregation schemes for the respective data sources used are given in Annex II, Section 9.1. For the dataset of Banse the GTAP scheme was used. These nine sectors are aggregated to the six sectors used within IASON corresponding to the aggregation scheme also presented in Annex II, Section 9.1.

In order to achieve the intended benchmark dataset 1997 for the CGEurope model, the input-output tables for all 41 countries have been scaled with a single table-wide deflator so that in each table total GDP, calculated from the income side as total factor payments, matches GDP in current prices for 1997 in US dollars. The GDP dataset for 1997 was provided by the World Bank (2002) for 39 countries. Additional data for Liechtenstein and Yugoslavia were taken from other sources (see Table 4.2).

Table 4.1. Input-output database overview

Region	Country	I-O	Proxy I-O	Source	Year
EU member states	Austria	yes		Beutel	1995
	Belgium	yes		Beutel	1995
	Denmark	yes		Beutel	1995
	Finland	yes		Beutel	1995
	France	yes		Beutel	1995
	Germany	yes		Beutel	1995
	Greece	yes		Beutel	1995
	Ireland	yes		Beutel	1995
	Italy	yes		Beutel	1995
	Luxembourg	yes		Beutel	1995
	Netherlands	yes		Beutel	1995
	Portugal	yes		Beutel	1995
	Spain	yes		Beutel	1995
	Sweden	yes		Beutel	1995
	United Kingdom	yes		Beutel	1995
Candidate countries	Bulgaria	yes		Banse	1997
	Cyprus	yes		Banse	1997
	Czech Republic	yes		Banse	1997
	Estonia	yes		Banse	1997
	Hungary	yes		Banse	1997
	Latvia	yes		Banse	1997
	Lithuania	yes		Banse	1997
	Malta	yes		Banse	1997
	Poland	yes		Banse	1997
	Romania	yes		Banse	1997
	Slovakia	yes		Banse	1997
	Slovenia	yes		Banse	1997
Other countries in central Europe	Liechtenstein	no	Austria		
	Norway	yes		Other	1996
	Switzerland	yes		Other	1995
Rest of Europe	Albania	no	Bulgaria		
	Belarus	no	Former SU		
	Bosnia and Herzegovina	no	Croatia		
	Croatia	yes		Banse	1997
	Iceland	yes		Other	1992
	Macedonia	no	Bulgaria		
	Moldova	no	Romania		
	Russia	yes		Other	1997
	Turkey	yes		GTAP	1995
	Ukraine	no	Former SU		
	Yugoslavia	no	Average estimate		
Rest of world	All other countries				

Table 4.2. GDP in benchmark year 1997 (million US$)

Region	Country	GDP (1997)
EU member states	Austria	206,668
	Belgium	243,540
	Denmark	168,365
	Finland	122,419
	France	1,406,120
	Germany	2,114,465
	Greece	120,933
	Ireland	79,983
	Italy	1,164,849
	Luxembourg	17,459
	Netherlands	376,602
	Portugal	105,808
	Spain	558,568
	Sweden	237,479
	United Kingdom	1,318,524
Candidate countries	Bulgaria	10,056
	Cyprus	8,448
	Czech Republic	52,647
	Estonia	4,634
	Hungary	45,724
	Latvia	5,638
	Lithuania	9,585
	Malta	3,340
	Poland	148,862
	Romania	32,478
	Slovakia	20,410
	Slovenia	18,206
Other countries in central Europe	Liechtenstein*	720
	Norway	154,971
	Switzerland	256,037
Rest of Europe	Albania	2,294
	Belarus	23,010
	Bosnia and Herzegovina	3,527
	Croatia	21,063
	Iceland	7,474
	Macedonia	3,183
	Moldova	1,930
	Russia	428,464
	Turkey	189,878
	Ukraine	53,459
	Yugoslavia**	18,146
Rest of world	All other countries	

Source: World Bank, 2002
* Adapted from *http://www.worldlanguage.com/Countries/Liechtenstein.htm*
** WIIW, 2002

As mentioned, the EU dataset of 15 input-output tables was available for 1995 in national currencies and current prices. The tables for the 13 countries in the Banse dataset were harmonised to 1997, also in national currencies and current prices. As Banse (2001) reports, all original tables used were constructed for years varying from 1995 to 1997, except for Cyprus, for which he used a table of 1985. In addition, as Table 4.2 shows, the other sources used are within the same time range (Russia 1997, Norway 1996, Turkey 1995). It is only Iceland (1992) for which a table more then two years away from the benchmark year had to be used. Given the very restricted time range around the base year 1997, for which almost all input-output tables are constructed, the straightforward scaling to 1997 GDP was considered acceptable for the benchmark database.

4.1.3 International Trade

A further important variable in the structure of the CGEurope model is the international and interregional exchange of goods and services. This importance is given by the fact that the purposed analysis will concentrate on the consequences that transport projects and policies have in the region in question as well as how much of these consequences flow outside the region. On account of scarce parameterisation in the CGEurope model, data on exchange of goods and services is only required at the international level, while interregional trade flows result from the calibration procedure. Hence, trade information has to be considered within the national SAM framework. There exist several approaches for establishing SAM for linked economies, each having its own advantages and shortcomings depending on the particular model and issues being addressed (see e.g. Round, 1995).

For the CGEurope model all tables have been processed so that the input structure of each national sector reflects technology, e.g. inputs *including* foreign imports. Total imports are registered through one column for all industries showing foreign imports by sector of origin. For the tables from Beutel, Banse and GTAP, this information was readily available. For the remaining tables, when needed, import matrices were retrieved from GTAP. The processing of exports did not need special adjustments because this vector was available in all tables. The resulting imports and exports by sector were balanced with sectoral trade flows between all countries. Different data sources had to be used for constructing bilateral trade flows for each sector. In particular two main datasets were used for bilateral trade in agriculture, manufacturing, energy and construction and for bilateral trade in services. This distinction is due to the fact that information on trade of services is not provided for all countries considered in IASON, such that exports and imports of services could be balanced only for 23 countries or regions, such as the rest of EFTA and the rest of the Central and Eastern European Association as well as the rest of the world. For the remaining countries bilateral trade flows in services will be derived in the CGEurope model.

Data on trade flows in agriculture, manufacturing, energy and construction are available for all 41 countries and were mainly taken from the dataset constructed by Feenstra (2000), who published a large consolidated dataset of imports and exports between all countries worldwide based on the World Trade Analyser (WTA) assembled by Statistics Canada over the period 1980-1997. From this set, inter-country trade data for 24 countries were directly available (see Table 4.3). From the rest of the dataset five additional aggregates were extracted: Belgium, Luxembourg, former Czechoslovakia, the former USSR, former Yugoslavia and the rest of the world.

Table 4.3. Sources of the international trade matrix of agriculture, manufacturing, energy and construction

Region	Country	Source
EU member states	Austria	Feenstra
	Belgium	OECD
	Denmark	Feenstra
	Finland	Feenstra
	France	Feenstra
	Germany	Feenstra
	Greece	Feenstra
	Ireland	Feenstra
	Italy	Feenstra
	Luxembourg	OECD
	Netherlands	Feenstra
	Portugal	Feenstra
	Spain	Feenstra
	Sweden	Feenstra
	United Kingdom	Feenstra
Candidate countries	Bulgaria	Feenstra/WIIW
	Cyprus	Feenstra
	Czech Republic	WIIW
	Estonia	*
	Hungary	Feenstra/WIIW
	Latvia	*
	Lithuania	*
	Malta	*
	Poland	Feenstra/WIIW
	Romania	Feenstra/WIIW
	Slovakia	WIIW
	Slovenia	WIIW/*
Other countries in central Europe	Liechtenstein	**
	Norway	Feenstra
	Switzerland	Feenstra
Rest of Europe	Albania	Feenstra
	Belarus	*
	Bosnia and Herzegovina	*
	Croatia	WIIW
	Iceland	Feenstra
	Macedonia	WIIW
	Moldova	*
	Russia	WIIW/*
	Turkey	Feenstra
	Ukraine	WIIW
	Yugoslavia	Feenstra
Rest of world	All other countries	

* Other sources, mostly national statistical offices
** For Liechtenstein, Austria was used as a proxy

In the first version of the trade matrix these five aggregates were each represented as a row and column next to the 24 by 24 inter-country trade matrix. First, with OECD data the two countries Belgium and Luxembourg could easily be disaggregated. Next, from WIIW (2002) additional information was available for 12 east European countries about their trade with the 15 EU countries and among each other. Where trade flows were available from both sides, i.e. imports and exports, the unweighted average of both was taken. With this data, the Feenstra totals for the former Soviet Union and former Yugoslavia could largely be broken down. Missing information about import and export destinations for remaining countries (the Baltic states, Belarus, Moldova and Malta) was retrieved from national statistical offices. The row and column of Bosnia were largely constructed by taking those of Croatia as a reference weighted with GDP size, although some trade cells were exogenously given. For Liechtenstein, again as with the input-output tables, Austria was used as a reference.

After this breaking down process the result is a full trade matrix for 42 countries (the 41 countries of Table 4.2 plus the rest of the world as a 42nd region) consistent with the aggregates of the Feenstra data. The final step to be taken was to map this trade structure with the imports and exports that come out of the input-output table database. In order to have a correct benchmark year dataset, the structure of the trade matrix was put under the constraint of a RAS procedure with imports and exports from the input-output data as row and column totals. The new trade matrices add up to the trade matrix resulting from running the RAS procedure with aggregate imports and exports and the aggregated full trade matrix constructed from Feenstra, OECD etc.

Information on bilateral trade flows in services is provided by the GTAP database for the European Union member countries, Switzerland, the rest of EFTA, Hungary, Poland, Turkey and the rest of the central and east European countries as well as for the rest of the world. For each country or region bilateral trade flows in market services, non-market services, financial services and total services are available. Again, all trade matrices were made consistent to the respective imports and exports of the input-output tables by applying a RAS procedure. The new trade matrix of market services, non-market services and financial services add up to the new trade matrix of total services.

4.2 Demographic Data

Changes of regional population are modelled in the extended SASI model at the regional level. However, only in few countries fertility and mortality data are available for individual regions. Interregional migration data are available for some countries, however, for international migration in general only the country of origin, but not the region of origin is recorded. Therefore, fertility, mortality and migration data were collected only at the national level.

4.2.1 Fertility and Mortality

Fertility rates by age group of mothers and mortality rates by year of age and sex are available from the New Cronos database (Eurostat, 2002b) for the 15 current EU member states for most years since 1981. For the candidate countries, only crude fertility and mortality rates are available for selected years since 1981.

4.2.2 Migration Data

Although the migration submodel in the extended SASI model models interregional migration flows, its calibration will have to be performed with national migration data for lack of consistent data on interregional migration flows. However, even the analysis of international migration in Europe, and especially migration from outside the European Union, is limited by patchy availability of data and lack of consistent data on the number of foreign population.

The main problems of existing data arise from variations in national practices and incompatibility of sources, concepts and definitions. For instance, there exist differences in the length of stay above which a visitor is considered a migrant. In Germany, the intended length of stay is not a criterion in the definition of migration; therefore the figures presumably include many short-term migrants. In Denmark the required length of stay is three months or more, in Norway six months, and one year in Sweden. Moreover, the data do not include a substantial number of unregistered and illegal migrants (Salt et al., 1994). There are considerable differences if one compares the statistics of two countries on the migration between them. These data problems affect the analysis of patterns and trends, and hence also projections of future potential movements.

For these reasons, for the calibration and validation of the migration submodel in the extended SASI model a combination of data on international migration flows, national immigration and outmigration and national net migration will have to be used.

Migration Flows

In the absence of consistent data on interregional migration flows, data on international migration flows would be the second best solution for calibrating or validating a migration model. However, even information on migration flows between European countries is far from being complete. The New Cronos database (Eurostat, 2002b) contains information on annual migration flows between the EU member states and selected other European countries. However, many rows and columns of these migration matrices are not filled or are filled only for a few years.

This implies that migration flow data cannot be used to calibrate or validate the migration submodel. However, the total volume of immigration into and outmigration from a country predicted by the model can be compared with data on immigration and outmigration or, if even these are not available, with net migration data. The strategy to be followed in the calibration and validation of the extended SASI model is therefore to use data on immigration and outmigration or net migration to calibrate and validate the *volume* effect of migration on population development of the regions of a country and to use migration flows, as far they are available, to calibrate and validate the spatial *pattern* of migration.

Immigration, Outmigration and Net Migration

Eurostat in its European Social Demography statistics (Eurostat, 2002a) and the New Cronos database (Eurostat, 2002b) offer data on annual immigration, outmigration and net migration of EU member states and selected other central and east European countries.

Wherever possible, immigration and outmigration will be used for calibrating and validating the migration submodel of the extended SASI model. However, net migration data are more complete than data on immigration and outmigration. Figure 4.1 shows net migration rates for selected European countries between 1981 and 1999.

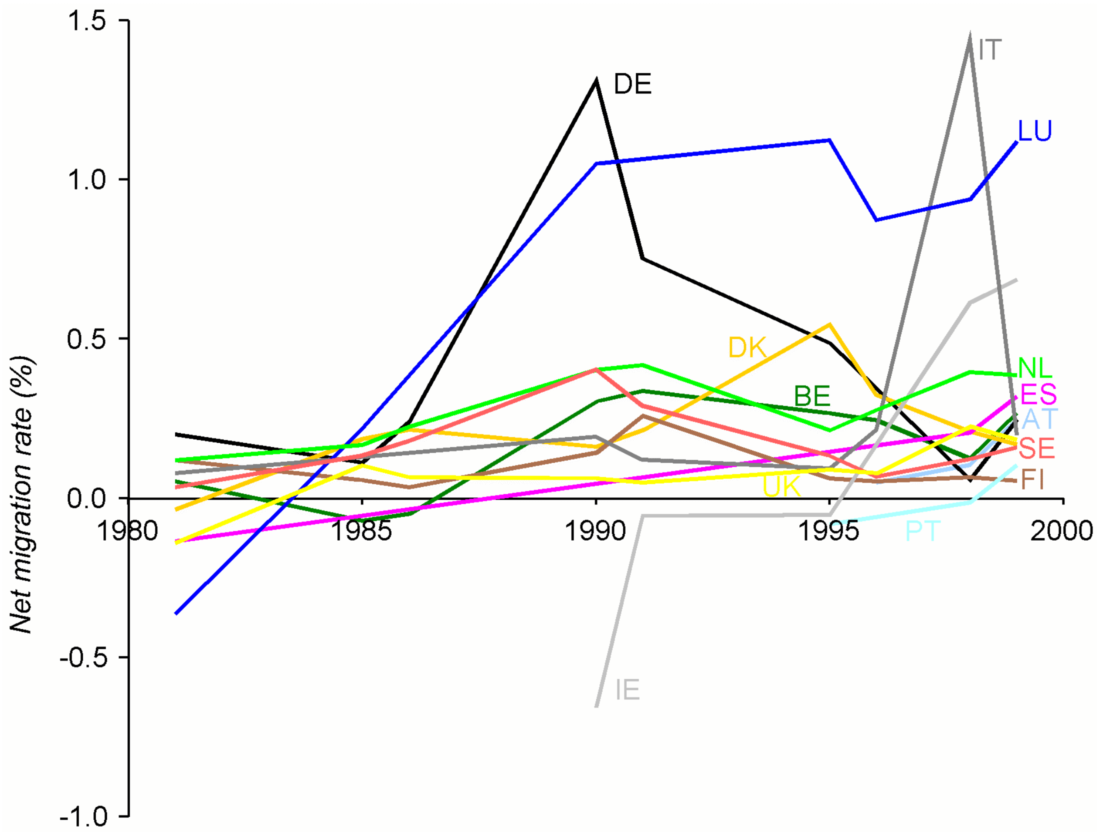

Figure 4.1. Net migration rates of European countries since 1981

For most countries, net migration rates remain more or less stable over time in a range well below half a percent per year, e.g. Austria, Belgium, Finland and Sweden. Other countries show increases of net migration due to increased immigration, e.g. Italy and the Netherlands (the sudden peak for Italy in 1998 is probably a data error). The United Kingdom, Spain, Luxembourg, Portugal and Ireland turned from outmigration countries to immigration countries during the 1980s and 1990s, with the largest changes in Luxembourg and Ireland reflecting the economic growth in these countries.

However, net migration in all these countries was low compared to net migration in Germany in the late 1980s and early 1990s. Because of the inflow of people from the former GDR and the former Soviet Union before and after the German unification, Germany experienced a massive wave of immigration. In 1990, Germany had a net gain of population through immigration of more than one million. Discounting the special situation before and after the unification of the two German states, net migration for Germany has since significantly decreased, mainly caused by tightened immigration and political asylum legislation.

For the candidate countries, the development of population and migration is of even greater importance than for the present EU member states. In times of economic transition and declining industrial production, unemployed people tend to move to more prosperous regions. In turn, the loss of human resources and shrinking market potentials might hinder further economic development. It is a serious issue for these countries whether the expected positive (spread) effects of gaining better access to European markets will outweigh the negative (backwash) effects after their accession.

Because of the radical change in the possibility to migrate after accession, past migration patterns have only limited value as predictor of future migration from the candidate countries. Figure 4.2 shows net migration rates for selected candidate and east European countries for the time period from 1980 to 2000.

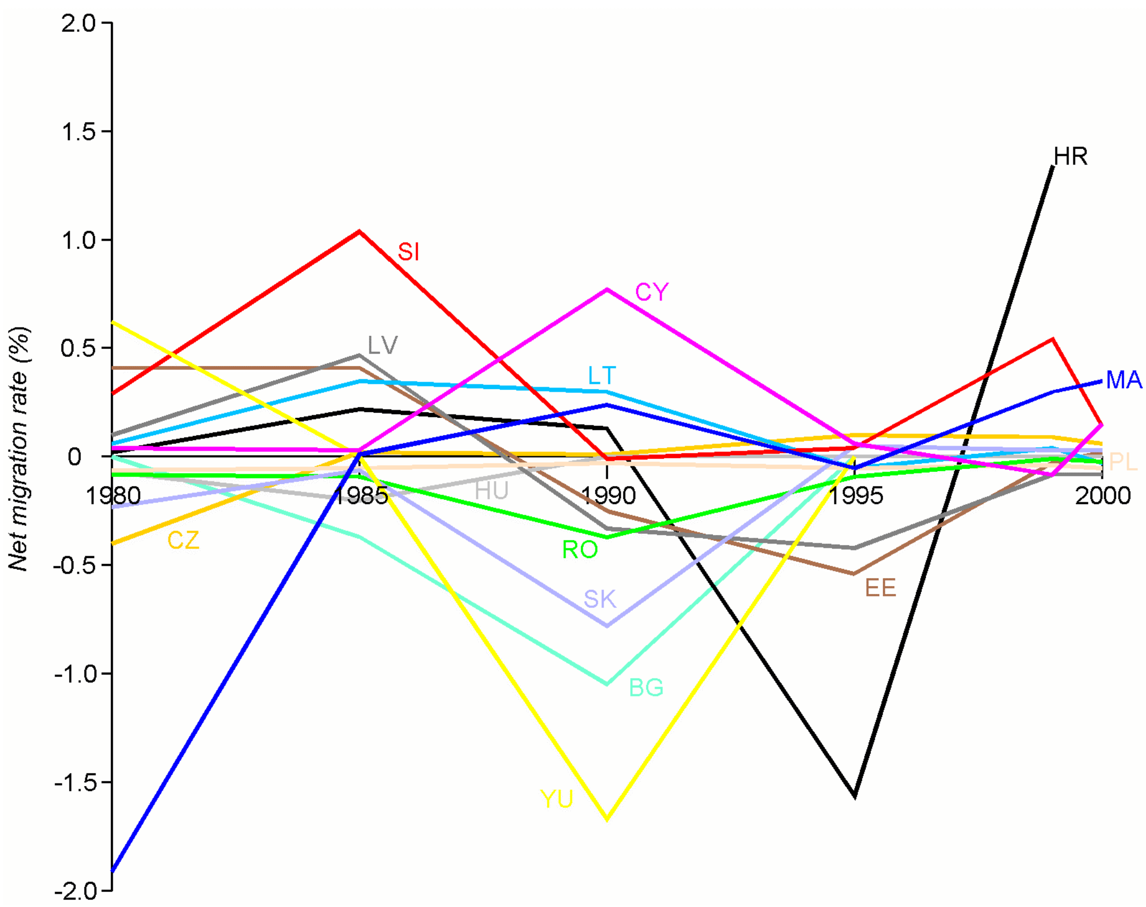

Figure 4.2. Net migration rates of central and east European countries (Eurostat, 2002a)

Three clusters of countries can be distinguished: countries experiencing population losses (Latvia, Lithuania and Poland), countries showing a more or less balanced situation (Bulgaria, Hungary and Rumania) and finally countries with positive net migration (Croatia, the Czech Republic, Estonia, Slovakia, Slovenia and Malta). Forecasts of net migration are not available for the candidate countries.

In the European Social Demography statistics (Eurostat, 2002a) an 'official' EU baseline projection of net migration of EU member states and Iceland, Liechtenstein, Norway and Switzerland in the period from 2000 to 2020 was published (see Table 4.4).

Table 4.4. Future net migration into EU countries in 1,000

Country	2000	2005	2010	2015	2020
Austria	17.3	13.0	14.7	16.5	18.2
Belgium	12.1	7.7	6.5	5.6	4.8
Germany	105.3	190.0	230.2	230.1	215.0
Denmark	10.1	13.9	16.9	18.0	18.0
Spain	20.8	35.0	35.0	35.0	35.0
Finland	2.4	4.0	4.0	4.0	4.0
France	55.0	50.0	50.0	50.0	50.0
Greece	23.9	23.3	25.0	25.0	25.0
Ireland	20.0	15.0	10.0	5.0	5.0
Italy	181.3	112.2	113.3	114.7	116.0
Luxembourg	3.6	2.5	2.5	2.5	2.5
Netherlands	53.1	45.9	40.3	36.4	33.5
Portugal	11.0	18.6	25.0	25.0	25.0
Sweden	24.4	12.0	12.0	12.0	12.0
United Kingdom	140.0	95.0	95.0	95.0	95.0
European Union	680.4	638.1	680.4	674.8	659.0
Iceland	1.8	0.0	0.0	0.0	0.0
Liechtenstein	0.2	0.1	0.1	0.1	0.1
Norway	9.7	10.0	10.0	10.0	10.0
Switzerland	25.7	10.0	11.3	5.7	4.0

Source: Eurostat, 2002, 129

The Eurostat scenario assumes a continuing trend in economic growth, but with only moderate creation of new jobs. Labour demand is expected to be too low to absorb additional foreigners, so migration regulations will continue to be strict. However, due to family reunification and migration pressure, immigration levels will decline only moderately. The scenario assumes that the restrictive immigration policies of the early 1990s will continue until 2005, counteracted only by increasing immigration to Germany, Denmark, Spain, Finland and Portugal. However, it also assumes that a further decline in immigration is unlikely, given the enlargement of the EU and continuing migration pressure from east and south European and Third-World countries, and that therefore net migration will again grow 2010 and remain relatively stable afterwards.

Beside this official EU forecast, net migration scenarios developed by De Jong and Visser (1997) were also explored. They presented not only a baseline scenario, in which observed developments are continued and which in most cases resembles national forecasts, but they included also a low and high scenario. The low and high scenarios describe possible alternatives, assuming a different economic and political context, affecting push and pull factors, in particular the need for workers and changes in migration policies. Table 4.5 shows the projections of net migration of the EU and the EU member states in the four scenarios:

Table 4.5. Future net migration projections in 1,000

Country		Low scenario			Baseline scenario			High scenario		
	1994	2000	2005	2010	2000	2005	2010	2000	2005	2010
Austria	13	10	12	15	15	19	23	26	30	30
Belgium	19	6	6	10	10	13	15	18	19	20
Germany	316	300	213	150	391	283	200	500	369	250
Denmark	11	6	5	5	11	105	10	16	16	15
Spain	24	5	23	40	31	46	60	57	72	80
Finland	4	-1	0	0	6	5	5	12	11	10
France	50	20	25	30	50	50	50	80	75	70
Greece	27	14	17	20	22	23	25	30	30	30
Ireland	-3	-10	-7	-5	-8	-5	-3	-3	-1	0
Italy	153	20	40	60	50	65	80	80	90	100
Luxembourg	4	2	1	1	3	2	2	4	4	3
Netherlands	20	10	15	20	33	34	35	57	53	50
Portugal	10	6	13	20	12	19	25	29	29	30
Sweden	51	6	7	10	15	18	20	32	30	30
UK	84	16	13	20	38	38	45	73	69	70
EU	784	411	382	396	680	714	592	1,010	897	788

Source: De Jong and Visser, 1997

The baseline scenario of De Jong and Visser uses the same assumptions as the Eurostat projections, but is based on older input data. However, the high scenario of De Jong and Visser is based on assumptions of higher economic growth, leading also to higher growth in labour demand. With increasing educational levels of EU citizens, imbalances in demand and supply of particularly low skilled labour cause a need for workers from outside the EU. This leads to more relaxed regulations on immigration, resulting in an increase of labour migration to the European Union, reinforced by family reunification and family formation.

The low scenario foresees economic stagnation in Europe. It assumes that high unemployment further deepens negative attitudes towards foreigners and leads to even tighter restrictions on immigration. The restrictive measures are assumed to be effective and to be accompanied by emigration of foreigners due to the unfavourable situation and negative public attitudes towards foreigners.

Because the extended SASI model makes it own forecasts of interregional migration, projections of net migration by country as the ones shown in Tables 4.4. and 4.5 are not used as control totals in the extended SASI model. However, projections of total net migration of the EU from these scenarios can be applied as control totals in the European Developments submodel of the extended SASI model (see Section 3.1.2).

For the base or reference or business-as usual scenario (see Section 3.2.6) it is planned to use the Eurostat baseline projection of total EU net migration from Table 4.4. However, if desired, alternative projections by De Jong and Visser (Table 4.5) can also be used for certain scenarios.

Immigration Limits

It can be assumed that international migration, in particular immigration from eastern Europe into the EU would be much greater without the increasingly strict immigration laws of the EU member states, and this protective legislation is likely to get more rigorous with the enlargement of the EU. It is therefore logical to introduce immigration limits imposed by individual countries as the upper limit of immigration permitted in the model.

In the extended SASI model it will therefore be possible to constrain the immigration to a particular country predicted by the model on the basis of its attractiveness as a place to live and work by an exogenous upper limit representing the effect of restrictive immigration laws. For the past it can be assumed that the net immigration observed in a country corresponds to the upper limit set at that time by its government. For future years, assumptions have to be made as to whether that particular country is like to reinforce or relax its restrictions on immigration.

5 Regional Data

Regional data are used by the two models to establish the base year situation in the model regions. Regional economic data include gross domestic product (GDP) and gross value added (GVA), employment and unemployment as well as interregional flows of commodities and passengers and, finally, regional transfers. Regional population data include population, educational attainment, labour force participation and attractiveness data, such as indicators of quality of life.

5.1 Economic Data

For the purpose of assessing the economic impacts of transport projects and policies, both models rely on information on the economic situation of each region. Whereas the CGEurope model requires information on the regional location of the sectors, which can be represented by the sectoral gross regional product, gross value added or employment, and information on interregional flows of commodities and passengers, the extended SASI model in addition needs data on unemployment and regional transfers.

The CGEurope model requires input data for the common benchmark year 1997 only, whereas the extended SASI model requires time-series data since 1981 (the SASI historical base year) until the common benchmark year 1997 (see Section 2.2).

5.1.1 GDP, GVA and Employment

Ideally, a spatial CGE model would require information for each sector in each region, all inputs by sector and region of origin. But, due to missing data, it would be impossible to establish this full SAM at the regional level. Therefore CGEurope assumes that production technologies of firms and household preferences do not depend on location, such that social accounting information is only required at the national level.[4] By restricting the number of parameters in this way it follows that information on the location of sectors on a regional scale is sufficient for calibrating the CGEurope model for the benchmark year.

Gross regional product, gross value added and employment by sector and region represent this kind of information. As sectoral data at the regional level is scarcely available, it was impossible to decide for one of these activity indicators. Hence the regional indicators were selected in the following way: wherever data were available for more than one indicator, gross regional product or gross value added was preferred to employment since the former two also

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[4] Other techniques for building a full SAM with missing entries would be the RAS or cross entropy approach. The RAS is the most mechanical technique for generating a new balanced matrix from an initial unbalanced matrix by means of a biproportional row and column approach (Stone et al. 1963; Bacharach, 1970). Another method presented by Byron (1978) takes into account different degrees of reliability of the initial estimates. The cross entropy approach proposed by Robinson et al. (2001) can be used in a deterministic and in a stochastic mode and represents a generalisation of the RAS method in the sense of allowing a wide range of additional prior information to be used in the estimation.

include productivity of each individual sector. Exceptions were made where the indicators differed from the benchmark year 1997. In this case sectoral shares were compared with the corresponding shares of the SAM on the national scale and that indicator was selected which best fits the national structure.

This procedure did not apply where data differed with respect to sectoral or regional disaggregation. In general a higher level of disaggregation was always preferred and the trade-off between sectoral and regional disaggregation of the available data was solved in favour of a more detailed sectoral classification.

Applying these rules to the available data resulted in the specification of six sectors according to NACE Rev.1 TA6 (see Section 2.3.4 for a definition of these sectors).[5] This sectoral classification can be used also for east European countries, where the available data would allow for only three sectors. Two exceptions were made: For Estonia financial intermediation, renting and business activities, wholesale, retail trade, transport and communication were included in one sector (corresponding to NACE Rev.1 sector G_K) and in Lithuania market services, repair, trade, lodging and catering services, transport and communication, services of credit and insurance institutions, other market services as well as non-market services make up one sector (corresponding to NACE Rev.1 sector G_P).

Despite the above methodology for selecting activity indicators, it was still impossible to use the same level of regional disaggregation for all countries given the degree of country and regional specificity of the data. Therefore a differentiation between three groups of countries was proposed in IASON Deliverable 2, Section 3.5: EU member states, other European countries and the rest of the world. Accordingly, for the CGEurope model regional data are required as a minimum at the NUTS-2 or NUTS-3 level for EU regions and at the NUTS-2 or the national level for other European regions.

Nevertheless, data availability allows for a more detailed regional disaggregation than the one proposed. Therefore, for both EU member countries and other European countries data were compiled either for NUTS-2 or NUTS-3 regions, except for those countries considered on the national scale in the system of regions of IASON.

EU Countries

For the European Union member countries data were taken from the New Cronos database of Eurostat (Eurostat, 2002b), although this database suffers from strong drawbacks. Data are not available for the benchmark year 1997; instead 1998 had to serve as a proxy. Also sectoral information is displayed only at the NUTS-2 level, for Germany and the United Kingdom only at the NUTS-1 level, and for Denmark only at the national (NUTS-0) level. Hence, supplementary databases mostly provided by national statistical offices had to be used. For Denmark and Germany data were extracted from the *Statistical Yearbook 1998* (Danmarks Statistik, 1998) and from the *Statistik Regional* CD-ROM. So far it could not be decided about the

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[5] In most of the countries sectoral data are compiled according to the NACE or NACE-CLIO classifications. Wherever any other international or national classification was used, the corresponding aggregations were made.

final database to be used for the United Kingdom. Publications like *Region in Figures* present data for NUTS-2 or NUTS-3 regions of England, but similar data for regions in Wales, Scotland and Northern Ireland are not published. *Regional Trends 36*, however, offers consistent data only at the NUTS-1 level. The final decision will be made as soon as possible depending on whether regional data are available for purchase from the UK National Statistical Office.

Regarding data for European Union member countries, it is still an option to expand the regional disaggregation by supplementary databases. Nonetheless, it is important to distinguish between desirability and feasibility. The existing information base and the time and resource constraints of Task 2.2 were key factors considered when deciding which data sources to use.

Candidate Countries

Eurostat's New Cronos database (Eurostat, 2002b) also provides information on candidate countries in east and south European countries, but most data are restricted to the national level.[6] Hence supplementary data had to be collected for central, east, and south European non-EU countries from national statistical offices and several publications like statistical yearbooks and special issues on regional statistics. The majority of this information is exclusively presented in native languages such that gathering data from these sources has been a very time-consuming task. Also data had to be scanned or typed for most countries.

Against expectations data were compiled for NUTS-2, NUTS-3 or even NUTS-4 regions as well as for other more detailed regional classifications. The latter information was aggregated to NUTS-3 regions in order to assure consistency with the system of regions of IASON.

Data are still missing for Bulgaria, Belarus and Ukraine. Regional information has neither been found on the respective web sites nor in statistical publications. So far there has been no response from the national statistical offices to the regional data request sent by letter as well as by e-mail. If data at the regional level are not available, these countries have to be considered at the national level.

Although information for all six sectors exists for the regions of Switzerland, some data are still missing and have to be purchased from the Swiss Federal Statistical Office. The corresponding data gaps will be eliminated when the data are available.

Table 5.1 gives an overview about the available information on sectoral activity by region. The fourth column headed by 'Code' represents the kind of activity indicator used, with 1, 2 and 3 indicating gross regional product, gross value added and employment, respectively:

[6] Since there is no agreement on the regional structure to be defined for Turkey, Malta and Cyprus, the NEW CRONOS database only covers the remaining ten candidate countries. Nevertheless regional data are still missing for Bulgaria, Estonia, Lithuania, Latvia, Romania and Slovenia.

Table 5.1. Data availability of economic activity indicators

Country	NUTS level	No. of sectors	Code	Year	Source
Austria	2	6	2	1998	Eurostat
Belgium	2	6	2	1998	Eurostat
Denmark	3	6	3	1997	Statistical Yearbook 1998
Finland	2	6	2	1998	Eurostat
France	2	6	2	1998	Eurostat
Germany	3	6	3	1997	Statistik Regional, 1999
Greece	2	6	2	1998	Eurostat
Ireland	2	6	2	1998	Eurostat
Italy	2	6	2	1998	Eurostat
Luxembourg	0	6	2	1998	Eurostat
Netherlands	2	6	2	1998	Eurostat
Portugal	2	6	2	1998	Eurostat
Spain	2	6	2	1998	Eurostat
Sweden	2	6	2	1998	Eurostat
United Kingdom	2	5	1	1997	
Bulgaria					
Cyprus	0	6		1997	
Czech Republic	3	6	2	1997	National Statistical Office
Estonia	3	5	2	1997	National Statistical Office
Hungary	3	6	3	1997	Regional Statistical Yearbook, 1998
Latvia	3	6	3	1998	Statistical Yearbook 1998
Lithuania	3	4	3	1998	Department of Statistics
Malta	0	6		1997	
Poland	2=3	6	2	1998	Eurostat
Romania	3	6	3	1997	Territorial Statistics/Statistical Yearbook 1998
Slovakia	2	6	2	1998	Eurostat
Slovenia	3	6	2	1997	Statistical Yearbook 1998
Liechtenstein	0	6		1997	
Norway	3	6	3	1997	National Statistical Office
Switzerland	3	6		1997	
Albania	0	6		1997	
Belarus					
Bosnia & Herzegowina	0	6		1997	
Croatia	0	6		1997	
Iceland	0	6		1997	
Macedonia	0	6		1997	
Moldova	0	6		1997	
Russia	3	6	3	1998	Regions of Russia
Turkey	0	6		1997	
Ukraine					
Yugoslavia	0	6		1997	
Rest of world	0	6		1997	

- *Gross Regional Product*. Ideally sectoral output data should be collected for the CGEurope model. Estimates of gross regional product could be based on regional accounts by activity tables.[7] However, since activity detail is only provided at fairly aggregate levels, e.g. for three sectors (agriculture, services and industry), other kinds of activity indicator are used.

- *Gross Value Added*. Value added at market prices enters the database as the amount by which the value of the outputs produced exceeds the value of the intermediate inputs consumed. In the New Cronos database of Eurostat (2002b), gross value added is compiled for six sectors according to NACE Rev.1 TA6 covering all European Union member countries as well as some candidate countries of central, eastern and southern Europe (see above). It is worth mentioning that usually gross value added figures are provided without correction for 'financial intermediation services indirectly measured' (FISIM). Consequently total gross value added is less than the sum of gross value added for each of the six sectors, since the sector-specific gross value added series also contains the output of bank services. In order to avoid double counting, the difference between the sum and total value added being equivalent to FISIM was subtracted from all sectors proportionately to their respective share on regional gross value added. Currently the European System of National Accounts does not call for indicating FISIM by sector, such that the above methodology presents the only solution possible to overcome double counting.

- *Employment*. In most of the statistical sources, employment is measured as the number of persons on the payrolls in the respective industries. In the IASON Common Spatial Database, employment data would preferably be converted to a 'full-time equivalent' (FTE) basis, in which part-time workers are counted according to the time worked (e.g., two workers on half-time schedules count the same as one full-time worker). Although FTE employment may provide a better measure for assessment of spatial economic impacts of transport projects and policies purposes, this measure is not as widely available as number of employees and is difficult to implement consistently. For these reasons, the employment variable in the common database is the number of persons employed in the benchmark year. The number is chosen representative of the benchmark year 1997 in the absence of strong seasonal and other fluctuations in employment and should be measured at a point in time (the end of the year), following national practices. For some countries data on employment has been available only for 1998, which is indicated in Table 5.1.

Time Series Data: Regional GDP

The extended SASI model requires time-series data of regional GDP for the period 1981 to 1997. These data were extracted from Eurostat's New Cronos Database (Eurostat, 2002b) for the years 1981, 1986 and 1991 at the NUTS-3 level.

[7] CGEurope requires nominal gross regional product, e.g. data should be expressed at current prices. If gross regional product is compiled at constant prices, the corresponding deflator is not allowed to vary over regions. Usually it is also assumed that there are no purchasing power disparities between the regions within individual countries or that such discrepancies are negligible. This methodology is also followed by Eurostat (see European Commission, 2001b).

However, regional GDP was not differentiated by sector, and several data gaps had to be filled. Data for the New German Länder, for Austria and Ireland were missing for 1981 and 1986; data for France and Sweden were lacking for 1981, data for the UK for all years were available only at the national level. Besides these gaps, for some countries data were available only at the NUTS-2 level (Italy for all years, the Netherlands for 1981, Portugal for 1981 and 1986). Therefore, disaggregation, interpolation and extrapolation techniques had to be used to fill these gaps.

Es expected, the data situation in the east European countries is even more problematic (Korcelli and Komornicki, 2002b):

- GDP data which are comparable with GDP data in west European countries are in general only available for the years after the economic transition of these countries, i.e. after the mid-1990s, and in many cases with severe limitations: in Bulgaria only for six regions, in the Czech Republic and Lithuania without sectoral subdivision and in Latvia, Slovenia, Bosnia and Herzogovina and Croatia only for the whole country.

- GDP data for earlier years are only available for Poland (since 1992, but for an older regional subdivision than the one used in IASON) and for Russia (since 1994). However, the comparability of these GDP data with GDP data for west European countries is necessarily doubtful because of the economic transition in these countries..

Therefore, substantial work will still be necessary to estimate missing data for the east European countries and to "construct" GDP figures for the time before the economic transition in eastern Europe for the backcasting exercise in the extended SASI model.

Figure 5.1 shows GDP per capita (in Euro) by NUTS-3 region in the EU and selected candidate and east European countries in 1996.

The most striking phenomenon expressed by the map is the huge gap in affluence between the current EU member states and the candidate countries. On average, the GDP per capita in the east European countries was lower than in the most lagging regions in the EU, one tenth of the EU average and less than five percent of the GDP per capita of the most affluent metropolitan regions in the EU.

However, there are also large differences in GDP per capita between regions in the EU: There is a clear north-south gradient with significantly lower GDP per capita in the Mediterranean countries Portugal, Spain, southern Italy and Greece. There is also the east-west divide between the New German Länder and former West Germany. There are peripheral regions in north-western Ireland and Scotland, which clearly suffer from their peripheral location. However, the Nordic countries Norway, Sweden and Finland show much higher GDP per capita than their remote location would suggest.

In addition, there is a clear distinction between the highest GDP per capita in metropolitan areas and significantly lower GDP per capita of rural regions. However, part of the this apparent difference in affluence is due to the effect of commuting, i.e. to the fact that the people who produce the GDP in the large cities are counted as population in the surrounding suburban and periurban hinterlands.

Time Series Data: Employment

The extended SASI model requires also time-series of regional employment by sector from 1981 to 1997 for model calibration and validation. In the model, employment by sector is derived from regional GDP and regional productivity forecasts. Employment by sector represents the demand side of regional labour markets.

Eurostat's New Cronos Database (Eurostat, 2002b) provides data on employed persons by sector (agriculture, industry, services), full/part time and sex at NUTS-2 level for EU member states and the candidate countries. Unfortunately, this dataset is incomplete:

- Data for the EU member states are almost complete, yet show a number of gaps, particularly for the years 1981, 1982 and 1983, for the New German Länder, Austria, Finland and Sweden. The data gaps at the NUTS-2 level were filled using interpolation and extrapolation techniques. The GDP shares of NUTS-3 regions were used to further disaggregate NUTS-2 employment to NUTS-3 regions.

- Like regional GDP data, regional employment data for the east European countries are in general available only from the mid-1990s onward. (Korcelli and Komornicki, 2002b). There are also similar limitations: Employment data are available only for three main sectors in Lithuania and Slovakia and only for the whole country in Slovenia, Albania, Macedonia and Moldova. Again earlier data are only available for Poland (since 1981, but for the years 1981-1998 with an older regional subdivision than the one used in IASON) and Russia (since 1992).

So, like with regional GDP time-series data, regional employment time-series data will still require substantial estimation work before a consistent dataset will be available.

5.1.2 Unemployment

Data on regional unemployment for NUTS-3 regions were taken from Eurostat's Regio database (Eurostat, 2002b). The database provides harmonised numbers of unemployed persons and unemployment rates based on the results of the European Union Labour Force Survey. With the exception of Greece, the numbers were updated according to the trend of the number of persons registered at unemployment offices. Regional unemployment rates were calculated by dividing the estimated unemployed persons by the economically active population.

The definition used for unemployed persons was changed in 1983 and in 1992:

- Until 1983, the unemployed included people without work looking for paid work.

- From 1983 onwards, the definition conforms to the International Labour Office (ILO) recommendations. For the series between 1983 and 1991 the definition used for the unemployed was: "Unemployed persons are those who, during the reference period of the interview, were aged 14 years or over, without work, have made serious efforts to find job and who were immediately available for work".

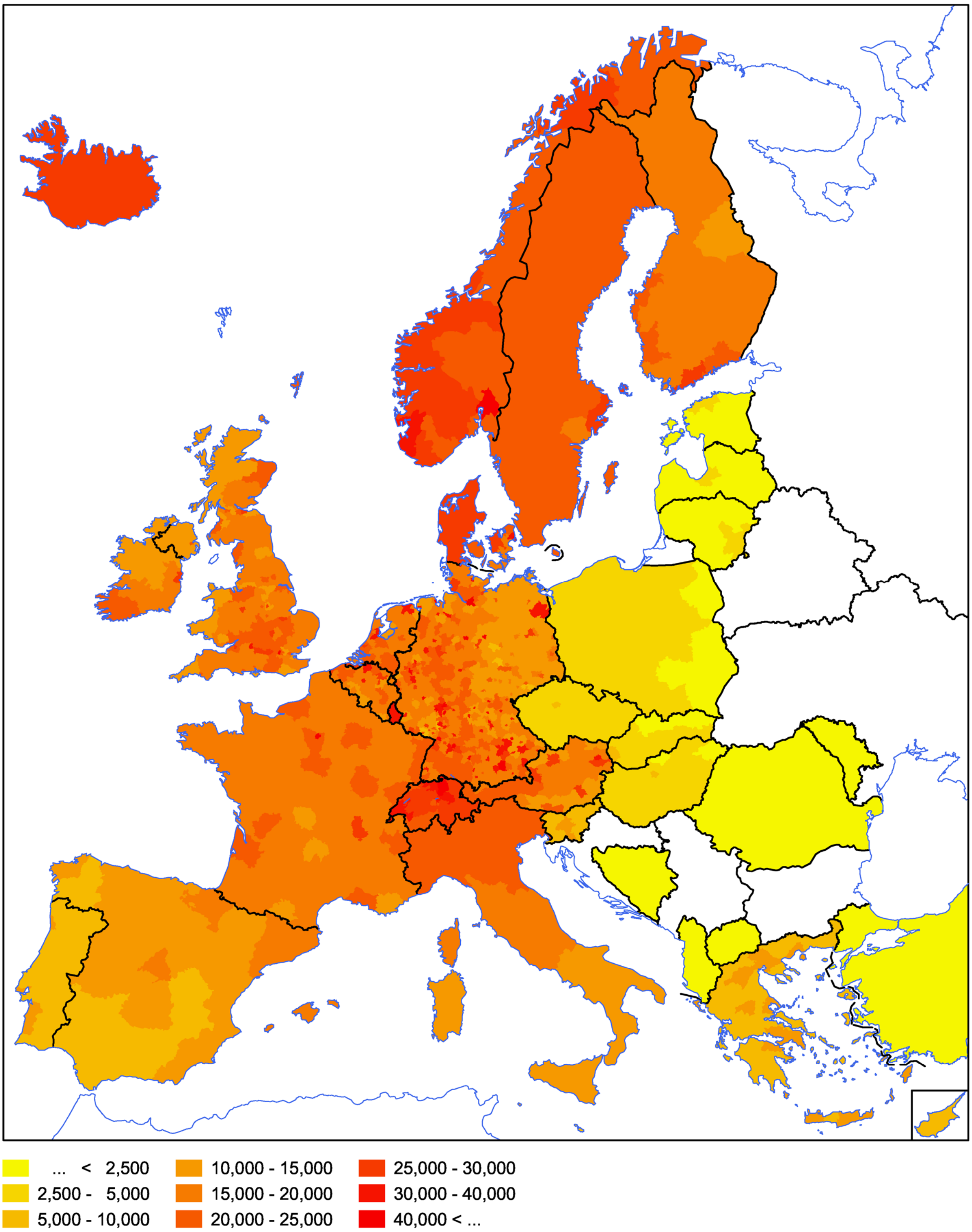

Figure 5.1 GDP per capita (in Euro) in the EU and candidate countries, 1996

- From 1992 onwards the definition was revised as follows: "Unemployed persons are those who, during the reference period of the interview, were aged 15 years or over, without work, available for work within the next two weeks and had used an active method of seeking work at some time during the previous four weeks".

For the EU countries, harmonised unemployment data cover the years from 1983 onwards. For the extended SASI model, unemployment figures (unemployed persons and unemployment rates) were collected for the years 1983, 1986, 1991 and 1996. Data for Austria are missing for all years, data for Finland up to 1989 and data for Sweden up to 1990. Data for the New German Länder became first available at the NUTS-1 level in 1991. All other EU countries have complete unemployment data at the national level from 1983 onwards. At the regional level Greece and the Netherlands have no data until 1988, and Portugal until 1986. These gaps were filled using disaggregation, interpolation and extrapolation techniques.

Unemployment data for the candidate countries are available from the New Cronos database (Eurostat, 2002b) at the national level only from 1995 onwards. Regional unemployment data are only available for Hungary for 1997. Data for Bulgaria, Cyprus, Latvia, Lithuania, Malta and Slovakia are altogether missing in the New Cronos database. However, for Bulgaria, Latvia, Lithuania and Slovakia, regional unemployment data can be retrieved from national statistical sources (Korcelli and Komornicki, 2002b). For Estonia and Lithuania, time-serie data are available from 1993, for Poland, since 1990 (however, until 1998 for an older regional subdivision than the one used in IASON) and for Russia since 1985.

Figure 5.2 shows unemployment rates in the EU and the candidate countries by NUTS-2 region in 1999. It can be seen that some EU countries have been more successful in fighting unemployment than others: the lowest levels of unemployment are found in the Netherlands, the south of England and parts of Austria and northern Italy followed by regions in north-western and central Europe. There are areas of very high unemployment in southern Spain and southern Italy corresponding with the low GDP per capita in these regions (cf. Figure 5.1), whereas the low unemployment rates in Portugal contrast with the low GDP per capita in that country. The New German Länder have much higher unemployment than western Germany – an indication that the adjustment of their economy takes longer than expected. Similar levels of unemployment are found in the candidate countries, which are in different stages of the transition from planned to market economies.

5.1.3 Interregional Flows

Information on interregional flows is indispensable for the empirical implementation of the enhanced CGEurope model to. In the CGEurope model, not only effects of transport cost changes for goods and services, but also for private long distance travel, which could also include interregional travel within a country, will be evaluated. Hence data on interregional commodity flows as well as on interregional passenger flows are required, if possible by region of origin and region of destination.[8] Data on interregional commodity and travel flows are not necessary for the extended SASI model.

[8] It is worth mentioning that, unlike engineering models of travel flows, CGEurope measures real flows not in tons, but as values in constant benchmark-year prices.

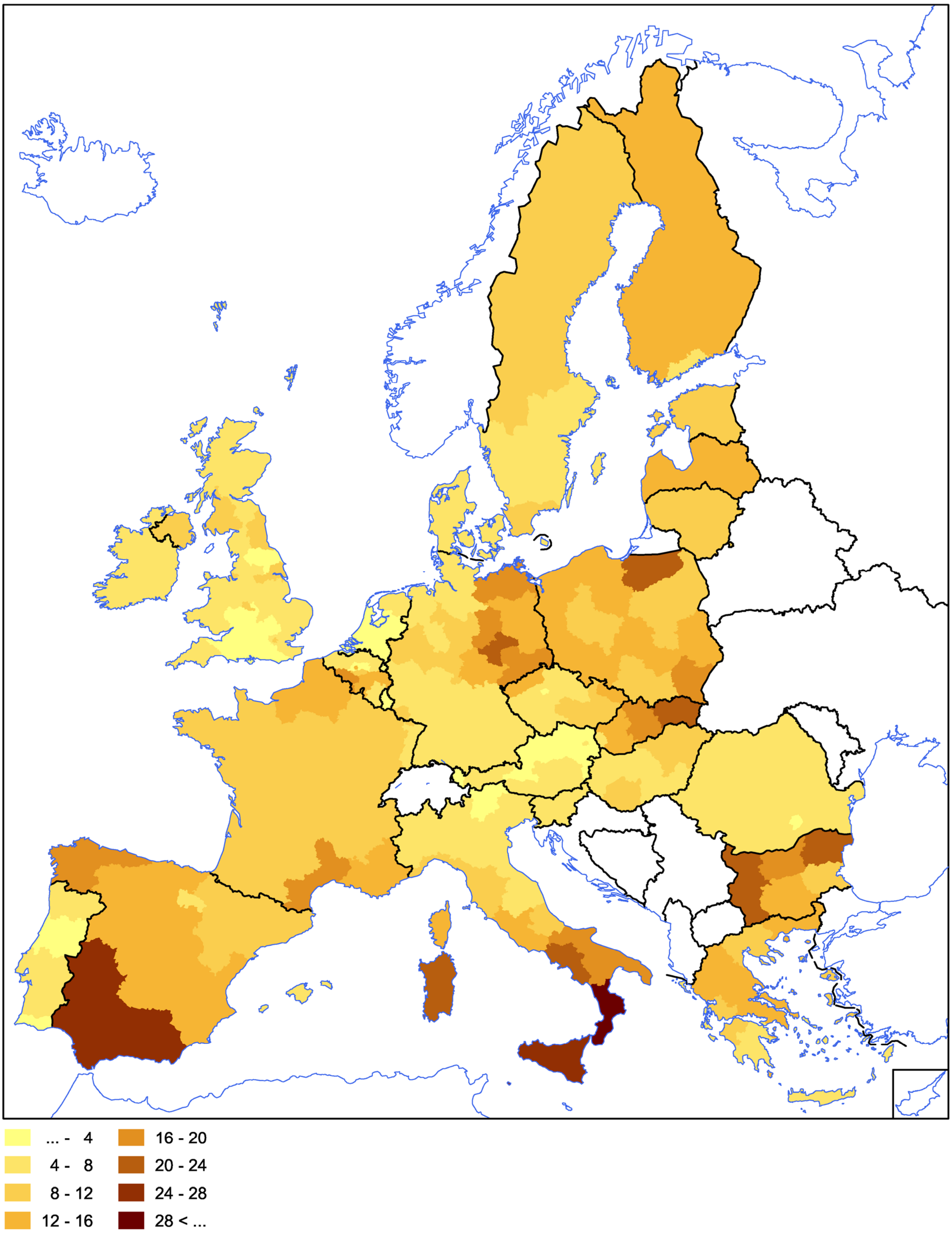

Figure 5.2. Unemployment rates (%) in EU and candidate countries, 1999

Commodity Flows

Ideally, input-output studies require original or derived full information about monetary flows between each agent (firm or household) in each region in the benchmark year. This covers trade by sector between firms, trade between firms and households, factor expenditures flowing from firms to households and interregional capital flows. However, it was impossible to obtain a full database at a sub-national (NUTS-2) level. Hence, a different approach was developed combining information on the distribution of sectoral output by region with national and international information on national accounts and international trade. If identical preferences and technology for different regions within one nation are assumed, national information is sufficient for calibrating the technology parameters, e.g. the scale parameter of the transport function, as well as the price mark-up-factor (for a full technical description see Bröcker, 1995; 1998a and 1998b).

Although interregional trade at a sub-national level is not observed, it can be derived from the calibrated equilibrium solution based on the above described methodology. The essential hypothesis in this context is that customers of traded goods substitute between varieties stemming from different regions, taking prices and interregional transaction costs into account. These transaction costs also include international trade impediments (cross-border effects), which are indirectly quantified by adjusting estimated trade flows to the international totals available from international trade statistics (see Section 4.1.3.). There are two different ways for estimating interregional flows through calibration using national and international data.

In one approach the scale parameter of the transport cost function is calibrated using an independent estimate of the transport cost intensity. Estimates of transport costs and logistic costs, of which transport costs are a subset, can in fact be found in the literature. In a review of Weber (1987) logistics costs as a share of sales value vary between 12 percent and 22 percent, averaged over manufacturing industries. Mere transport costs, however, are close to 5 percent of sales value. Logistics costs include several components which are not related to distance and therefore should not be included in our estimate. On the other hand, our notion of distance costs includes components like costs of transferring information, which are clearly related to distance and not included in transport cost. Hence, distance cost intensity is probably in the order of 5 to 10 percent in manufacturing. More empirical information on this issue will come from the other project partners and from the SCENES database and is subject of Task 2.3.

Another independent information for the calibration of interregional commodity flows is revealed by empirical studies on monopolistic price mark-ups, making use of the Amoroso-Robinson relation (for more technical details see Bröcker 1995; 1998a).

Travel Demand and Passenger Flows

In IASON the previous version of CGEurope is extended by considering private passenger travel in addition to interregional trade described above. Therefore a new approach has been developed to model passenger travel behaviour in a microeconomic framework that is consistently integrated into the general equilibrium context. Accordingly households simultaneously decide about goods consumption and passenger travel depending on goods prices, monetary and time costs of passenger travel and income by maximising their utility. Obviously time costs are an important determinant of travel behaviour and the change of time costs is an essential element of households' welfare.[9]

In the new version of CGEurope travel preferences are specified in a way that observed dispersed travel behaviour can realistically be reproduced and that the parameters can be calibrated with minimum data availability. Travel demand is differentiated by purpose of travel and destination, such that information on interregional travel flows in quantity terms differentiated by kind of travel activity is required.

Since travel demand information is scarcely available at the sub-national level, an obvious alternative is to use data compiled in the SCENES project. Although these data are entirely generated by the model, they offer a consistent information set across the considered countries and regions for 1995. In addition, the output of the SCENES model incorporates interesting features useful for the CGEurope model: (i) information is provided at the NUTS-2 level for nearly all countries of the system of regions of IASON; (ii) data are differentiated by both kind of travel activity and mode used for travelling; (iii) additional variables like time travelled, travel costs as well as modal share are compiled in a consistent way.[10]

- *Regional coverage of the SCENES data*

  The SCENES project builds upon the strategic transport model developed in STREAMS. In SCENES the passenger module of the STREAMS model was extended with respect to regional coverage by including the central and east European countries in addition to the European Union member countries. Hence, data are available for all countries of the system of regions of IASON with the exception of Cyprus, Malta and Liechtenstein. In contrast to the IASON system of regions, which is subdivided into NUTS-3 regions, SCENES data is provided at the NUTS-2 level for nearly all countries. Exceptions are Ukraine, Romania, Bulgaria and Belarus for which information is only available on the national scale. In addition Switzerland is only divided into the two regions 'East' and 'West', and for Russia only Moscow and St. Petersburg are considered. However, because travel demand information is scarcely available at the sub-national level, the SCENES data will be employed by the CGEurope model, regardless of the differences between the regional systems of IASON and SCENES. In SCENES passenger travel flows are modelled on an origin-destination basis, i.e. travel flows are identified by the region of origin and the region of destination. This matrix-type data is available for travel within the European Union member countries, between the European Union member countries and the central and east European countries and so-called external countries, which are aggregated to the following four regions: (i) West Africa and America, (ii) East Africa, Asia and Australia, (iii) Egypt and the Middle East and (iv) Morocco, Algeria, Tunisia and Libya. Passenger travel within the central and east European countries, between these countries and the external regions as well as travel within the external regions are not modelled.

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[9] Of course, households gain utility from a set of activities connected with travel, like tourism etc., and suffer from disutility for spending travel time.

[10] For a more detailed description of the SCENES data availability as well as for technical details of the transport and passenger travel demand model see SCENES (1999; 2000; 2001).

- Travel purposes and passenger modes

In SCENES travel demand is modelled in four different stages, taking as a starting point observed key factors as well as original trip purposes, such as commuting, business, education, shopping, personal business, sport and entertainment, visiting friends or relatives, day trips and holidays. Key factors like age, employment and car ownership are combined into twenty different population groups. Trip purposes are differentiated by short and long distances resulting in ten different kinds of purposes. Instead of distributing the generated trips over the 200 possible travel group combinations, these are aggregated to 24 so-called 'travel groups'. The resulting output of the travel demand model is a matrix of trips per annum expressed in terms of these travel groups. Further aggregations and transformations finally give a matrix of the number of trips per day expressed in terms of fifteen different kinds of passenger flows. These trips are used in the transport model which assigns the modes used in each trip and calculates additional variables associated with a particular origin-destination relation, such as modal share, generalised costs (in Euro of 1995 per trip), distance (in km) as well as the time travelled (in hours). Passenger travel flows are presented on an origin-destination basis differentiated by kind of travel activity and mode. Tables 5.3. and 5.4. show the travel purposes and the passenger modes, respectively.

Table 5.3. SCENES passenger flow codes

No.	Code	Passenger flow name
11	c&b s nc	Commuting and business - short no car
12	c&b s pc	Commuting and business - short part car
13	c&b s fc	Commuting and business - short full car
14	ch pbe S	Children - shopping, personal business, education - short
15	ad pbe nc	Adult - shopping, personal business, education & visits - short no car
16	ad pbev c	Adult - shopping, personal business, education & visits - short 1 car
17	ad pbev 2c	Adult - shopping, personal business, education & visits - short 2 car
18	vistent pc	Visit friends, day trip long - no car
19	vistent c	Visit friends, day trip long - car
20	business L	Business L passenger !
21	busi_in L	International business (1+ night)
22	int_hol nc	International holidays - no car availability
23	int_hol ot	International holidays - partial and full car availability
24	dom_hol nc	Domestic holidays - no car availability
25	dom_hol ot	Domestic holidays - partial and full car availability

Table 5.4. SCENES passenger modes

No.	Passenger mode name
1	Car
2	Coach
3	Ordinary train
4	High-speed train
5	Business air
11	Slow
12	Business car
13	International train
16	Chartered air travel
17	Independent air travel

5.1.4 Regional Transfers

In published statistics, subsidies and transfer payments are categorised according to donor institutions (European Union, member states etc.). The only exceptions are the agricultural subsidies which are integrated into one category irrespective of the funding source. The following sections describe the categories as provided by the statistics and their assignment to either the 'subsidies' or 'transfer payments' type (see Section 3.1.3)..

National Transfer Payments

At the national and regional levels, there is a broad variety of vertical and horizontal monetary flows targeted at stimulating economic growth and technological innovation. Already in 1980 the expenditure of member states for business investment incentives amounted to some € 5.1 billion and exceeded € 7 billion by the year 1983 (Yuill et al., 1990). Subsidies with a clearly regional framework account for only 25 percent of all economic aid regimes to the productive sector within the member states. For the purpose of the extended SASI model, all public and private expenditures on sectoral and individual business assistance (business rescue programmes, loans, tax breaks and all other incentives) are excluded from consideration because of the intractable nature of modelling general monetary flows in a region. In this context, only funds that are solely earmarked for regional purposes by public authorities are included.

One of the few data sources on national transfer payments is provided in the European Commission's Fifth Report on Regional Cohesion and Competitiveness (European Commission, 1994). It contains per-capita expenditure in subsidised regions and the percentage of subsidised population by member state. However, the information is not sufficient to allocate the national totals to subsidised regions at the NUTS-3 level. A second data source is provided in the 1996 Cohesion Report (European Commission, 1996) in the form of a map showing the distribution and intensity of national transfer payments. Neither of the two sources provides regional data on national subsidies suitable for the extended SASI model.

However, by combining both the data on national totals and the spatial categorisation, it was possible to assign values for national subsidy payments to the IASON regions. The process is divided into the following steps:

(1) Calculate national total subsidies from per-capita subsidies in subsidised regions, percentage of subsidised population and population data.

(2) Assign distribution keys to regions using the map categories. As only positive monetary flows into regions are considered for the extended SASI model, regions with a negative balance are assigned to the category 'no subsidies'. For a second category of regions, it is assumed that these regions receive 30 percent of the average national per-capita subsidies, the third category receives 70 percent and the fourth 130 percent.

(3) Calculate weighted regional subsidised population by multiplying the population in the subsidised regions with the regional distribution keys.

(4) Distribute subsidies in Euro of 1997 to the regions for the years 1981, 1986, 1991 and 1996 in proportion to weighted regional subsidised population.

(5) Calculate per-capita subsidies in subsidised regions.

As a result of these calculations, a database for all regions is available containing data on national subsidies for the years 1981 to 1996.

Regional subsidies by member states vary greatly across countries. Even though national transfers are not comparable at the European level, since they are based on considerations within national systems, it becomes clear that subsidies are highest in countries with geographically strongly polarised economies (Germany, Italy, Spain etc.).

The method used to forecast national subsidies was mainly based on an extrapolation of previous trends, since subsidisation patterns remained relatively constant over the observed period (1981-1996). Additionally, impending policy changes were taken into account. In general, national policies will increasingly adopt the strategic guidelines the European Union has set up for the Structural Funds. The following assumptions reflect the most likely development of national transfer payments until the year 2021:

- In the foreseeable future, member states will not cease to pursue their individual regional policy agendas. Nevertheless, as national policies will be tied more closely to EU policies and standards, a slight general decrease in national transfer payments can be assumed.

- Equivalently to EU policies, member states will increasingly abandon a categorisation of subsidised regions by the 'watering-can principle' (Santer, 1998). Most member states will focus the flow of subsidies on regions in genuine need, whereas the volume of subsidies for regions with less grave economic problems is likely to diminish in the future. In terms of the categorisation of regions used above, this can be reflected by a reduction of regions in the '30-percent' and '70-percent' categories in most countries.

- EU guidelines require national institutions to align criteria for national subsidisation with EU standards. The definition of 'lagging' and 'leading' regions is therefore likely to refer to European rather than national standards, which implies that the nationally subsidised regions will be identical with the regions supported by the European Union (see below). In some cases, however, deviations from the European territorial definition will remain due to specific national policy considerations.

- Thanks to extensive regional support policies, the new German Länder received € 92.5 billion of incentives and subsidies in 1998, of which about € 8 billion were subsidies in the narrower definition used here. It can be assumed that the current high level of subsidisation will not be maintained in the future because some of the support programmes are due to be phased out in the near future. A reduction of funds to 50 percent of the present volume within ten years seems to be a realistic forecast.

Based on these assumptions, national subsidies were predicted for each region so that a complete database on national subsidies from 1981 to 2016 is available.

European Union Structural Funds

There are great disparities in economic performance between the regions in the European Union. One of the main political objectives of the European Union is the economic development of regions which are lagging behind the average economic development of the Union.

This is done by the EU Structural Funds. Today in some regions the magnitude of the structural expenditures by the EU is in the same range as the increase of the economy as such. Therefore transfer payments to assist specific regions are included in the extended SASI model.

Data on the expenditures of the Structural Funds are provided in the Annex of European Commission (1997) for the EU member states for the two past funding periods. These periods covered the years 1989-1993 (first phase) and 1994-1999 (second phase), respectively. Data on the expenditures for the current funding period 2000-2006 are provided in European Commission (1999) and at the Inforegio website (European Commission, 2002a; 2002b). However, because the regions in these reports are NUTS-2 regions not equivalent to the NUTS-3 regions used in IASON, several transformations had to be made (break down of expenditures from NUTS-2 to NUTS-3 level using population shares). For the two terminated funding periods, transfer payments serving the following policy objectives are differentiated:

- Objective 1: Economic development of regions whose development is lagging behind
- Objective 2: Economic conversion of declining industrial areas
- Objectives 3 and 4: Support for youth unemployment and long-time unemployment
- Objective 5a: Economic adjustment of the agricultural sector and the fishing industry
- Objective 5b: Economic diversification of rural areas
- Objective 6: Development of sparsely populated regions in Sweden and Finland

Objective 6 was introduced with the entry of Sweden and Finland to the European Union. So this objective was not included in the first funding period 1989-1993.

Besides assistance by objectives, there have been attempts to assist specific regions: The Integrated Mediterranean Programme (IMP) was the precursor for the objective funding system before 1989. Because there has still been money spent from that programme at the beginning of the first funding period, it has to be considered. Objectives 1, 2, 5b, 6 and the Integrated Mediterranean Programme are determined spatially, while the other objectives are not limited to certain means within the countries. The Cohesion Fund is exclusively targeted to Greece, Spain, Ireland and Portugal, but is not further spatially determined to regions.

The total expenditures per region are calculated as the total over all objectives, Community Initiatives, the Cohesion Fund and the IMP. Because the source contains data for the whole funding periods, the yearly amount is calculated by dividing the totals by the number of years. All these totals are broken down to NUTS-3 regions. In case there was no regional differentiation available, in particular for Objectives 3, 4, and 5a, the funds were allocated to the regions in proportion to regional population.

Figure 5.3 shows total public expenditures per capita per year in Euro by NUTS-3 region in 1996. Portugal, Ireland and Greece received the highest level of transfer payments with more than € 200 per capita per year. Some regions in the north of Spain as well as the Highlands in Scotland show a similar level. Other regions in central Europe and in the United Kingdom received less than € 60 per capita per year, with the exception of the New German Länder, which received between € 120 and € 200.

The transfer payments received by a region have to be seen in relation to total regional per-capita GDP. In the funding period 1989-1993, transfer payments represented 0.02 percent of total GDP in Hamburg, whereas they amounted to 6.23 percent in Alentejo. The average share over all regions was about 0.6 percent. In the funding period 1994-1999 the smallest share was observed for Luxembourg with 0.03 percent, whereas again Alentejo showed the greatest share with 12.07 percent. The average share increased to about 1.0 percent.

Current Funding Period (2000-2006)

In the context of the integration of east European countries and in anticipation of new member states of the EU, the European Commission decided to reform the system of Structural Funds in the Agenda 2000 (European Commission, 1999c). The propositions made there are the basis for the development of the Structural Funds until 2006. According to the Agenda 2000, the number of objectives is reduced to three:

- The new Objective 1 (Development of regions whose development is lagging behind) is proposed to cover the old Objectives 1 and 6.
- The new Objective 2 (Economic and social conversion of regions in structural crisis) is to cover the old Objectives 2 and 5b.
- The new Objective 3 (Development of human resources) is proposed to cover the old Objectives 3 and 4.

This concentration of programmes aims at raising the effectiveness of the Structural Funds. The Agenda 2000 does not contain any regional differentiation of funds, but proposes detailed criteria for the distribution and for the definition of assisted regions.

Regions eligible under Objective 1 are NUTS-2 regions whose per-capita GDP (measured in PPS) is less than 75 percent of the Community average (see Figure 5.4). Additionally, the overseas French, Spanish and Portuguese regions plus regions eligible under Objective 6 in the previous funding period are also automatically under the new Objective 1. A list of NUTS-2 regions eligible under Objective 1 was published in 1999 (European Communities, 1999a). Corresponding eligible NUTS-3 regions were identified in conjunction with detailed maps produced by the Commission (European Commission, 2002a). Regional expenditures for the NUTS-3 regions are then estimated as the product of the percent shares of populations of the total national population multiplied by the overall funds allocated to the corresponding member state derived from Europäische Kommission (1999).

Funds for those regions in transition still eligible under Objective 1 in the current funding period which do not meet the criteria for the new Objective 1 are phased out with declining amounts of money until 2005. According to European Commission (1999b), the following regions receive transitional support: Hainaut (Belgium), Ostberlin (Germany), Cantabria (Spain), Corse and Arronsissements Valenciennes, Douai and Avesnes in France, Molise (Italy), Southern and Eastern regions in Ireland, Flevoland (Netherlands), Lisboa and Vale do Tejo in Portugal and finally Northern Ireland and the Highlands and Islands in the UK.

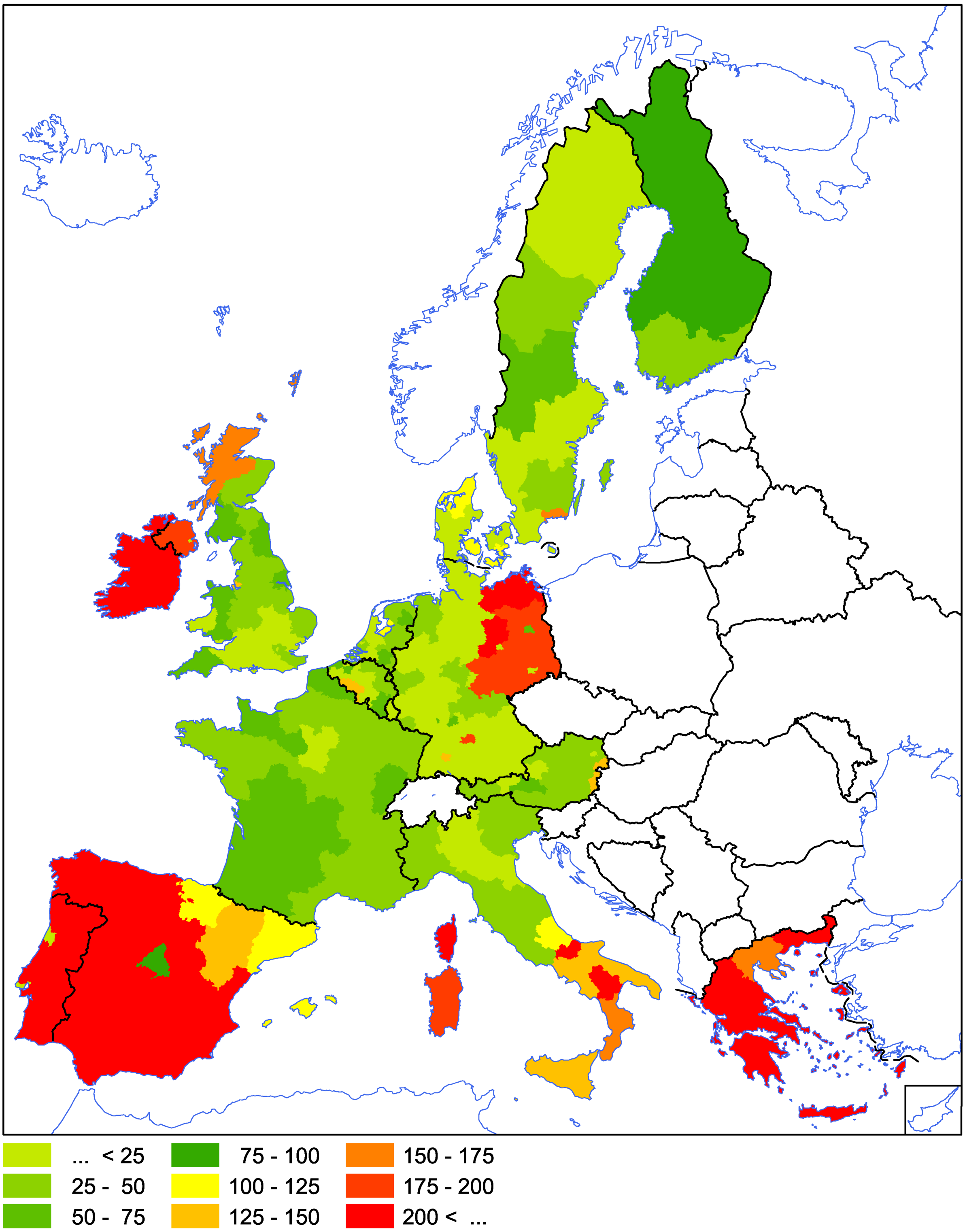

Figure 5.3. Total transfer payments per capita in 1996

Regions eligible under the new Objective 2 are regions which satisfy one of the following criteria:

- industrial areas, whose unemployment rate is higher than the Community average and whose percentage share of employment in industry is higher than the Community average and where is a decline in this employment category;
- rural areas which satisfy one of the following criteria
  - a population density of less than 100 people per km^2 or a share of agricultural employment in total employment which is at least double the Community average
  - an unemployment rate above the Community average or a decline in population.
- urban areas which meet at least one of the following criteria
  - a rate of long-term unemployment higher than the Community average
  - a high level of poverty, including poor housing conditions
  - a particularly degraded environmental situation
  - a high crime rate
  - a low level of education among the resident population.
- fisheries-dependent areas with a significant share of employment in the fisheries sector and restructuring problems leading to a significant decline in employment in this sector.

The criteria for Objective 2 are to be applied to NUTS-3 regions. Similar to Objective 1, areas covered by Objectives 2 and 5b for the 1994-1999 period which do not meet the criteria for the new Objective 2 gain benefit from degressive transitory support until 2005. Maps published at the Inforegio homepage (European Commission, 2002b) together with lists of eligible NUTS-2 regions (European Communities, 1996) were used to determine NUTS-3 regions eligible under new Objective 2. Regions eligible under the new Objective 3 will be all regions outside the areas covered by the new Objective 1 (European Communities, 1999c).

Table 5.5 gives the proposed total financial volume of the Structural Funds for the current funding phase (Europäische Kommission, 1999). It is proposed that about 70 percent of the volume is spent for Objective 1, 11.5 percent for Objective 2 and about 12 percent for Objective 3. About 5 percent will be reserved for Community Initiatives, and 0.5 percent for fishery and technical support each.

Table 5.5. Structural Funds for 2000-2006 in million Euro

Objective	2000	2001	2002	2003	2004	2005	2006	Total
Objective 1 (69.7 %)	20.51	20.10	19.70	19.29	18.87	18.87	18.58	135.90
Objective 2 (11.5 %)	3.38	3.32	3.25	3.18	3.11	3.11	3.07	22.50
Objective 3 (12.3 %)	3.62	3.55	3.48	3.40	3.33	3.33	3.28	24.05
Fishery (outside Obj. 1) (0.5 %)	0.15	0.14	0.14	0.14	0.14	0.14	0.13	1.11
Community initiatives (5.35 %)	1.57	1.54	1.51	1.48	1.45	1.45	1.43	10.44
Technical support (0.51 %)	0.15	0.15	0.14	0.14	0.14	0.14	0.13	1.00
Total Structural Funds	29.42	28.84	28.26	27.67	27.08	27.08	26.66	195.00

Source: Europäische Kommission, 1999

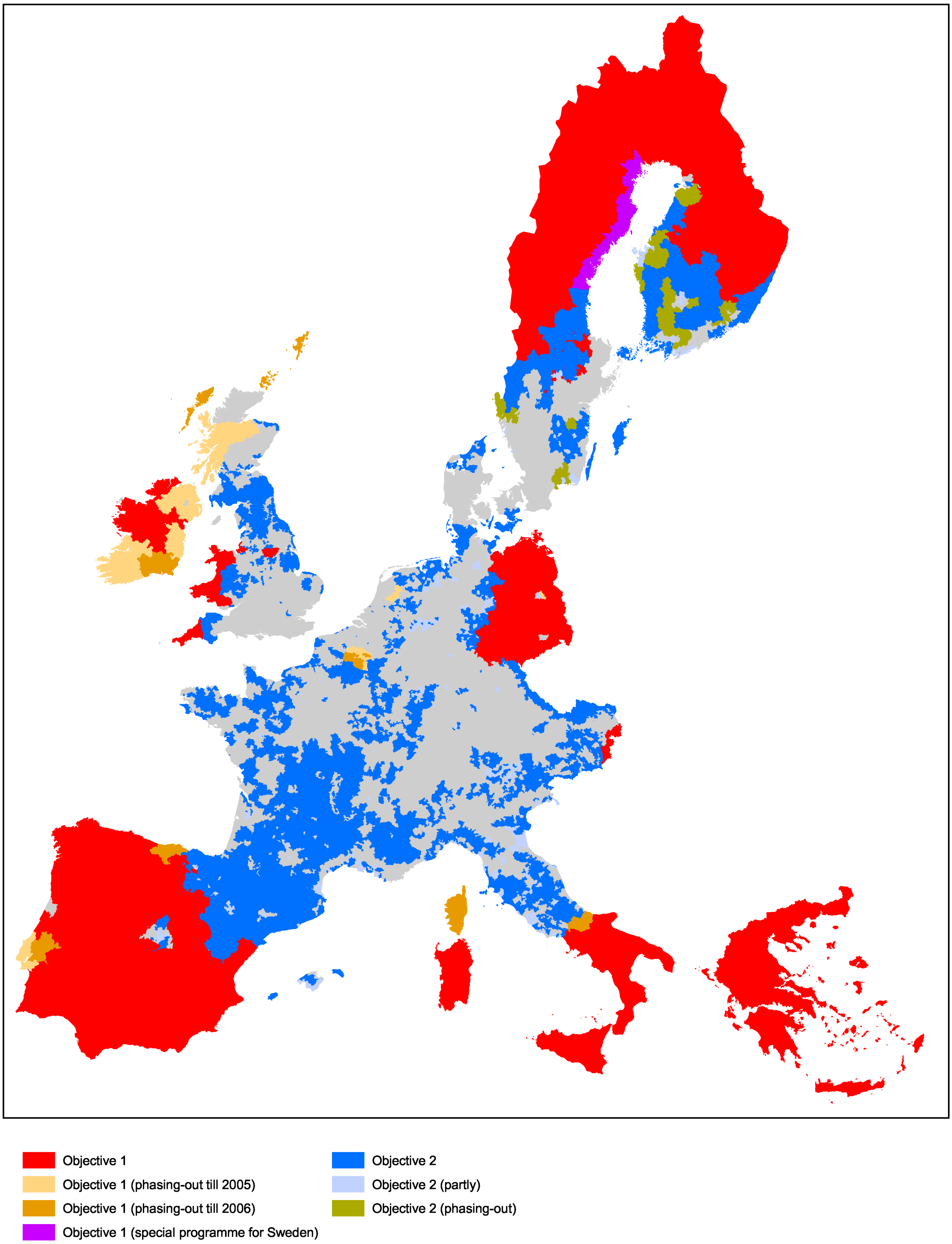

Figure 5.4. Regions eligible under the new Objective 1 (European Commission, 1999a)

After the determination of the eligible regions, the total expenditures were broken down to NUTS-3 regions in proportion to population or, in case of Objective 3, by using the percentage shares of the last funding period. For the time period 2007-2016 it was assumed that the same regions as determined for the period 2001-2006 will be assisted and that the amount of the expenditures will be as in 2006 (including inflation).

Candidate Countries

The European Commission aims at establishing a co-ordinated framework for technical and financial support for candidate countries in order to help them to build up their administrative, institutional and economic capacities before they join the European Union. Therefore, candidate countries can apply for financial support prior to their entry from the PHARE, SAPARD and ISPA programmes. The overall expenditures available for the current funding period are summarised in Table 5.6.

Table 5.6. Transition subsidies for applicant countries in million Euro (2000-2006)

	2000	2001	2002	2003	2004	2005	2006	Total
PHARE	1,560	1,560	1,560	1,560	1,560	1,560	1,560	10,920
SAPARD	520	520	520	520	520	520	520	3,640
ISPA	1,040	1,040	1,040	1,040	1,040	1,040	1,040	7,280
Total	3,120	3,120	3,120	3,120	3,120	3,120	3,120	21,840

Source: Europäische Kommission, 1999, 126

Per-capita GDP in purchasing power standards, population and area were used as criteria for the allocation of the ISPA fund among applicant countries. For flexibility reasons it was decided to determine ranges of percentage points for each country, i.e. to define lower and upper limits for financial aid. For the extended SASI model, these limits were used to break down the PHARE and SAPARD funds to the candidate countries (Table 5.7). The same criteria as for the ISPA fund were used to allocate the subsidies from the national to the regional level.

Table 5.7. Allocation of funds to candidate countries per year in million Euro

		ISPA			PHARE			SAPARD			Total
Country	Range (%)	Min	Max	Ø	Min	Max	Ø	Min	Max	Ø	(5+8+11)
1	2	3	4	5	6	7	8	9	10	11	12
BG	8-12	83.2	124.8	104.0	124.8	187.2	156	41.6	62.4	52.0	312.0
CZ	5.5-8	57.2	83.2	70.2	85.8	124.8	105.3	28.6	41.6	35.1	210.6
EE	2-3.5	20.8	35.4	28.1	31.2	54.6	42.9	10.4	18.2	14.3	85.3
HU	7-10	72.8	104.0	88.4	109.2	156.0	132.6	36.4	52	44.2	265.2
LT	4-6	41.6	62.4	52.0	62.4	93.6	78.0	20.8	31.2	26.0	156
LV	3.5-5.5	35.4	57.2	46.3	54.6	85.8	70.2	18.2	28.6	23.4	139.9
PL	30-37	312.0	384.8	348.4	468.0	577.2	522.6	156.0	192.4	174.2	1,045.2
RO	20-26	208.0	270.4	239.2	312.0	405.6	358.8	104.0	135.2	119.6	462.8
SI	1-2	10.4	20.8	15.6	15.6	31.2	23.4	5.2	10.4	7.8	46.8
SL	3.5-5.5	35.4	57.2	46.3	54.6	85.8	70.2	18.2	28.6	23.4	139.9

Source: adopted from Europäische Kommission, 1999

Agricultural Transfer Payments

Monetary and fiscal interventions in the primary sector are among the most prominent policies of the European Union. Support measures related to the Common Agricultural Policy (CAP) account for more than fifty percent of the Union's total budget. The CAP is the single largest sectoral policy of the EU to incite large-scale income distributions in the form of transfer payments from consumers and taxpayers to the producers of agricultural goods (European Commission, 1996, 60). Particularly in regions with a high share of agriculture and agriculture-related industries, CAP subsidies are an important factor in the regional economic accounts. This is why agricultural subsidies are considered in the extended SASI model.

Agricultural transfer payments follow a complex pattern of direct and indirect market support mechanisms at different levels. The OECD introduced a dichotomous model to categorise agricultural transfer payments which is also the basis for EU calculations (OECD, 1996; European Commission, 1996, 140). This approach divides agricultural support measures into Producer Subsidy Equivalents (PSE) and Consumer Subsidy Equivalents (CSE), where PSE indicate the amount of monetary transfers to agricultural producers resulting from agricultural policies concerning domestic market supports (transfers from consumer to farmer) and direct subsidy transfer payments (transfers from taxpayer to farmer). Consequently, the CSE indicates the amount of monetary transfers to consumers as a result of agricultural policies. A negative value of this indicator signifies that consumers had to pay an implicit tax on agricultural products due to specific political regulations (National Library for the Environment, 1998). For the purpose of modelling the economic regional and structural effects of agricultural transfer payments, PSE is the indicator to be considered. PSE is a compound measure that comprises direct payments and net trade gains of agricultural producers in a region. Since net trade gains are the outcome of complex trade and market structures, which are difficult to grasp in a model of regional economic development, it is more appropriate to consider solely gross direct subsidy transfers to agricultural producers.

Data on agricultural accounts comprising information on subsidies, taxes and gross value added in the primary sector can be extracted from the Regio database. The database contains separate data series albeit in incomplete form for each of the above categories from 1980 to 1997 at the NUTS-2 level. The following steps were taken to fill the gaps in the database and to disaggregate the numbers to the NUTS-3 level required in IASON:

(1) *Disaggregation 1.* In some cases data were only available at the national level and not at the NUTS-2 level. Therefore, the national figures were disaggregated according to the distributions of some other year for which a complete dataset was available. If NUTS-2 data were missing for all years, the national data were disaggregated in proportion to population.

(2) *Back- and forecasting.* Data on agricultural accounts are not available for all countries and all years in the 1980s. Missing national values were estimated using the average of the relative differences to the previous year for countries with complete datasets and modifying the base values accordingly.

(3) *Disaggregation 2.* Once the database for NUTS-2 regions was completed, the NUTS-2 aggregates were disaggregated to NUTS-3 regions in proportion to population.

As a result, a database on agricultural subsidies, agricultural taxes and agricultural GVA is available for all IASON regions from 1980 to 1996. Figures are even available for countries which joined the EU after 1980 (Greece, Spain and Portugal) because national subsidies are contained in the figures as well.

Agricultural transfers make up a large percentage of the agricultural value added in most regions. The average share of subsidies on the market value of agricultural produce of all regions is 17.4 percent. A comparison of the absolute amounts of agricultural subsidies shows that the volume of these payments has increased steadily over time so that the total sums for most countries exceed 1 billion € per year, in some cases they amount to more than 5 billion € in 1996 (France 8.3 billion, Germany 6.1 billion and Spain 4.6 billion). Data broken down to the regional level reveal that the total amount of agricultural subsidies varies greatly within the member states.

Major policy changes were introduced with the implementation of the Agenda 2000 of the European Union with severe cutbacks of agricultural subsidies and market support measures. The contents of the reform are influenced by the frequent cases of inefficient allocation of funds in the past, the agricultural structure of the membership applicants and the outcomes of the negotiations on global tariff agreements in the agricultural sector. The following assumptions concerning the development of agricultural subsidies were derived from the Agenda 2000:

- The overall principle of the Agenda 2000 with respect to agriculture is to cut down the market and price support measures (CSE) and increase the volume of subsidies paid directly to the farmers (PSE). International pressure on the European Union to abandon price support measures led to a severe CSE cutback after the 1999 global talks on market liberalisation. However, as only PSE transfers are considered in the extended SASI model, it was assumed that subsidies will continue to rise after implementation of Agenda 2000 policies.

- The rise in PSE transfers is likely to be limited at the aggregate level because of the changing structure of the agricultural sector. The share of agriculture in economic activities is likely to decline further and, in addition, the agricultural produce will be produced by an ever diminishing number of active persons. The planned CSE reductions will catalyse this process. Therefore, in spite of growing volumes in agricultural goods production, the number of PSE recipients is likely to decline in the current member states. However, rationalisation and structural change potentials have to be assessed for each region separately.

- Future member states are the most difficult factor in predicting the general development of agriculture in the EU. On the one hand, the new member states will require additional funding for technological modernisation and organisational adjustment. On the other hand, their mostly low-priced products would distort the current EU price system were they to join the Union now. In order to support modernisation, it is foreseeable that a special support and subsidisation system will be worked out for the new member states. It can therefore be assumed that the old member states will follow the guidelines of the Agenda 2000 as outlined above irrespective of the special requirements of the new member states.

Based on these assumptions, agricultural subsidies were predicted for each region so that a database on this category from 1981 to 2021 is available.

5.2 Population Data

Population data are needed for the extended SASI model as the supply side of regional labour markets. Regional population changes due to natural change (fertility, mortality) and migration.

In order to model fertility and mortality by a cohort-survival model, regional population has to be disaggregated by age and sex. Age-specific fertility and mortality rates are required as exogenous forecast for each simulation period. Migration is modelled as interregional migration flows. However, as fertility and mortality rates as well as migration data are only available at the national level, these data were dealt with in Section 4.2.

5.2.1 Population

Regional population by age and sex is required as time-series data for the historical base year 1981 and for later years until the benchmark year 1997 for validation.

The New Cronos database (Eurostat 2002b) contains data on population by sex of each NUTS-3 region of the EU, in most cases since 1981. For some countries (Austria, France, Sweden), only population without disaggregation by sex is available for NUTS-3 regions. For some regions data for certain years are missing. Data on age groups by sex are available in 5-year intervals, but only for NUTS-2 regions. Also the age groups used in different countries are not always compatible.

The New Cronos database contains population data also for the candidate countries, mostly since 1990. If also national data sources are taken into account (Korcelli and Komornicki, 2002b), the following picture emerges: Regional population data are available for Bulgaria for the years since 1981 (but for only three age groups), for the Czech Republic for the years since 1995 (without age division), for Estonia since 1990, for Hungary since 1998, for Latvia since 1981, (without age and sex division), for Poland since 1981 (but until 1998 for another regional subdivision than the one used in IASON) and for Romania, Slovakia and Slovenia only data for recent years.

The situation for the remaining east European countries is similar (Korcelli and Komornicki, 2002b): regional population data are available mostly only for recent years and without age and sex subdivision, except for Russia where regional population by age and sex is available for all years since 1981.

In all cases of missing data estimation techniques had to be used to fill the gaps in the data. Where regional population was not subdivided by age and sex, age and sex structures of higher-level regions or national populations were used to disaggregate regional populations. Larger age structures where made compatible by subdividing larger age groups to 5-year age groups using higher-level age structures or age structures from similar regions or countries. Where data for individual years were missing, interpolation or extrapolation was used to fill the gaps.

The result of this work will be a consistent database of population by twenty 5-year age groups and sex for all NUTS-3 regions for selected years between the historical base year 1981 and the common benchmark year 1997.

Summary statistics of the population data for the 1,083 regions in the EU between 1981 and 1996 can be seen in Table 5.8. In 1996, the total population of today's 15 EU member states amounted to 372 million. The great variation in average population size of the regions in individual countries was already noted in Table 2.1. Here the huge gap between the smallest region (Orkney Islands) and the largest region (Madrid) can be seen, and that also the ratio between the region increased between 1986 and 1991, even though the coefficient of variation of population size decreased. It is also apparent that there is an obvious inertia in the distribution of population as the significant population changes during the 1980s and 1990s have not led to large changes in the diversity of population sizes.

Table 5.8. Summary statistics of population of NUTS-3 regions in the EU, 1981-1996

Summary statistics*	1981	1986	1991	1996
Total EU population (1,000)	353,894,300	357,296,400	364,729,200	371,880,600
Minimum (1,000)	19,199	19,100	19,600	19,900
Maximum (1,000)	4,700,400	4,799,200	4,894,700	5,022,300
Ratio max/min	244,800	251,300	249,700	252,400
Mean (1,000)	326,772	329,914	336,777	343,380
Coefficient of variation	0.062	0.064	0.060	0.059

Source: Eurostat, 2002b
* excluding French, Portuguese and Spanish overseas regions

Figure 5.5 shows the distribution of population density of NUTS-3 regions in the European Union clearly highlighting the large variation in population density between metropolitan and rural regions.

Average annual population growth in the European Union amounted to 0.3 percent per year between 1981 and 1996. This very low rate of increase reflects a general trend towards stagnation and zero growth of the European population (Faus-Pujol, 1995). The rates of change in population, however, varied considerably for different regions. Table 5.9 shows the regions with the highest population increases and those with the largest population losses in the periods 1981-1986, 1986-1991 and 1991-1996.[11] The spatial patterns of population change in the regions of the EU are different in the three periods (see also Figure 5.6-5.8).

Between 1981 and 1986 the regions with the highest population increases were in the south of the United Kingdom, in the south of Spain and Italy, in Greece and in the south and the west of France. Finland and Ireland also experienced population growth, with the strongest increases in the regions of Helsinki and Dublin. The regions of the New German Länder and Merseyside, Overijssel, Alentejo, Liguria and Vienna showed the strongest population decreases.

[11] There are a number of anomalies caused by boundary changes which account for the unusually high population growth of Flevoland in all three periods and of Berlin in the second period. The population of Berlin increased by more than 60 percent from 1989 to 1990 due to the unification of West and East Berlin. Flevoland and Berlin have to be seen as statistical artefacts.

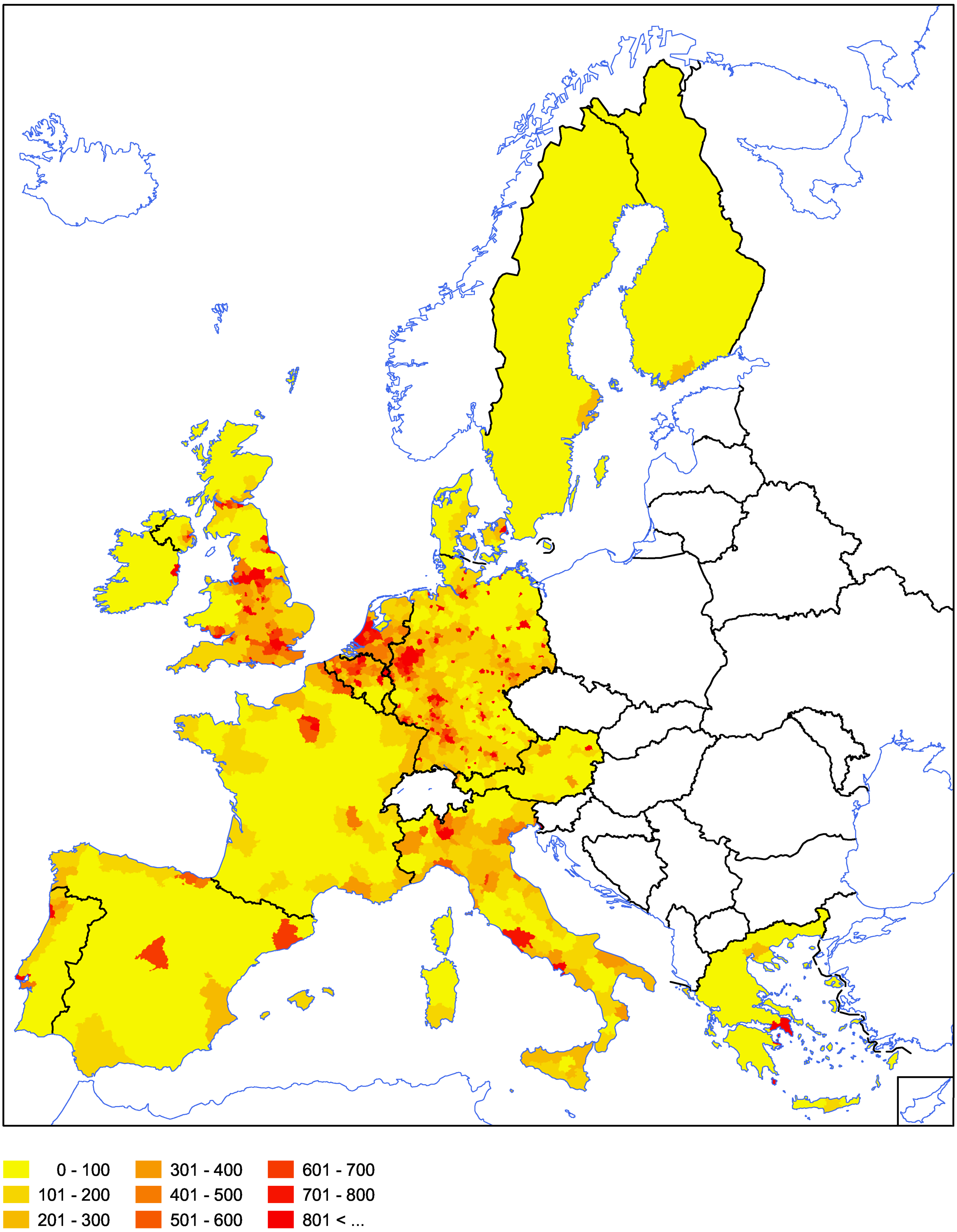

Figure 5.5. Population density in 1981 (after Eurostat, 2002b)

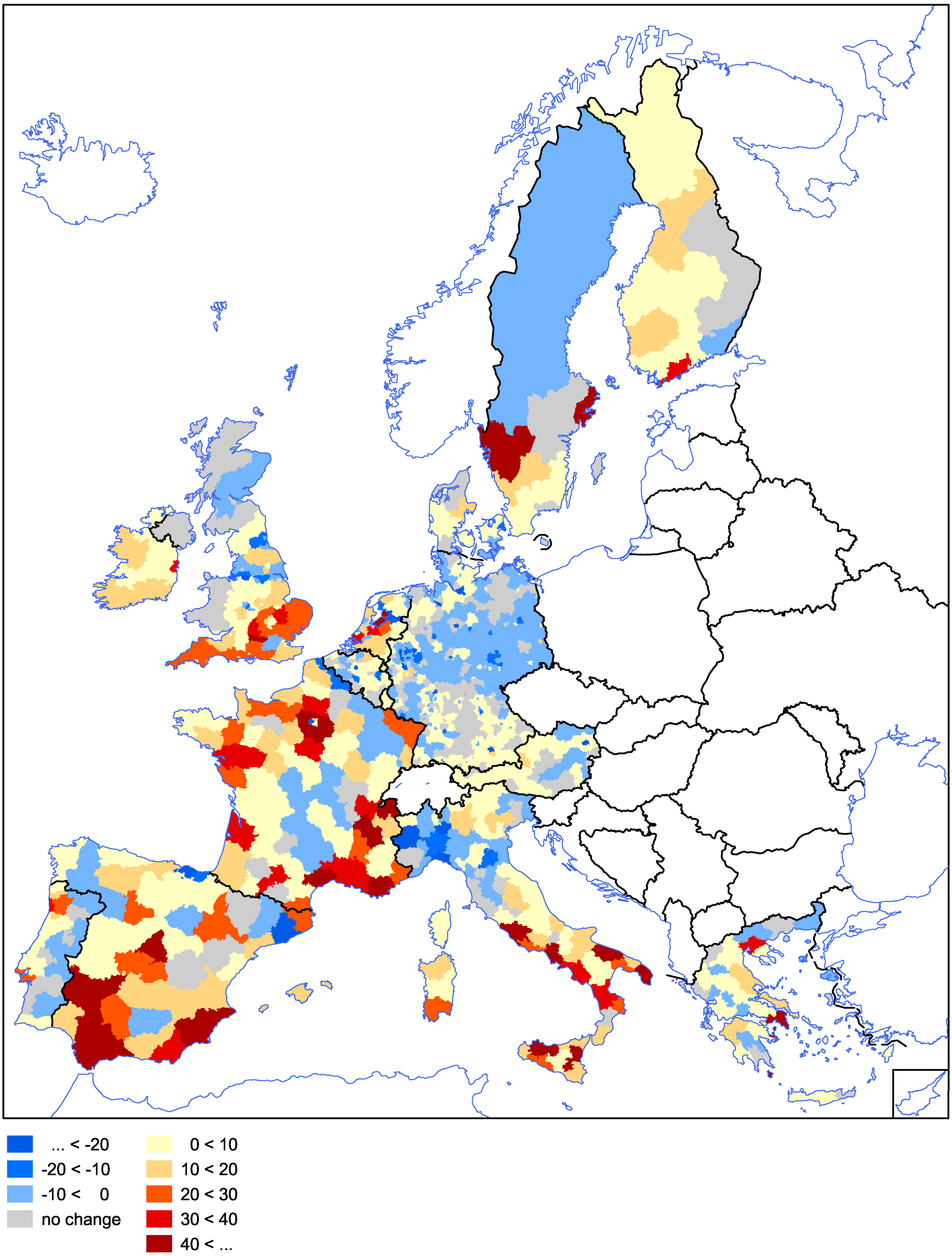

Figure 5.6. Population change in the EU 1981-1986 (in 1,000)

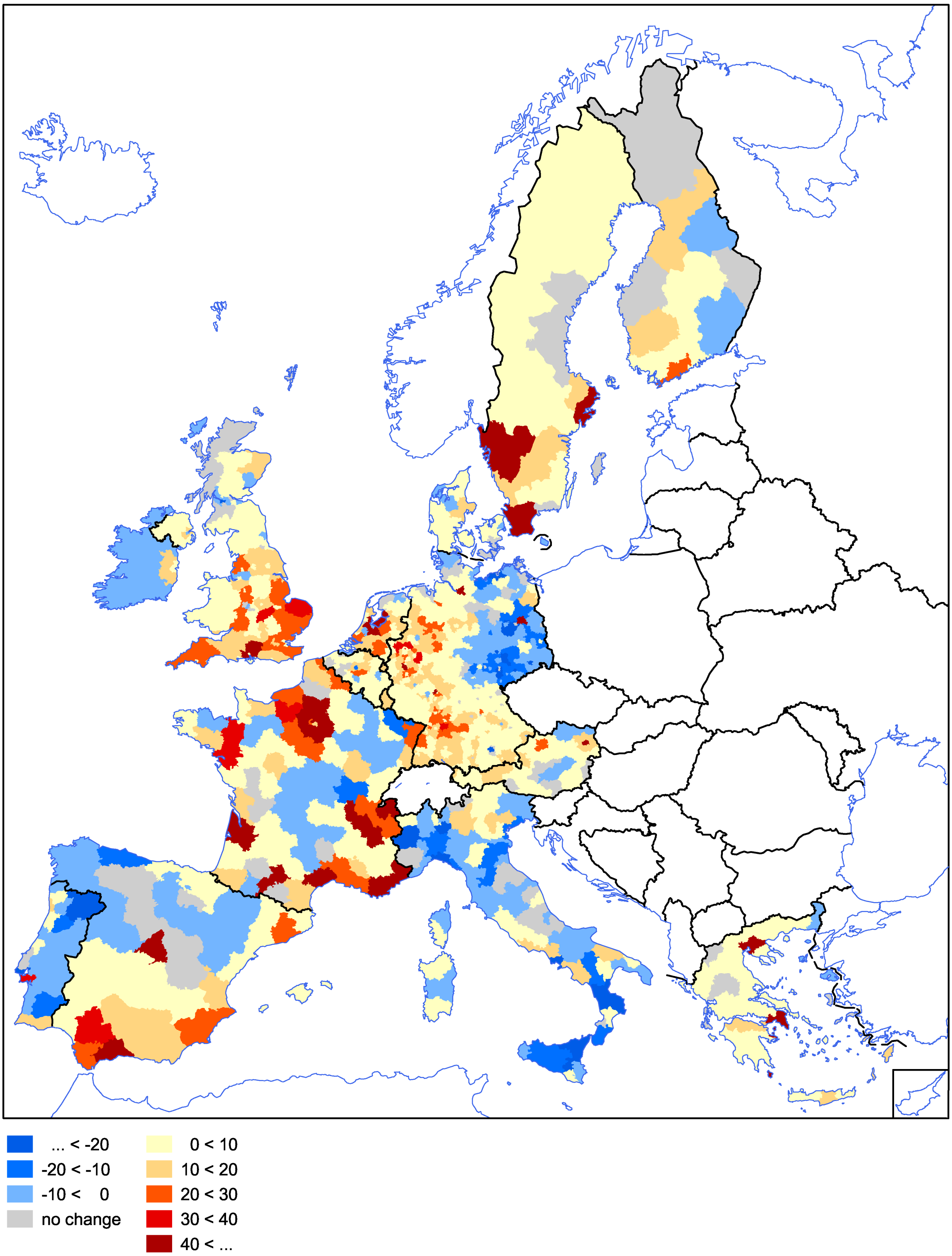

Figure 5.7. Population change in the EU 1986-1991 (in 1,000)

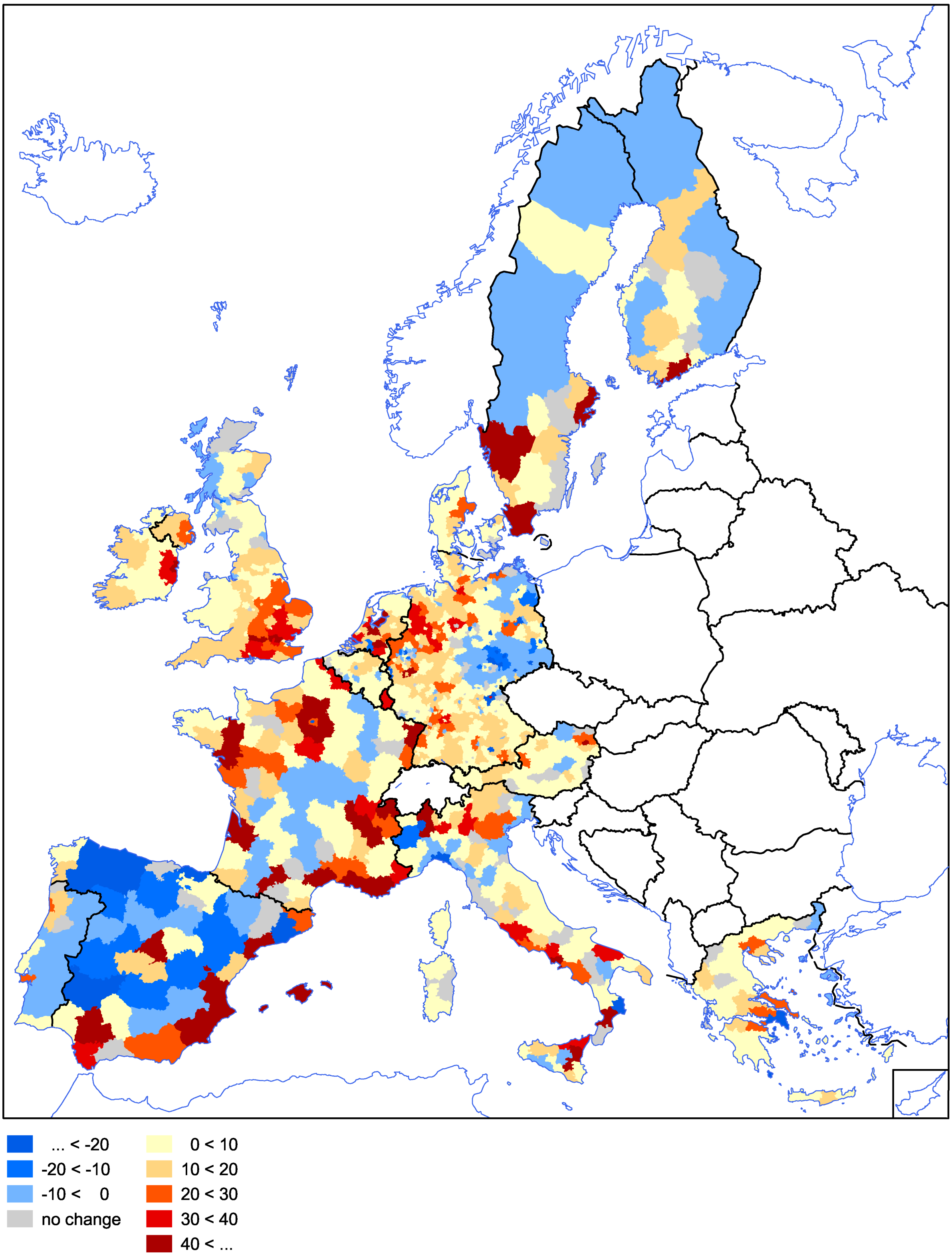

Figure 5.8. Population change in the EU 1991-1996 (in 1,000)

Table 5.9. Regional population change in the EU 1981-1996

Regions	1981-1986	Regions	1986-1991	Regions	1991-1996
Highest 10					
Flevoland (NL)	2.19	Berlin-Ost (DE)	1.84	Verbano-Cusio-Oss. (IT)	1.82
Málaga (ES)	1.13	Berlin-West (DE)	1.84	Vercelli (IT)	1.82
Suhl (DE)	1.11	Flevoland (NL)	1.25	Novara (IT)	1.82
Kefallinia (GR)	1.10	Ingolstadt (DE)	1.15	Bayreuth (Stadt) (DE)	1.50
Seine-et-Marne (FR)	1.10	Seine-et-Marne (FR)	1.15	Evrytania (GR)	1.28
Cottbus (DE)	1.10	Krefeld (DE)	1.13	Flevoland (NL)	1.26
Hérault (FR)	1.10	Ulm (DE)	1.11	Fokida (GR)	1.25
Haute-Savoie (FR)	1.08	Chalkidiki (GR)	1.11	Bad Doberan (DE)	1.22
Ain (FR)	1.08	Var (FR)	1.11	Cloppenburg(DE)	1.20
Vaucluse (FR)	1.08	Dachau (DE)	1.11	Gifhorn (DE)	1.17
Lowest 10					
Quedlinburg (DE)	0.93	Delitzsch (DE)	0.89	Stralsund (DE)	0.85
Salzgitter (DE)	0.93	Muldentalkreis (DE)	0.89	Greifswald (DE)	0.85
Dessau (DE)	0.93	Leipziger Land (DE)	0.89	Halle/Saale (DE)	0.85
Schönebeck (DE)	0.93	Pinhal Interior Sul (PT)	0.88	Rostock (DE)	0.84
Fokida (GR)	0.93	Cávado (PT)	0.88	Schwerin (DE)	0.83
Duisburg (DE)	0.93	Nordwestmeckl. (DE)	0.87	Vogelsbergkreis (DE)	0.83
Holzminden (DE)	0.89	Eichsfeld (DE)	0.87	Vizcaya (ES)	0.82
Noord-Overijssel (NL)	0.89	Potsdam-Mittel. (DE)	0.86	Bayreuth (Kreis) (DE)	0.72
Zuidwest-Friesland (NL)	0.88	Gera (DE)	0.84	Biella (IT)	0.38
Evrytania (GR)	0.87	Bad Doberan (DE)	0.79	Crotone (IT)	0.24

Source: after Eurostat, 2002b

From 1986 to 1991, part of the picture is reversed. Former West-German regions feature now at the top of population increase with migration from the New German Länder and east European countries culminating in the immigration wave of the years 1989 and 1990, which led to population increases in most West German regions (Bucher and Gatzweiler, 1996; Salt, 1993). The regions of the New German Länder continue to loose population and are in the group of highest population decline. In the group of highest growth are Utrecht and Brabant Wallon. In the bottom group are Liguria, Alentejo and Calabria. Most Irish, several Spanish and many Italian regions experienced very low population growth. Portuguese regions had among the lowest rates for both periods. Both Sicilia and Calabria showed above-average increases in the first half of the decade and a population decline in the second half. Other regions experienced high growth in both periods. These include the south-west of the United Kingdom, East Anglia and the south-east of France and Greece.

Again significant shifts in population development can be found in the period 1991-1996. Irish regions and most Italian regions (in particular south of Rome) now again experience population growth. Regions in Brandenburg (Germany) close to Berlin benefit from suburbanisation of Berlin leading to significant population growth. Apart from this, most of the New German Länder continue to lose population. A remarkable polarisation trend can be observed for Spain. Several regions in the north-west of Spain (around Léon) and in the central-south (e.g. Badajoz, Ciudad Real) belong to the regions with greatest population decline, while the Mediterranean coastal regions and Madrid belong to the fastest growing regions.

Figures 5.9 and 5.10 show examples of the diversity of age structures of regional populations. Figure 5.9 represents the age structure of two selected NUTS-3 regions for 1981, Lisbon in Portugal and Munich in Germany, whereas the map in Figure 5.10 shows the spatial distribution number of children younger than 15 years by NUTS-2 region in 1998.

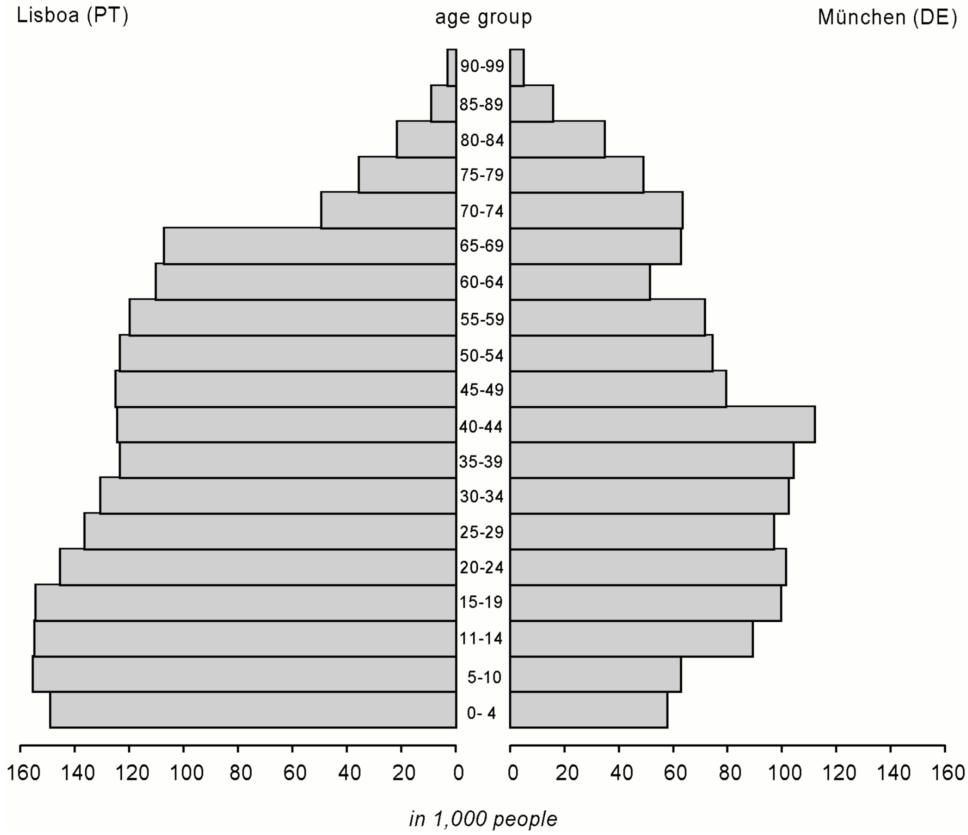

Figure 5.9. Regional age structure in Lisbon (left) and Munich (right) in 1981

5.2.2 Educational Attainment

The economic performance of a region depends not only on physical infrastructure but to a great extent also on the skills of the regional labour force. Skilled labour force and "higher education institutions have the potential to make a considerable contribution to the economic development of the region in which they are located. Their involvement in regional development is enhanced by the growing importance of knowledge and information within the global economy" (Thanki, 1999, 85). For individuals there is a strong correlation between levels of education and income (European Commission, 2001b) which might be true also for regions.

As a key indicator of the availability of skilled labour in the regions, educational attainment of working age population can be used (European Commission, 1999c). The highest level of education completed is the most easily measurable proxy for the overall qualification of the workforce (OECD, 1999).

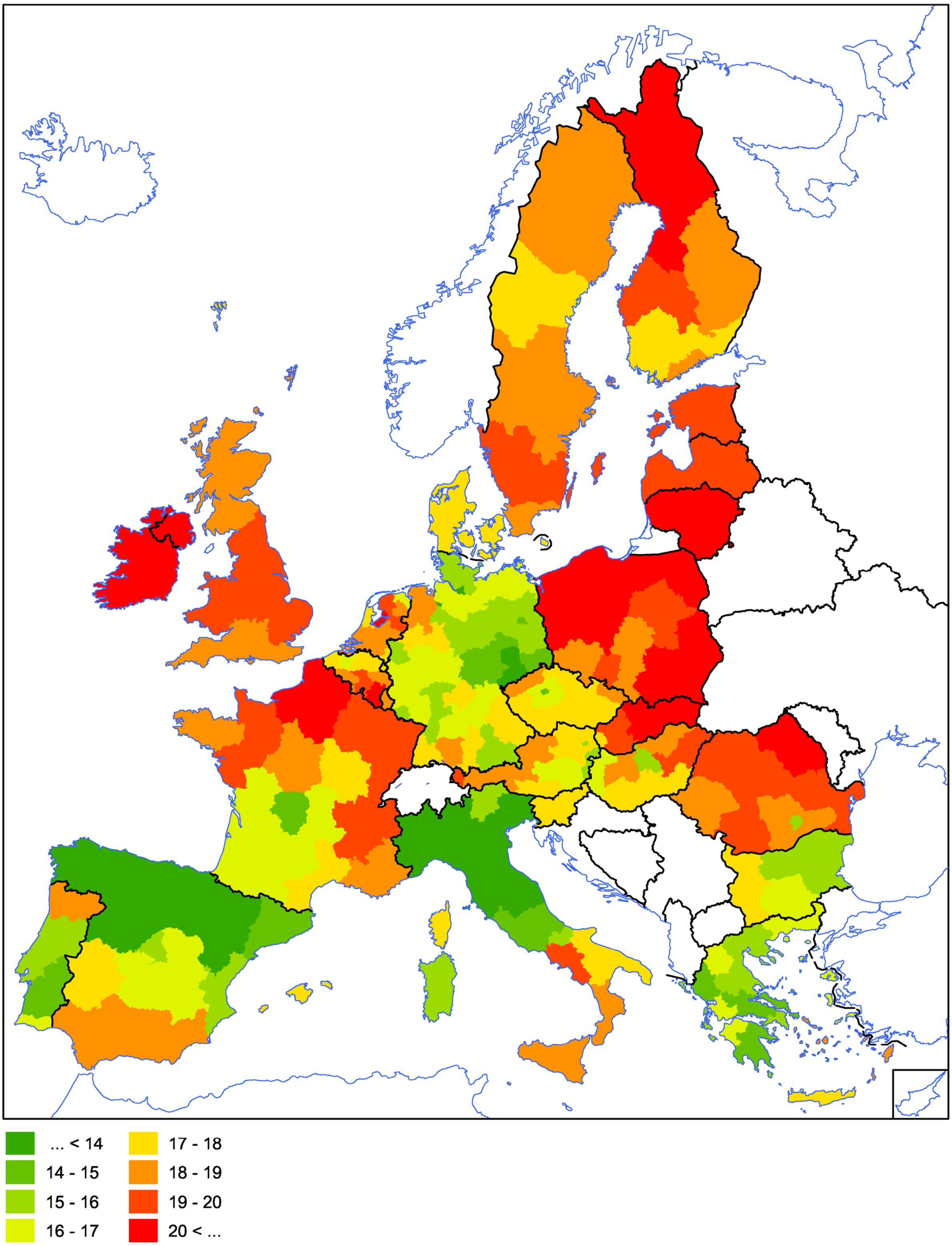

Figure 5.10. Percent children younger than 15 years in 1998

The data used in the extended SASI model are based on the International Standard Classification of Education (ISCED), which was defined to facilitate the international comparison of educational attainment. The ISCED classification is commonly aggregated to three broad groups (e.g. Eurostat, 1998a):

- *Low* (ISCED *<3)* comprises pre-primary education, primary education and lower secondary education. The end of lower secondary education often coincides with the end of full-time compulsory schooling.

- *Medium* (*ISCED 3)* is upper secondary education. It begins around the age of 14 or 15 and refers to either general, vocational or technical education. It can lead to the standard required for admission to tertiary education.

- *High (ISCED 5, 6, 7)* is tertiary education. It covers programmes outside universities for which successful completion of upper secondary level is required, leading to university degrees or equivalent or leading to a second, postgraduate university degree.

For the extended SASI model educational attainment of residents in working age was selected as appropriate endowment factor describing human resources. It will be determined during calibration whether the proportion of residents in working age with medium and high education or with high education only will be used as variable. To illustrate the spatial distribution in Europe, Figure 5.11 shows high educational attainment for NUTS-3 regions of the EU and the candidate countries.

It can be seen that there are great disparities in educational attainment across Europe and even within countries. In Portugal only 22 percent of the population aged 25 to 59 and in Spain only one third has a qualification beyond compulsory schooling. On the opposite side, in countries such as Austria, Germany and the Nordic countries, about two thirds of the population have medium or higher education. Most candidate countries have a high level of education; sometimes there are only between 10 and 20 percent with low education. However, there are less persons having high education compared with advanced EU countries. In most countries educational attainment is higher in urban regions than in rural areas.

Time-series data on educational attainment are difficult to obtain. According to information provided by Eurostat, data on educational attainment is not available in a systematic manner for years before 1990. But even for the 1990s comparable regional data hardly exist because of a reclassification of ISCED in the late 1990s. Also, NUTS-3 data are not available, and data for the candidate countries are only available for very recent years.

National data of educational attainment of the population aged 25 to 59 are available for 1991 by OECD country (CERI, 1993) and for the years 1992-1999 by EU country (Freysson, 2001, see Figure 5.12). NUTS 2 data do exist for NUTS-2 regions of EU-12 for 1993 (Eurostat, 1995), for NUTS-2 regions of EU-15 for 1996 (Eurostat, 1998) and for NUTS-2 regions of EU-15 and candidate countries for 1999 and 2000 (European Commission, 2001; Commission of the European Communities, 2002, see Figure 5.11).

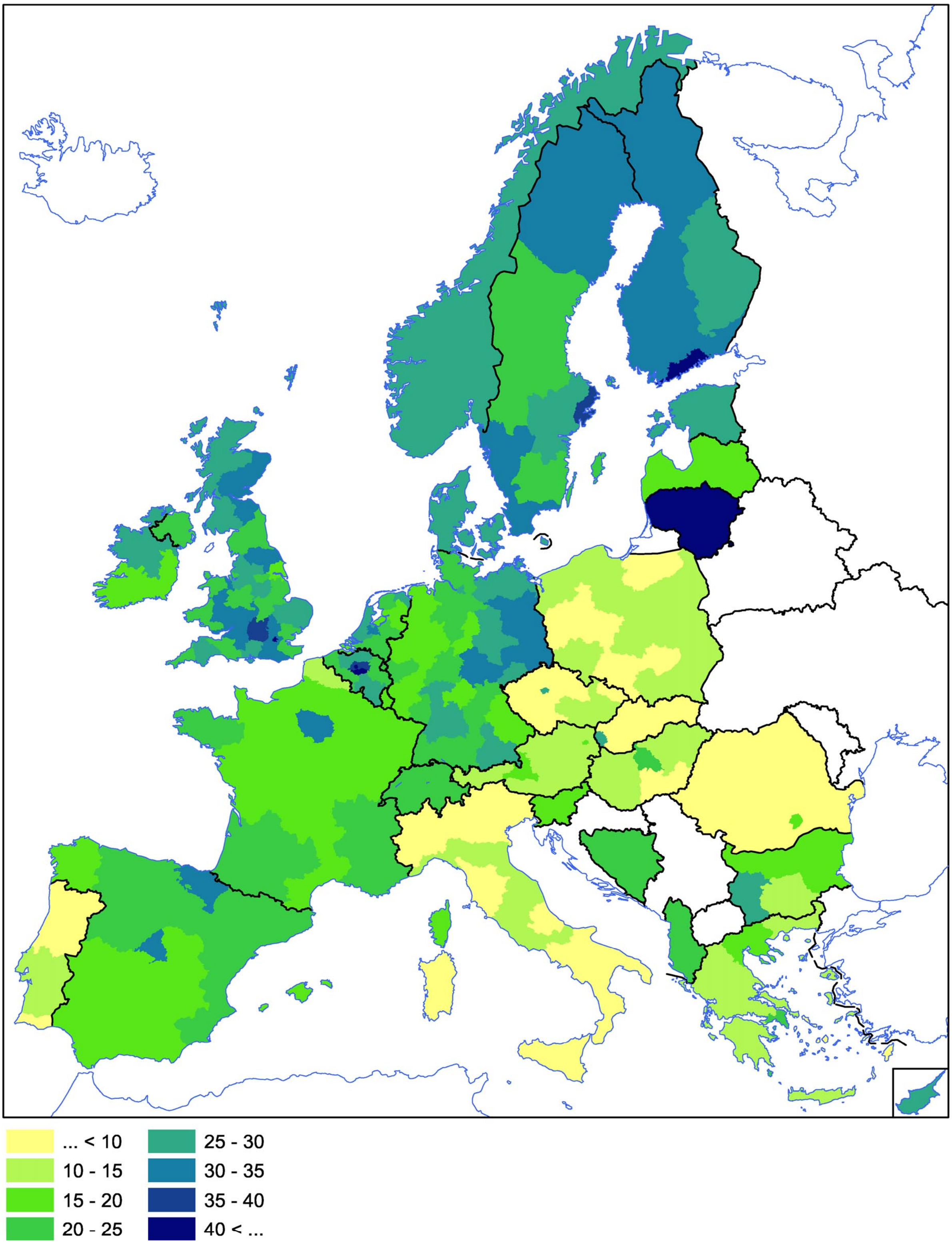

Figure 5.11. Regional proportions of high educational attainment of persons aged 25 to 59 (after Commission of the European Communities, 2002)

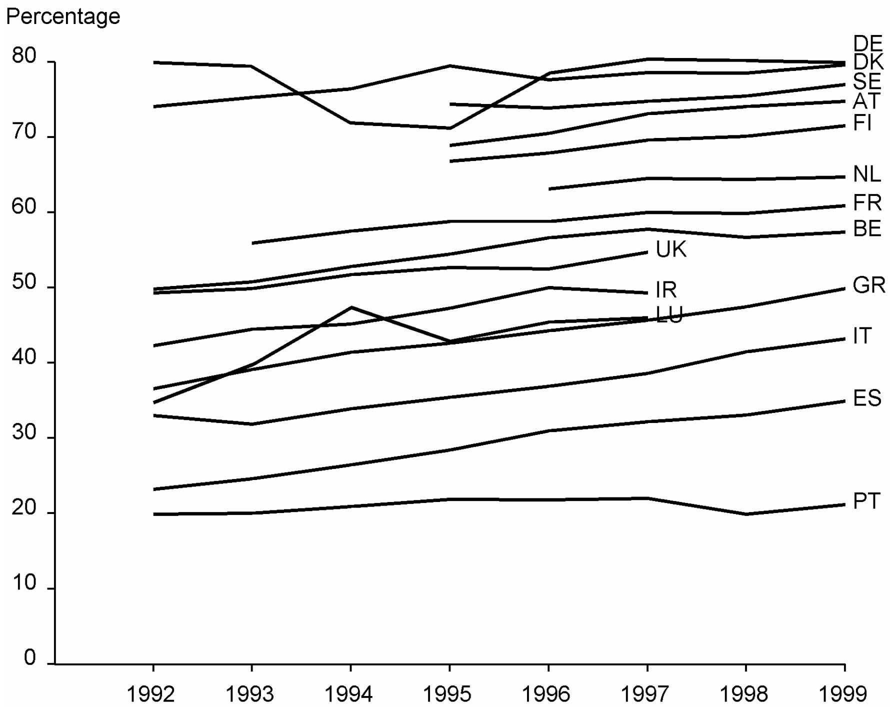

Figure 5.12. Educational attainment of persons aged 25 to 64 by country (Freysson, 2001)

Because of the lack of data regional educational attainment data for the period between 1981 and 1996 had to be estimated using backcasting based on national trends observed in the period between 1991 and 1999 and on regional data for some few points in time. For the backcasting of the data for candidate countries it was assumed that they had a similar development in the past as EU countries with a comparable level of educational attainment. The backcasting was done for NUTS-2 regions. It is assumed that there is no further differentiation below NUTS 2 regions, i.e. that NUTS-3 regions have the level of educational attainment of the corresponding NUTS-2 regions.

For future years regional educational attainment is exogenously forecast assuming that the educational attainment of a region develops as in the country or group of regions to which it belongs.

The national forecasts used for this are based on expectations of future educational attainment by the OECD (1998a) for the year 2005. These forecasts were extrapolated until 2021 taking account of the results of the European Union Labour Force Survey which concluded "that the differences in education levels of the various Member States are gradually being reduced" (Freysson, 2001, 1).

5.2.3 Labour Force Participation

Regional labour force is derived from regional population and regional labour force participation or economic activity rates.

Labour force participation rates by sex were collected from the New Cronos Database (Eurostat, 2002b) for NUTS-2 regions for 1981, 1986, 1991 and 1996.

For 1981, there are considerable gaps in the data. Apart from the new EU member states and the New German Länder, there are no data for Spain, Luxembourg and Portugal. Greece has data for only two of its NUTS-2 regions (Thessalia and Kriti). Data for the UK are only available at the NUTS-2 level, and data for Ireland only for the whole country. For 1986, data are available for Spain, Luxembourg and Portugal. There are no data for the Netherlands. For 1991, data for some Austrian regions are missing. Labour force participation data are available for most east European countries, as for GDP and employment data, mostly only for a few recent years and partly without division by sex (Korcelli and Komornicki, 2002b). So in many cases labour force participation rates of NUTS-3 regions had to be estimated assuming that activity rates of NUTS-2 regions can be transferred to NUTS-3 regions.

Table 5.10 shows some summary statistics for activity rates in the European Union. The economically active population of the EU in 1981 was approximately 54 % of the population of working age. The rate increased slightly to 55 % from 1981 to 1996. There was, however, considerable regional variation. The highest regional activity rate found in all years was more than 60 percentage points higher than the lowest rate. Moreover, there were substantial differences between male and female activity rates. Therefore it is necessary to analyse male and female activity rates separately (Lillydahl and Singell, 1985; Eurostat, 1992).

Table 5.10. Summary statistics for regional activity rates

	1981		1986		1991		1996	
	male	female	male	female	male	female	male	female
Minimum (%)	40.9	12.5	52.3	16.7	56.5	17.5	50.9	19.0
Maximum (%)	77.3	43.8	89.8	70.1	87.5	74.7	88.7	76.3
Ratio max/min	1.89	3.50	1.72	4.20	1.55	4.27	1.74	4.01

As it can be seen from Table 5.10, the slight increase in total activity rates has been a combined results of a decreasing male and an increasing female labour force participation. The growth of the work force has hence been due to a greater participation in the labour force of women and the gap between female and male activity rates has narrowed over the period. It can also be seen that regional variations are much higher for women than for men, leading to the observation that in many regions the labour force participation rate of women is steadily increasing, but in some lagging regions the activity rate increased only very moderately so that the gap between the regions increased. For a detailed analysis of female and male labour supply see for example Pencavel (1986), Killingsworth and Heckman (1986), Johns and Taylor (1996) and Perrons (1996).

5.3 Regional Attractiveness

The extended SASI model considers various measures of attractiveness, partly as additional production factors in the regional production functions, partly as pull and push factors in the migration submodel. Migration to or from a region depends partly on job opportunities and partly on the attractiveness of the region as a place to live (Fürst et al., 1999). Not only highly skilled persons but also pensioners who want to spend their retirement age at the countryside, at the shores or at other attractive places account for a large percentage of European migration flows. These flows are nearly independent of the economic situation of regions.

The migration submodel of the extended SASI model therefore includes a composite regional quality-of-life indicator derived by multi-criteria analysis (Schürmann, 1999). The indicator considers three categories, *climate*, *landscape* and *tourist facilities* (Figure 5.13). The *climate* category considers the fact that retirement migration prefers regions with warm climate and little rain. The beauty and variety of the *landscape* plays also a prominent role. The number and degree of leisure and *tourist facilities* is also an import point for many people in their decisions regarding migration targets.

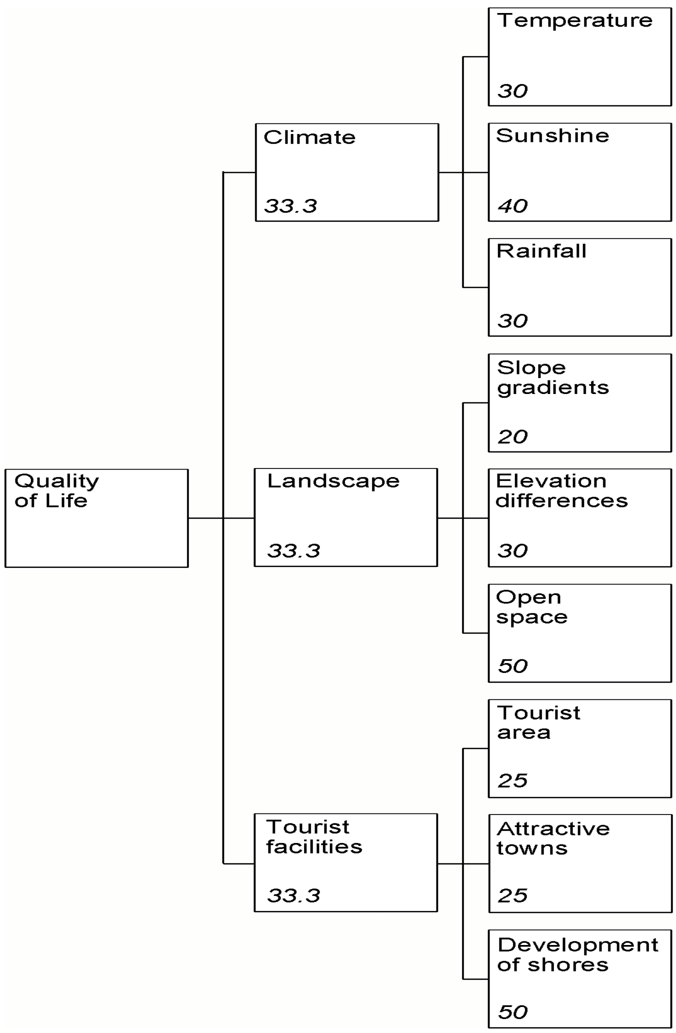

Figure 5.13. Composition of the regional quality-of-life indicator

Each of the three categories is composed of three subindicators. The resulting nine subindicators are (with the categories given in brackets):

- *Temperature* (Climate). The temperature subindicator indicates the long-term average temperatures in July expressed in degrees centigrade taken from Westermann (1997).

- *Sunshine* (Climate). The daily global radiation on the ground is used as a proxy for sunshine, because information on the number of sunshine hours for the entire European continent is not available. The radiation data are given as the average of the years 1966-1975 of the annual averages over all months in kWh/m^2 and are taken from Palz and Greif (1995).

- *Rainfall* (Climate). This subindicator is measured as the long-term average yearly amount of rain in millilitres and is based on Westermann (1997).

- *Slope gradient* (Landscape). The average slope gradients are used as a proxy for surface variety. They are derived from a three-dimensional surface elevation model of Europe produced at IRPUD (2002) and are measured in percentage slope.

- *Elevation differences* (Landscape). The elevation differences are used as a second proxy for surface variety and are also taken from the surface elevation model of IRPUD (2002). They are calculated as the difference between the maximum and minimum elevation within one region and are measured in metres.

- *Open space* (Landscape). This subindicator estimates the percentage of open space on the region's area as a function of population density and area. Population density is used as a proxy for open space mainly because of two reasons: First, figures on open space for NUTS-3 regions for the whole of Europe are not available. Second, by linking this subindicator to population development predicted by the extended SASI model, the quality-of-life indicator is made dynamic (see below).

- *Tourist area* (Tourist facilities). This subindicator represents the degree of development of regions with soft tourist facilities such as footpaths, resting places, hotels, other recreation facilities, mountain railways, tourist information services etc. This is a qualitative indicator adopted from Ritter (1966) differentiating between (a) areas which are totally influenced and formed by tourism, (b) areas which are locally influenced and formed by tourism, (c) areas which are only sparsely formed by tourist facilities, (d) areas which are not influenced and not formed by tourism and finally (e) agglomerations (no tourist regions). Figure 5.14 shows the spatial distribution of these areas.

- *Attractive towns* (Tourist facilities). This subindicator counts the numbers of historical and winter sports towns as well as the number of health and seaside resorts and relates it to the size of the region. The cities are taken from Westermann (1983).

- *Development of shores* (Tourist facilities). This subindicator represents the degree of development of tourist facilities in coastal regions. This is another qualitative indicator adopted from Ritter (1966) which differentiates between regions with (a) totally developed shores, (b) well developed shores, (c) sparsely developed shores, (d) no developed shores or (e) no shores at all. Figure 5.15 shows the resulting classification of shores.

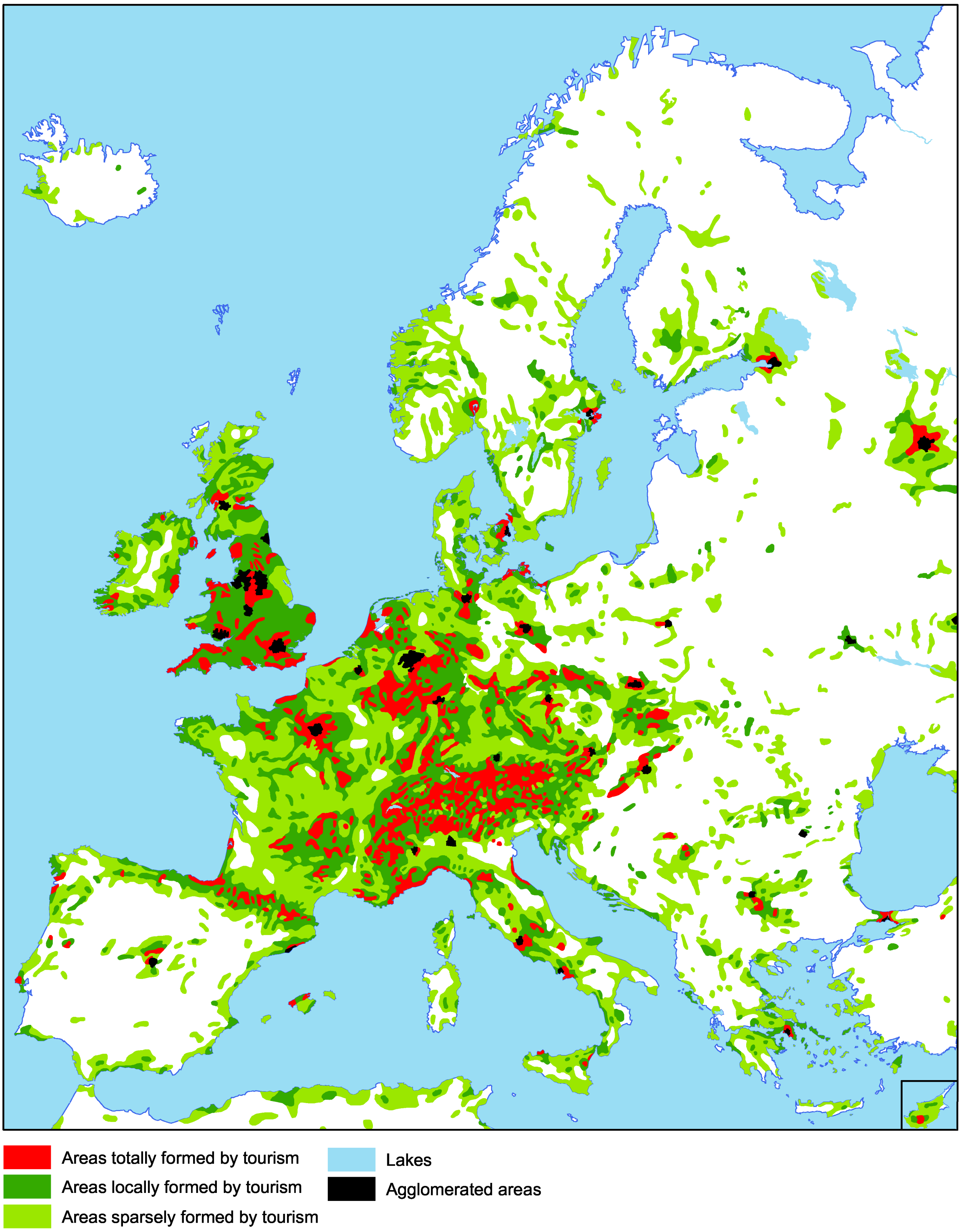

Figure 5.14. Tourist areas in Europe (Ritter, 1966)

Figure 5.15. Development of shores for recreation in Europe (Ritter, 1966)

Figure 5.13 also shows the weights of the categories and subindicators. The weights were derived through expert ratings. The three categories (climate, landscape, tourist facilities) were equally weighted with 33.3 percent each. Within the three categories, the following weights were determined:

- Within the climate category, the subindicators *temperatur*e and *rainfall* received both a weight of 30, whereas *sunshine* received a weight of 40.

- Within the landscape category, the subindicators *slope gradient* and *elevation differences* have weights of 20 and 30, respectively, i.e. taken both together as 'relief energy', they have the same weight as the *open space* subindicator (50).

- Of the tourist facilities, the main subindicator is *development of shores* with a weight of 50, whereas the subindicators *attractive towns* and *tourist area* both have a weight of 25. The assumption behind this was that seaside regions are more attractive than hinterland regions. Moreover, historical towns are to some extent an attraction factor but they are unlikely to be the only criterion in a migration choice.

Development over Time

It was assumed that the regional quality-of-life indicator is not an exogenous, static indicator but that it dynamically responds to the development of regional population. The subindicators are partly static, partly dynamic:

- The *climate* subindicators can be considered to stay constant over the forecasting period, although there might be climate changes. These changes, however, take place over long time periods so that the three climate subindicators are assumed to be constant.

- Similarly, in the *landscape* category, changes in relief energy evolve in time periods far beyond the forecasting period, so both subindicators can be assumed to stay constant. However, the share of open space may significantly change within the modelling period due to regional population growth. The open-space subindicator is therefore updated in each simulation period.

- The three subindicators of *tourist facilities* are qualitative indicators measuring the degree of development of the regions. It can be assumed that changes in the development of a region is a matter of many years and that, if development takes place, it will take place in regions which are already highly developed, so that these three subindicators can also be assumed to remain constant over the modelling period.

6 Conclusions

The work reported in this Deliverable has accomplished the objectives of Task 2.2 of IASON Work Package 2:

- Data on GDP, value added and employment, international trade, interregional flows of goods and passengers, passenger travel demand by firms and households, national accounts, including input-output information, population and labour force by region and indicators of regional attractiveness were collected for NUTS-3 regions in the EU and equivalent regions in the candidate countries and other European countries including Norway and Switzerland.

- Where data at the NUTS-3 level were not available, proxies were estimated using interpolation techniques or disaggregation from higher spatial levels from other regions with similar character.

- The IRPUD trans-European road, rail, air and inland waterway networks were refined, extended and updated to connect NUTS-3 regions and equivalent regions in the candidate and other countries and incorporate the projects of the TEN and TINA masterplans.

The IASON Common Spatial Database emerging from these efforts is a highly useful basis for regional research at the NUTS-3 level for the current European Union and the candidate countries in central, eastern, and southern Europe. Its value consists not only of the original data it contains but more importantly of the work that has been done to harmonise the data and fill data gaps.

Lessons Learned

The work on the IASON Common Spatial Database has shown that the data requirements of the two models, the extended SASI model and the new CGEurope model, go to the limits of available regional data in Europe and in many respects beyond. This is due mainly to three reasons.

- The desired spatial resolution of the two models with 1,083 NUTS-3 regions in the EU represents the most ambitious effort of disaggregate spatial modelling of the European territory to date. The resulting data requirements of the two models exceed what has been asked from data providing institutions in the past. Despite the intensive efforts of Eurostat to collect and harmonise socio-economic spatial data from the national statistical offices of the member states, high-resolution, consistent spatial data covering the whole of the European Union are still the exception.

- The data situation is even more difficult in the candidate countries of central, eastern and southern Europe. These countries have undergone, and are still experiencing, substantial changes in their social, economic and political organisation. During this transition, the emphasis and focus of data collection practices of their national statistical offices have also been subject to significant changes. In many cases the regional subdivisions of these countries were changed with the changes in political organisation and economic process.

- The emphasis of the extended SASI model on the temporal dynamics of regional development put high demands on the availability of historical time-series data extending as far back as the historical base year of SASI, 1981. This requirement has multiplied the difficulties of data collection. Even in the EU member states, data definitions and classifications and regional subdivisions have undergone many subtle changes in the past two decades. However, in the candidate countries these changes have been so dramatic that in many cases even available time-series data are almost useless.

The two modelling teams have in different ways responded to these challenges depending on their emphasis and characteristics:

- The extended SASI model requires a much greater variety of economic and demographic data than the CGEurope model, and these not only for one point in time but for as many years as possible. However, the SASI model, because of its many built-in negative feedbacks is probably more tolerant with respect to minor errors in the base-year data. Moreover, because it models developments over time, it is less dependent on the precision of the *calibration* of model parameters at base-year time. More important is the process of *validation* of the behaviour of the model by comparing its results with observed aggregate data of the backcasting period between the historical base year and the present. The Dortmund modelling team was therefore able to fill many gaps in the data by estimation.

- The CGEurope model is more parsimonious in its data requirements. It works only with data on economic activities and interactions at one point in time, the common benchmark year 1997. However, within this narrower domain, its data requirements are much more rigorous and demanding, in particular with respect to the classification of economic activities, commodities, transport and travel costs and travel purposes and modes. Moreover, central data of the CGEurope model are matrix data, such as intersectoral input-output data, international trade flows and interregional travel flows. With increasing sectoral disaggregation of the model, the number of intersectoral-interregional interactions increases rapidly, and so do the data requirements of the model. In addition, input-output information and information on trade flows is as fragmented and incoherent as the national economies in the European Union and even more so in the candidate countries are different and have different accounting principles and traditions. The modelling team at Kiel has therefore developed sophisticated strategies to combine information from very different primary and secondary sources in a consistent and comparable manner.

It is also necessary to emphasise that establishing a complex modelling database and the actual model development, including model calibration and validation, are not consecutive processes neatly occurring one after the other but occur in an iterative fashion in which the results of model calibration, experimental model runs and comparison of the tentative results with observed data are likely to lead to new or modified data requirements that could not have been anticipated at the time of the initial data collection. In this sense, this deliverable is a report on work in progress. The scope and content of the database will not be finalised before the calibration and validation of the two models will be completed.

For the same reason the CD-ROM with the data files and metadata files of the database will be distributed only after model calibration and validation have been completed.

Next Steps

At the time of this writing the Common Spatial Database is not complete. As indicated in the chapters of the Deliverable, various gaps in the data still have to be closed. Also work has still to be done to complete the data required for the candidate countries and other east-European countries with the help of the Stanisław Leszczycki Institute of Geography and Spatial Organization of the Polish Academy of Sciences (IGiPZ PAN). Finally, conversion of the data to the common data file formats developed by the two modelling teams has to be completed.

In the next work phase the two models will be calibrated and validated using the data of the Common Spatial Database and the results of the SCENES model runs.

It has been agreed between the SCENES and IASON modelling teams that the SCENES model will use the same updated version of the IRPUD strategic road, rail and inland waterways networks and that the cost functions developed for the SCENES model will be made available to the two IASON models in order to achieve the highest possible degree of comparability between the three models.

Further Research

The work on the IASON Common Spatial Database has also highlighted the need for a European system of spatial monitoring. The lack of consistent, complete and harmonised data on socio-economic development at the level of NUTS-3 regions is a serious impediment for policy analysis and project appraisal in important areas of European policy making. The future enlargement of the European Union by countries with very different social, economic and political experiences and traditions will further aggravate this impediment. A unified European spatial monitoring system with the mission to harmonise regional socio-economic data from national sources and to set standards and promote co-operation for future data generation, collection and dissemination would be of great value for the future quality of the information base for European policy making.

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8 Annex I: Description of the CD-ROM

Annex I is a description of the CD-ROM containing the Common Spatial Database. It explains the directory structure of the CD-ROM and the data formats used in the data files.

8.1 Data Files

The CD-ROM data file system follows the structure of this Deliverable. The **IASON** base directory comprises four main directories (see Figure AI.1): **REGIONS**, **EUROPEAN_DATA**, **NATIONAL_DATA**, **REGIONAL_DATA**. Each of these directories contains a number of subdirectories corresponding to the sections of this Deliverable.

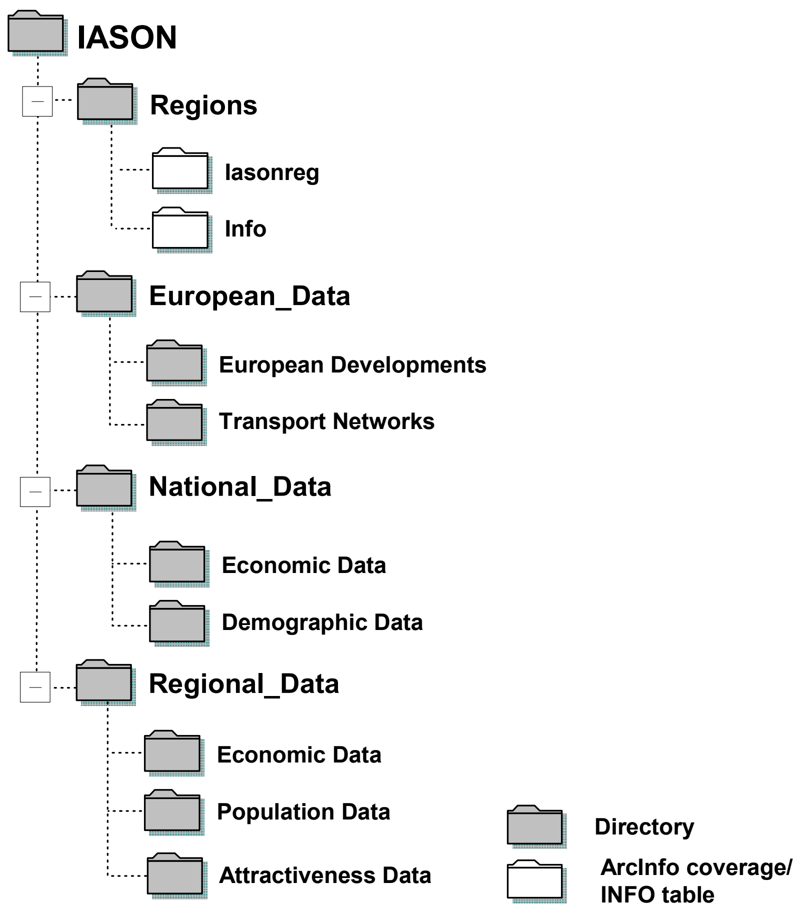

Figure AI.1. Directory structure of the CD-ROM

All data are stored in standardised ASCII files, except where indicated. The data formats of the files are explained in Section 8.2 of this Annex. As a principle, each data file is accompanied by a text file, storing metadata information on the data. The text files can be assessed using standard text editors.

8.2 Data Formats

The default name of each data file is **<NAME>.DAT** or **<NAME>.XLS** (in case of the social accounting matrices); the name of the accompanied text file describing the contents of the data file, i.e. the data sources and other relevant notes, is **<NAME>.TXT**.

To enable data exchange between the extended SASI model and the CGEurope model and to store input and output data of the two models, standard data formats were developed. The file system is mainly based on ASCII text files. As exceptions, the social accounting matrices are stored as Excel spreadsheets, and the boundaries of the IASON regions are stored as ArcInfo coverage.

The following seven standard file formats were defined:

- Region boundaries
- European Developments
- Network data
- National data
- Regional data
- Social accounting matrices
- Interregional flows

These data formats are described in the following sections.

8.2.1 Region Boundaries

The boundaries of the IASON system of regions (see Annex III) are stored and maintained in ArcInfo coverage format. The coverage is named **IASONREG** and contains arc, polygon and region feature classes. The following region subclasses representing the NUTS hierarchy are available: **NUTS0**, **NUTS1**, **NUTS2** and **NUTS3**.

Some basic information on the regions are associated with these feature classes. However, because of the size of the IASON Common Spatial Database, no regional data are associated with the coverage. National or regional data are associated with the regions at the different levels using the region codes as described in Sections 8.2.4 and 8.2.5.

Besides the standard ArcInfo attributes, the following user-defined attribute is associated with the *Arc Attribute Table* (**AAT**):

```
Attribute    width     type      contents

BOUNDARY       4      integer    Type of boundary
                                  1 = Box
                                  2 = Coast line
                                  3 = Country boundary (NUTS 0)
                                  4 = NUTS 1 boundary
                                  5 = NUTS 2 boundary
                                  6 = NUTS 3 boundary
```

The following user-defined attributes are defined with the *Polygon Attribute Table* (**PAT**):

Attribute	width	type	contents
NUTS3_CODE	6	character	NUTS 3 region code
NUTS3_NAME	25	character	Name of the NUTS 3 region
NUTS3_CENTROID	20	character	Name of the region's centroid *blank* = Centroid is not located in this polygon
STATUS	10	character	Region status *Member state* = Region is located in EU *cand12* = Region is located in one of the 12 candidate countries *cand5* = Region is located in one of the core candidate countries *external* = Region is located in on of the other European countries
NUMBER	6	integer	Region number

NUTS3_CODE and **NUTS3_NAME** represent the official region code and region name NUTS-3 regions in the European Union and equivalent regions outside the EU as provided by Eurostat (1998a; 1998b) (see Annex III). **NUTS3_CODE** can be used to link model input data and model output to the ArcInfo coverage. **NUTS3_CENTROID** gives the name of the region's centroid. Because for some island regions, one NUTS_3 region may be represented by several polygons in this coverage, **NUTS3_CENTROID** is only set for the polygon in which the centroid is located. For all other polygons belonging to the NUTS-3 region this attribute is not set.

STATUS represents the status of the regions in terms of inclusion or non-inclusion in the EU. This attribute makes it possible to select regions located in EU member states, regions belonging to candidate countries or regions which are neither located in the EU nor in candidate countries.

NUMBER represents the unique region number in the IASON system of regions. Similarly to **NUTS3_CODE**, this number may be used to join model input data or model output to the coverage (in particular with respect to matrix data).

The **NUTS3_CODE** attribute can also be used to extract the Eurostat codes for the higher NUTS levels (NUTS 2, 1 or 0), using the ArcInfo concept of 'redefined' items.

The user-defined attributes of the *NUTS 0 Region Subclass* (**PATNUTS0**) are as follows:

Attribute	width	type	contents
COUNTRY	6	character	Country code
STATUS	10	character	Region status *(see PAT)*

The user-defined attributes of the *NUTS 1 Region Subclass* (**PATNUTS1**) are as follows:

Attribute	width	type	contents
COUNTRY	6	character	Country code
NUTS1_CODE	3	character	NUTS-1 region code
STATUS	10	character	Region status *(see PAT)*

The user-defined attributes of the *NUTS 2 Region Subclass* (**PATNUTS2**) are as follows:

Attribute	width	type	contents
COUNTRY	6	character	Country code
NUTS1_CODE	3	character	NUTS-1 region code
NUTS2_CODE	4	character	NUTS-2 region code
STATUS	10	character	Region status *(see PAT)*

In addition, the ArcInfo coverage contains a *NUTS-3 region subclass* (**PATNUTS3**). In contrast to the *Polygon Attribute Table*, which treats each polygon as an individual object, this region subclass treats each NUTS-3 region as an individual object. This object may consist of one polygon or of several polygons (e.g. representing island regions). The item structures for both feature classes are the same.

8.2.2 European Developments

European developments, such as control totals for total GDP by sector, total immigration or total European transfer payments (see Section 3.1) are entered into the extended SASI model using the data format for country data files described in Section 8.2.4.

8.2.3 Network Data

Each network scenario is stored in nine *link* files (one for each year, i.e. for 1981, 1986, 1991, 1996, 2001, 2006, 2011, 2016, 2021) and one *node* file per mode. The designation of the link files is as follows:

Each link file is named **Lmmxx.yyy**, where **mm** represents the travel mode (**RO** for road, **RA** for rail, **AI** for flights and **IW** for inland waterways), **xx** indicates the year (81, 86, …, 21), and **yyy** represents the scenario number (ranging from 000 to 999). The number of records depends on the scenario, since each link file comprises all links included in the specified scenario.

The transport module of the extended SASI model requires network topology only. This means that only link-node-topology has to be extracted from the GIS, and the exact link alignment is neglected. This leads to very condensed and compact data files. Although the general structure of the link and node network data files are similar for all modes, some modifications are necessary to match the specific needs of each mode.

The general structure of the link files is as follows:

```
<from_node> <to_node> <travel_time> <parameter 1> … <parameter n>
```

The structure of the node file is similar to that of the link files. The following record format is used:

```
<node_number> <x-coord> <y-coord> <parameter 1> … <parameter n>
```

The unique `<node_number>` in the node files correspond to the `<from_node>` and `<to_node>` numbers in the link data file so that both files can be related to each other.

The CD-ROM contains link and node files for the base or reference (or business-as-usual) network scenario. As mentioned in Section 3.2.6, a *Network Scenario Generation Tool* was developed which helps to generate pre-defined standard network scenarios and to compose individual new network scenarios.

8.2.4 National Data

National data are stored in ASCII data files. Two data categories are distinguished: country data and country matrix data. Country data represent data for a series of years from 1981 until 2021, with one number per year or sequence of years for each country. Country matrix data (e.g. trade flow data) represent one number per pair of countries, where one country represents the origin and the other country the destination of flows. The two data categories are stored in different data formats.

Country Data

Each country data file consists of 45 records. Each record represents one country or group of countries. The records are organised in six groups (see Figure AI.2):

- Three records containing totals for all internal regions (EU30), for all EU member states and candidate countries (EU27) and for the European Union (EU15) are placed before the record of the first country (i.e. Austria).

- After the three records with European totals, five groups of countries follow as in Table 2.1: EU member states (15), candidate countries (12), other countries in central Europe (3), rest of Europe (11) and rest of the world (1).

Within each group of countries, the countries follow each other in alphabetical order of their Eurostat ISO code. This order is different from the order used in the tables of this Deliverable, which is based on the English names of countries.

```
   EU30    <data1   > <data2   > <data3   > <data4   > <data5   > ...
   EUZ7    <data1   > <data2   > <data3   > <data4   > <data5   > ...
   EU15    <data1   > <data2   > <data3   > <data4   > <data5   > ...
   AT      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   BE      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   DE      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   DK      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   ES      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   FI      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   FR      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   GR      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   IE      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   IT      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   LU      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   NL      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   PT      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   SE      <data1   > <data2   > <data3   > <data4   > <data5   > ...
   UK      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c BG      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c CY      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c CZ      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c EE      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c HU      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c LT      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c LV      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c MA      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c PL      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c RO      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c SI      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 c SK      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 o CH      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 o LI      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 o NO      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 r AL      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 r BA      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 r BY      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 r HR      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 r IS      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 r MD      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 r MK      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 r RU      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 r TR      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 r UA      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 r YU      <data1   > <data2   > <data3   > <data4   > <data5   > ...
 w RW      <data1   > <data2   > <data3   > <data4   > <data5   > ...
```

Figure AI.2. Standard ASCII data file for European and national data

The record format of country data files is as follows:

```
 bytes    length   type      contents

  1-  1      1   character   Country level code
                              blank = Member states
                              c = Candidate countries
                              o = Other countries in central Europe
                              r = Rest of Europe
                              w = Rest of the world
  2-  2      1     blank     ---
  3-  8      6   character   Country code
  9-  9      1     blank     ---
 10- 19     10     real      Data field 1
 20- 29     10     real      Data field 2
 30- 39     10     real      Data field 3
 40- 49     10     real      Data field 4
 50- 59     10     real      Data field 5
 60- 69     10     real      Data field 6
 70- 79     10     real      Data field 7
 80- 89     10     real      Data field 8
 90- 99     10     real      Data field 9
100-109     10     real      Data field 10
```

The first one-character field serves to distinguish EU countries from candidate countries, other countries in central Europe, from the rest of Europe and the rest of the world. EU member states are indicated by a blank, candidate countries by a 'c', other central European countries by an 'o', countries in the rest of Europe by an 'r' and the rest of the world by a 'w'.

The country code for EU member states is the official Eurostat ISO code. The Eurostat ISO country code is a two-character string. For the EFTA and candidate countries, similar two-character country codes from Eurostat are used. For the other European countries and the region representing the rest of the world analogous codes were constructed.

These country identification fields are followed by up to ten data fields of 10 bytes width each storing national data or data for Europe as a whole. Not every data file includes the maximum number of ten data fields.

Figure AI.2 shows the record format of country data files.

Country Matrix Data

Country matrix data represent relationships between pairs of countries, whereby each matrix cell represents the relationship between an origin country and a destination country. The number of rows of the matrix corresponds to the number of origin countries, and the number of columns corresponds to the number of destination countries. Accordingly, the 42 countries in the IASON system of regions (see Table 2.1) lead to a matrix of 42 columns and 42 rows. The column and row numbers are used as identifiers for the pairs of countries. Table AI.1 indicates the association of rows and column numbers with countries.

Table AI.1 Countries and column and row identifiers for matrix data files

Country	Id	Country	Id	Country	Id
Austria	1	United Kingdom	15	Norway	29
Belgium	2	Bulgaria	16	Switzerland	30
Denmark	3	Cyprus	17	Albania	31
Finland	4	Czech Republic	18	Belarus	32
France	5	Eestonia	19	Bosnia & Herzegovina	33
Germany	6	Hungary	20	Croatia	34
Greece	7	Latvia	21	Iceland	35
Ireland	8	Lithuania	22	Macedonia	36
Italy	9	Malta	23	Moldova	37
Luxembourg	10	Poland	24	Russia	38
Netherlands	11	Romania	25	Turkey	39
Portugal	12	Slovakia	26	Ukraine	40
Spain	13	Slovenia	27	Yugoslavia	41
Sweden	14	Lichtenstein	28	Rest of the world	42

Country matrices can be stored as Excel spreadsheets (see below) or ASCII matrix files. Each ASCII matrix data file can consist of several matrix blocks, i.e. for the same group of data, several matrices can be stored in one file, each separated from each other by a blank record. The total number of records in an ASCII matrix data file will then be $n*42+(n-1)$, where n is the number of matrices and there are $(n-1)$ blank records (see Figure AI.3).

```
<data  1/1> <data  1/2> <data  1/3> <data  1/4> ... <data  1/42>
<data  2/1> <data  2/2> <data  2/3> <data  2/4> ... <data  2/42>
<data  3/1> <data  3/2> <data  3/3> <data  3/4> ... <data  3/42>
...
<data 40/1> <data 40/2> <data 40/3> <data 40/4> ... <data 40/42>
<data 41/1> <data 41/2> <data 41/3> <data 41/4> ... <data 41/42>
<data 42/1> <data 42/2> <data 42/3> <data 42/4> ... <data 42/42>

<data  1/1> <data  1/2> <data  1/3> <data  1/4> ... <data  1/42>
<data  2/1> <data  2/2> <data  2/3> <data  2/4> ... <data  2/42>
<data  3/1> <data  3/2> <data  3/3> <data  3/4> ... <data  3/42>
...
<data 40/1> <data 40/2> <data 40/3> <data 40/4> ... <data 40/42>
<data 41/1> <data 41/2> <data 41/3> <data 41/4> ... <data 41/42>
<data 42/1> <data 42/2> <data 42/3> <data 42/4> ... <data 42/42>
...
```

Figure AI.3. Format structure of the ASCII matrix data files

The name of ASCII matrix files data files is **<NAME>.MAT**. As all data files, ASCII matrix files are accompanied by an ASCII text file describing their contents named **<NAME>.TXT**.

8.2.5 Regional Data

All regional data for the IASON regions are stored in ASCII region data files. ASCII files enable data exchange between the two models and provide the possibility of storing or exchanging model results.

Each record in the region data file represents one region. The order of records reflects the hierarchy of regions in the European Union represented by the four NUTS levels NUTS 0, NUTS 1, NUTS 2 and NUTS 3 and equivalent regions outside the EU.

The records in the region data files are arranged such that the groups of countries follow each other as in country data files (see Section 8.2.4 or Table 2.1). In each group of countries, the countries follow each other in alphabetical order of their Eurostat ISO code. The record of a higher-level region is followed by the records of all lower-level regions belonging to it. Three records containing totals for all internal regions (EU30), for all EU member states and candidate countries (EU27) and for the European Union (EU15) are placed before the record of the first country (Austria).

The number of records in the region data files are calculated as follows:

There are 1,093-NUTS-3 regions in the European Union. However, ten NUTS-3 regions are located outside Europe: Ceuta y Melilla and the Canarias of Spain, the Departements d'outremer Guadeloupe, Martinique, Guayane and Reunion of France and Madeira and the Acores of Portugal. The number of NUTS-3 regions in the IASON system of regions is therefore 1,083 (see Table 2.1).

In addition, there are 15 NUTS-0 regions, 78 NUTS-1 regions and 206 NUTS-2 regions in the European Union. However, because several regions belong to more than one NUTS level, the total number of higher-level regions in the EU is only 249. The number of records for the regions of the EU is therefore 1,083+249 = 1,332.

The 12 candidate countries in central, east and south Europe (Bulgaria, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia) are represented by 162 regions and 39 higher-level regions. The number of records for the candidate countries is therefore 162+39 = 201.

The three non-EU member countries in central Europe contiguous to the European Union (Liechtenstein, Norway, Switzerland) are represented by 46 regions and 5 higher-level regions; so the number of records for these regions is 46+14 = 60.

The 11 countries of the rest of Europe (Albania, Belarus, Bosnia and Herzogovina, Croatia, Iceland, Macedonia, Moldova, Russia, Turkey, Ukraine and Yugoslavia) are represented by 50 regions and 9 higher-level regions and so require 50+9 = 59 records. The region representing the rest of the world is represented by one record.

Together with the three records with European totals at the start of the files, the total number of records in the region data files is therefore 3+1,332+201+60+59+1=1,656.

The record format of the region data files is as follows:

```
  bytes length   type      contents

  1-  1   1   character    Country level code
                              blank = Member states
                              c = Candidate countries
                              o = Other central European countries
                              r = Rest of Europe
                              w = Rest of the world
  2-  2   1     blank      ---
  3-  9   7    character   Region code
 10- 15   6    character   NUTS level
 16- 19   5     blank      ---
 20- 29  10      real      Data field 1
 30- 39  10      real      Data field 2
 40- 49  10      real      Data field 3
 50- 59  10      real      Data field 4
 60- 69  10      real      Data field 5
 70- 79  10      real      Data field 6
 80- 89  10      real      Data field 7
 90- 99  10      real      Data field 8
100-109  10      real      Data field 9
110-119  10      real      Data field 10
```

The first one-character field serves to distinguish EU countries from candidate countries, other central European countries, from the rest of Europe and the rest of the world. EU member states are indicated by a blank, candidate countries by a 'c', other central European countries by an 'o', countries in the rest of Europe by an 'r' and the rest of the world by a 'w'.

The region code for EU regions is the official Eurostat code of NUTS regions. The Eurostat region code is a five-character string composed of the ISO country code followed by three characters indicating the NUTS-1 region, NUTS-2 region and NUTS-3 region, respectively. The length of the region code therefore indicates the NUTS-level of the region: NUTS-0 regions have a two-character code (consisting only of the country code), NUTS-1 regions a three-character code, and so on. For the candidate countries, similar region codes from Eurostat are used. For the other countries in central Europe, the countries in the rest of Europe and the region representing the rest of the world analogous region codes (beginning with the ISO country codes for countries in Europe) were constructed.

The NUTS-level field was introduced to simplify processing of regions that are both NUTS-2 and NUTS-3 regions or even NUTS-0, NUTS-1, NUTS-2 and NUTS-3 regions. Each character of the six-character field is associated with one of the four NUTS levels as follows: If the region is a NUTS-0 region, the first character of the field contains a '0' (zero). If the region is a NUTS-1 region, the second character is a '1'. If the region is a NUTS-2 region, the third character is a '2', and finally if the region is a NUTS 3 region, the fourth character is a '3'. Regions belonging to more than one NUTS level, have more than one entry in the NUTS level field. Analogous region level codes were constructed for external regions in Europe and the region representing the rest of the world.

These region identification fields are followed by up to ten data fields at maximum of 10 bytes width each storing regional data. However, not every data file includes the maximum number of ten data fields.

Figure AI.4 shows the general structure of these data fields.

```
   EU30     0
   EU27     0
   EU15     0
   AT       0
   AT1       1
   AT11       2
   AT111       3     <data1   > <data2   > <data3   > <data4   > ...
   AT112       3     <data1   > <data2   > <data3   > <data4   > ...
   AT113       3     <data1   > <data2   > <data3   > <data4   > ...
   AT12       2
   AT121       3     <data1   > <data2   > <data3   > <data4   > ...
   AT122       3     <data1   > <data2   > <data3   > <data4   > ...
   AT123       3     <data1   > <data2   > <data3   > <data4   > ...
   AT124       3     <data1   > <data2   > <data3   > <data4   > ...
   AT125       3     <data1   > <data2   > <data3   > <data4   > ...
   AT126       3     <data1   > <data2   > <data3   > <data4   > ...
   AT127       3     <data1   > <data2   > <data3   > <data4   > ...
   AT13       23     <data1   > <data2   > <data3   > <data4   > ...
   AT2       1
   AT21       2
   AT211       3     <data1   > <data2   > <data3   > <data4   > ...
   AT212       3     <data1   > <data2   > <data3   > <data4   > ...
   AT213       3     <data1   > <data2   > <data3   > <data4   > ...
   AT22       2
   AT221       3     <data1   > <data2   > <data3   > <data4   > ...
   AT222       3     <data1   > <data2   > <data3   > <data4   > ...
   AT223       3     <data1   > <data2   > <data3   > <data4   > ...
   AT224       3     <data1   > <data2   > <data3   > <data4   > ...
   AT225       3     <data1   > <data2   > <data3   > <data4   > ...
   AT226       3     <data1   > <data2   > <data3   > <data4   > ...
   AT3       1
   AT31       2
   AT311       3     <data1   > <data2   > <data3   > <data4   > ...
 ...
```

Figure AI.4 Standard ASCII data file for NUTS-3 regions (excerpts)

8.2.6 Matrix Data: Social Accounting Matrix

There is no fixed design for a social accounting matrix (SAM). It rather depends on the purpose to be served and on data availability. For building a SAM, information is required on national accounts, including input-output information, institutional flows of goods and services and international trade flows linking countries with each other. Since the availability of these data differs among the countries considered in IASON, all social accounting matrices show different formats. Nevertheless they fulfil the following common key features in addition to the standard accounting rules applying to a social accounting system:

(i) Commodities and activities are the same indicating that each activity just produces one particular commodity and that the number of production sectors is the same as the number of different commodities. Hence in general it is sufficient to represent intermediate demand in an activity-by-activity block of the SAM.

(ii) Productive activities are aggregated to the six sectors of IASON presented in section 2.3.3. and are abbreviated in the SAM by their assigned number.[12]

(iii) Production generates value added and requires resource input, such as labour or capital.

(iv) Sectoral final demand is differentiated by household consumption, consumption by the government as well as by consumption in the rest of the world, indicating total exports by sector.

(v) Total imports of all sectors by sector of origin are shown in an additional column next to the SAM.

In the CGEurope model information about imports is only needed for the total imports of all sectors by sector of origin. Since capital as well as labour are assumed to be immobile, resource imports and exports are not relevant for the model and consequently are not shown in the social accounting matrices.

All values of the SAM are expressed in producer prices, net of VAT, in million US dollar of the benchmark year 1997. The social accounting matrices of all countries are stored in one standard Excel file including one spreadsheet for each country. Since accounting matrices have a spreadsheet-type structure, it is common practice to store them as Excel files. The name of the file is **`SAM.XLS`**. It is accompanied by a text file named **`SAM.TXT`** describing its contents and the sources of the data.

Although the social accounting matrices all show the above described structure, the formats still differ depending on the input-output data source. Hence, the SAM format is explained separately for each input-output data source used.

---

[12] A detailed overview about the sectoral aggregation and correspondence scheme of the original datasets with the IASON sectors is given in Annex II, Section 9.1.

Social Accounting Matrices based on the Banse Dataset

The Banse dataset (see Banse, 2001) was used for constructing the SAM of the candidate countries Bulgaria, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia and Slovenia as well as of Croatia and of Albania, Bosnia Herzegovina, Macedonia and Moldova taking as a proxy the Banse data of Bulgaria, Croatia, Bulgaria and Romania respectively. Hence the social accounting matrices of these countries have the same format (Table AI.2.). Each cell of the SAM should show a value (including zero, indicating flows that did not take place), except the ones marked by "-" in the table, like imports from the foreign labour market due to factor immobility.

Table AI.2. SAM structure based on the Banse dataset

	1	2	3	4	5	6	Labour	Capital	Private households	Government	Exports	Savings, investment	Change in inventories	SUM	Imports
1															
2															
3															
4															
5															
6															
Labour															-
Capital															-
Private households															-
Tax on production															-
Tax on products															-
Tax on income and capital															-
Savings, investment															-
Change in inventories															-
SUM															

Social Accounting Matrices based on the Beutel Dataset

For all European Union Member states the updated database provided by Beutel (1999) was used for building the social accounting matrices. For Liechtenstein the data for Austria were used as a proxy. In the Beutel dataset exports and imports are differentiated by European Union member states and non-European Union member countries. This distinction was not included in the SAM system of IASON, since international trade flows are computed in a consistent way to the social accounting matrices based on additional trade information. The resulting common structure of the SAM for all these countries is as follows (Table AI.3):

Table AI.3. SAM structure based on the Beutel dataset

	1	2	3	4	5	6	Gross fixed capital formation	Private households	Government	Exports	Change in stocks	SUM	Imports
1													
2													
3													
4													
5													
6													
Labour							-	-	-	-			
Net operating surplus										-			-
Other value added										-			-
Total value added										-			-
Non-deductible VAT										-			-
Transfers of ordinary by-products										-			-
Transfers of incidental sales										-			-
Total transfers										-			-
Rest of world													-
SUM													

Social Accounting Matrices based on the GTAP Dataset

No recent input-output tables could be gathered for Belarus and Ukraine. For these countries the Former Soviet Union table from GTAP was used as a proxy. In addition the table for Turkey was constructed based on the GTAP dataset. Using GTAP results in the following common structure of the social accounting matrices (Table AI.4):

Table AI.4. SAM structure based upon the GTAP dataset

	1	2	3	4	5	6	Investments	Private households	Government	Exports	Transport margins	SUM	Imports
1													
2													
3													
4													
5													
6													
Land							-	-	-	-	-		
Labour							-	-	-	-	-		-
Capital							-	-	-	-	-		-
Natural resources							-	-	-	-	-		-
SUM													

Social Accounting Matrices based on Different National Data Sources

For the remaining countries, Norway, Russia, Switzerland and Iceland data were collected from different sources, such as the national statistical offices. Hence the SAM of each of these countries looks different but basically follows the above described structure, such that the tables are self-explaining and are not presented here.

8.2.7 Matrix Data: Interregional Flows

Interregional flow data contain movements between a region of origin and a region of destination. This kind of matrix-type information is stored in an ASCII file with each record representing the flow between two regions. A distinction is made between interregional *trade* flows and interregional passenger *travel* flows with respect to the format used.

As explained in Section 5.1.3, interregional *trade* flows at a sub-national level are not observed but will be derived from the calibrated equilibrium solution by combining information of sectoral output by region with national and international information on national accounts and international trade. Hence, trade flow data are collected at the national level and stored according to the matrix format described in section 8.2.4.

As indicated in Section 5.1.3, passenger *travel* flows are available only at the NUTS-2 or national level and not recorded at the NUTS-3 level. In addition, as indicated in Section 5.1.3, the number of origin and destination regions is reduced to the regional system of the SCENES project which has only 272 regions.[13]

Nevertheless, for a full matrix of travel flows between the 272 SCENES regions, in IASON, this would imply a file with 73,984 records. However, since flows do not take place between all regions, a sparser data representation is achieved by only recording origin-destination combinations of actual flows – zero flows are skipped. Therefore, passenger travel flows are formatted in a different way as indicated in Section 8.2.4.

The records in the file are arranged in blocks of records, where each block corresponds to one origin region. The origin regions follow each other in the same order as in the region data file (see Section 8.2.5). In each block, i.e. for each origin region, the records in the file are arranged by destination region in the same order as the origin regions. The resulting data format shows interregional flows from the first origin region (AT11) to all destination regions (e.g. AT11, AT12 and so forth) and then from the second origin region (AT12) to all destination regions and so forth.

However, travel purpose and travel mode are also distinguished. To accomplish this, the above structure is applied to each of the fifteen travel purposes of Table 5.3 starting with Purpose 11 (commuting and business short car) and ending with Purpose 25 (domestic holidays - partial and full car availability).

The same principle is applied to record the ten travel modes of Table 5.4. For each origin-destination combination of a particular travel purpose, the records are arranged in the order of travel modes used, starting with Mode 1 (car) and ending with Mode 17 (independent air travel). Modes which are not used, are not recorded. So far it has not been decided yet which travel purposes and modes will be finally used in the CGEurope model, therefore the data file includes all modes and travel purposes provided by SCENES.

[13] A detailed description of the differences between these two regional systems as well as the definitions of travel purposes and modes is presented in section 5.1.3.

The resulting record format of the file for passenger travel flows is as follows:

```
bytes  length   type       contents

 1- 2     2      real      Travel purpose code (see Table 5.3)
 3- 3     1    character   Origin area code
                              blank = Member states
                              c = Candidate countries
                              o = Other central European countries
                              r = Rest of Europe
                              w = Rest of the world
 3- 9     7    character   Origin region code
11-16     6    character   NUTS level
17-17     1    character   Destination area code
                              blank = Member states
                              c = Candidate countries
                              o = Other central European countries
                              r = Rest of Europe
                              w = Rest of the world
18-24     7    character   Destination region code
25-30     6    character   NUTS level
31-32     2      real      Travel mode code (see Table 5.4)
33-37     5      blank     ---
36-45    10      real      Data field 1
```

The data file names are **TRADE_SECTORNAME.DAT** and **TRAVEL.DAT** for international trade flows and passenger travel flows respectively. Each data file is accompanied by the text file **TRADE.TXT** and **TRAVEL.TXT**, respectively, describing the contents of the data file, data sources and additional notes.

9 Annex II: Economic Data

In this Annex, the sectoral aggregation schemes used in the models as well as the country-specific details about the computation of input-output tables are presented in detail (refer to Section 4.1).

9.1 Sectoral Aggregation Schemes

Since input-output tables had to be built from different data sources, a common level of aggregation had to be defined based on sectoral disaggregation of each dataset used. In contrast to regional data, national information usually is provided with a more detailed sectoral classification. As the evaluation of regional data and the computation of input-output tables had to be done simultaneously, input-output tables were disaggregated to the finest level possible based on national information. Therefore, the resulting input-output tables cover nine sectors corresponding to the NACE-CLIO classification (see Table AII.1.). The exact aggregation schemes for each data source are given in Tables AII.2. and AII.3. For the Banse dataset the GTAP aggregation scheme was used. Table AII.4 presents the correspondence of the nine sectors of the input-output tables with the six sectors of IASON.

Table AII.1. Mapping between NACE-CLIO and the sectors of input-output tables

NACE-CLIO			I-O tables	
Codes R6	Codes R17	Labels	Number	Abbreviation
B01	B01	Agriculture, forestry and fishery products	1	Agriculture
B06	B06	Fuel and power products	2	Energy
B30		Manufactured products	3	Manufacturing
	B13	Ferrous and non-ferrous ores and metals, other than radioactive	3	Manufacturing
	B15	Non-metallic minerals and mineral products	3	Manufacturing
	B17	Chemical products	3	Manufacturing
	B24	Metal products, machinery, equipment and electrical goods	3	Manufacturing
	B28	Transport equipment	3	Manufacturing
	B36	Food, beverages tobacco	3	Manufacturing
	B42	Textiles and clothing, leather and footwear	3	Manufacturing
	B47	Paper and printing products	3	Manufacturing
	B50	Products of various industries	3	Manufacturing
B53	B53	Construction	4	Construction
B68		Market services		
	B58	Recovery, repair, trade	5	Trade
		lodging, catering services	8	Other market services
	B60	Transport and communication services	6	Transtelcom
	B69	Services of credit and insurance institutions	7	Financial services
	B74	Other market services	8	Other market services
B86	B86	Non-market services	9	Non-market services

Table AII.2. Aggregation of EU tables of Beutel and sectors of input-output tables

	EU database Beutel		Input-output-tables
1	Agriculture, forestry and fishery products	1	Agriculture
2	Fuel and power products	2	Energy
3	Ferrous and non-ferrous ores and metals	2	Energy
4	Non-metallic mineral products	2	Energy
5	Chemical products	3	Manufacturing
6	Metal products except machinery	3	Manufacturing
7	Agricultural and industrial machinery	3	Manufacturing
8	Office and data processing machines	3	Manufacturing
9	Electrical goods	3	Manufacturing
10	Transport equipment	3	Manufacturing
11	Food, beverages, tobacco	3	Manufacturing
12	Textiles and clothing, leather and footwear	3	Manufacturing
13	Paper and printing products	3	Manufacturing
14	Rubber and plastic products	3	Manufacturing
15	Other manufacturing products	3	Manufacturing
16	Building and construction	4	Construction
17	Recovery, repair services, wholesale, retail	5	Trade
18	Lodging and catering services	8	Other market services
19	Inland transport services	6	Transtelcom
20	Maritime and air transport services	6	Transtelcom
21	Auxiliary transport services	6	Transtelcom
22	Communication services	6	Transtelcom
23	Services of credit and insurance institutions	7	Financial services
24	Other market services	8	Other market services
25	Non-market services	9	Non-market services

Table AII.3. Aggregation of GTAP and Banse data and sectors of input-output tables

GTAP			CGE-IASON	
Code	Sector	Description	Code	Description
1	PDR	Paddy rice	1	Agriculture
2	WHT	Wheat	1	Agriculture
3	GRO	Cereal grains nec	1	Agriculture
4	V_F	Vegetables, fruit, nuts	1	Agriculture
5	OSD	Oil seeds	1	Agriculture
6	C_B	Sugar cane, sugar beet	1	Agriculture
7	PFB	Plant-based fibers	1	Agriculture
8	OCR	Crops nec	1	Agriculture
9	CTL	Bovine cattle, sheep and goats, horses	1	Agriculture
10	OAP	Animal products nec	1	Agriculture
11	RMK	Raw milk	1	Agriculture
12	WOL	Wool, silk-worm cocoons	1	Agriculture
13	FOR	Forestry	1	Agriculture
14	FSH	Fishing	1	Agriculture
15	COL	Coal	2	Energy
16	OIL	Oil	2	Energy
17	GAS	Gas	2	Energy
18	OMN	Minerals nec	2	Energy
19	CMT	Bovine meat products	3	Manufacturing
20	OMT	Meat products nec	3	Manufacturing
21	VOL	Vegetable oils and fats	3	Manufacturing
22	MIL	Dairy products	3	Manufacturing
23	PCR	Processed rice	3	Manufacturing
24	SGR	Sugar	3	Manufacturing

Table AII.3. continued

	GTAP		CGE-IASON	
Code	Sector	Description	Code	Description
25	OFD	Food products nec	3	Manufacturing
26	B_T	Beverages and tobacco products	3	Manufacturing
27	TEX	Textiles	3	Manufacturing
28	WAP	Wearing apparel	3	Manufacturing
29	LEA	Leather products	3	Manufacturing
30	LUM	Wood products	3	Manufacturing
31	PPP	Paper products, publishing	3	Manufacturing
32	P_C	Petroleum, coal products	3	Manufacturing
33	CRP	Chemical, rubber, plastic products	3	Manufacturing
34	NMM	Mineral products nec	3	Manufacturing
35	I_S	Ferrous metals	3	Manufacturing
36	NFM	Metals nec	3	Manufacturing
37	FMP	Metal products	3	Manufacturing
38	MVH	Motor vehicles and parts	3	Manufacturing
39	OTN	Transport equipment nec	3	Manufacturing
40	ELE	Electronic equipment	3	Manufacturing
41	OME	Machinery and equipment nec	3	Manufacturing
42	OMF	Manufactures nec	3	Manufacturing
43	ELY	Electricity	2	Energy
44	GDT	Gas manufacture, distribution	2	Energy
45	WTR	Water	2	Energy
46	CNS	Construction	4	Construction
47	TRD	Trade	5	Trade
48	OTP	Transport nec	6	Transtelcom
49	WTP	Water transport	6	Transtelcom
50	ATP	Air transport	6	Transtelcom
51	CMN	Communication	6	Transtelcom
52	OFI	Financial services nec	7	Financial services
53	ISR	Insurance	7	Financial services
54	OBS	Business services nec	8	Other market services
55	ROS	Recreational and other services	8	Other market services
56	OSG	Public Administration, Defense, Education, Health	9	Non-market services
57	DWE	Dwellings	7	Financial services

Table AII.4. Sectors of input-output tables and SASI/CGEurope sectors

Input-output-tables		NACE Rev.1 TA6 (SASI/CGEurope sectors)	
1	Agriculture	A_B	1
2	Energy	C_E	2
3	Manufacturing	C_E	2
4	Construction	F	3
5	Trade	G_I	4
6	Transtelcom	G_I	4
7	Financial services	J_K	5
8	Other market services	G_I	4
9	Non-market services	L_P	6

9.2 Processing of Input-Output Tables of Individual Countries

In this section the country-specific details about the computation of input-output tables are presented in detail.

EU Countries

For the 15 European Union member countries the dataset provided by Beutel was used. Foreign import matrices were separately available, specified by industry of origin abroad and industry of destination domestic, one for imports from EU countries and one for imports from the rest of the world. These imports were added to domestic inputs to achieve the technology matrix of all inputs. Consequently, both import matrices (EU and non- EU imports) were summed horizontally into one column of total foreign imports by industry of origin.

Candidate Countries

For the 12 candidate countries and Croatia a full SAM was available from Banse (2001) for 1997. As already mentioned in Section 4.1, there is a one-to-one mapping between activities and commodities which implies that, as far as technology input coefficients are concerned, no distinction is made between products (commodities) and industries (activities), which implies that the off-diagonal elements in the activity (rows) and commodity (columns) table are zero. The aggregation scheme used is identical to the one given in Section 9.1. since the dataset has been developed for future integration with GTAP and therefore has the same basic sector structure as GTAP. Imports are registered by commodities and inputs of activities reflect technology, i.e. including imports.

Countries with Individual Input-Output Tables

Norway. The input-output table for Norway 1996 was received from the Norwegian Bureau of Statistics. In this table a full import matrix was given, so no additional estimates were needed.

Russia. From the Central Bureau of Statistics in Moscow a new Russian input-output table for 1997 was received. This table has only an aggregate row of imports, which, analogous to the procedure followed for the EU countries, was disaggregated to an import matrix with the GTAP data for the Former Soviet Union.

Iceland. From the Statistical Office of Iceland the latest table available was for 1992. As for the EU and Russia, also for Iceland an aggregate imports row had to be disaggregated to a matrix with GTAP import coefficients.

Switzerland. For Switzerland the Swiss Federal Statistics Office compiled a table for 1990 in co-operation with the University of Geneva. An updated version of this table for 1995 was taken from Antille et al. (2000). From the make and use tables total imports by product of origin was available.

Turkey. As the latest Turkish input-output table turned out to be the same as the one used in GTAP Version 5, for practical reason it was directly taken out of GTAP, including the import matrix. Aggregation has taken place according to the scheme mentioned in Section 9.1.

Countries with Proxies

Belarus and Ukraine. As a proxy for these countries the input-output table for the Former Soviet Union from GTAP 5 was used. This table was adapted for each country using a RAS procedure with available recent macroeconomic totals and a basic sectoral structure from the World Bank. The resulting input-output table is consistent with:

- GDP % agriculture
- GDP % manufacturing
- GDP % services
- household consumption
- government consumption
- gross fixed capital formation
- imports
- exports

all in 1996 US dollar, taken from World Bank (2002). For the Ukraine more detailed sectoral information was used from WIIW (2002) for the following sectors:

- agriculture and forestry
- industry
- construction
- transport and telecommunication
- trade
- other sectors

Macedonia. As a proxy for Macedonia, the input-output table for Bulgaria was taken as a reference. The RAS method *was* carried out identically to the procedure described above for the Former Soviet Union countries, but with more detailed information (all in Denar of 1995) from WIIW (2002):

- gross value added by sector:
- agriculture and forestry
- industry
- construction
- transport and telecommunication
- trade
- other sectors
- household consumption
- government consumption
- gross fixed capital formation
- change in stocks
- imports
- exports

Yugoslavia (Serbia and Montenegro). As mentioned above, for Serbia and Montenegro the average input-output structure of Hungary and Bulgaria was taken as a reference. The starting matrix for the RAS procedure was constructed as a simple 50% average of the column coefficients of Hungary and Bulgaria, both taken form the Banse dataset. Just as for Macedonia, the national data were taken from Banse (2001), but with a slightly different sector structure (all in 1997 US dollar):

- gross value added by sector:
- agriculture and forestry
- manufacturing
- mining and quarrying
- electricity , gas, water supply
- construction
- wholesale, retail trade, repair
- hotels, restaurants
- transport, storage and telecommunication
- financial intermediation
- real estate, renting and business activities
- public administration and defence
- other sectors
- household consumption
- government consumption
- gross fixed capital formation
- change in stocks
- imports
- exports

Bosnia, Albania, Liechtenstein, Moldavia. For these four countries additional information was too scarce for a solid RAS procedure. Instead, the proxy input-output table taken was simply scaled to the benchmark GDP for the country in question. The proxies used were:

- Bosnia: Croatia
- Albania: Bulgaria
- Liechtenstein: Austria
- Moldavia: Romania

10 Annex III: IASON Regions

Annex III shows the full list of IASON regions. The column 'Status' represents the relationship of the regions to the European Union. 'Member states' indicates regions of EU member states. 'Candidate' indicates regions of accession countries. 'OCCE' indicates regions in other countries in central Europe (Liechtenstein, Norway and Switzerland). 'External' indicates regions located in the rest of Europe and the rest of the world. The column 'Centroid' indicates the economic or population centre in the region.

The regions in Bulgaria reflect the state of February, 1999; the new NUTS-2 level is still pending legislation. The region system for Poland represents a temporary subdivision using voivodships as NUTS-2 equivalent regions, as new NUTS-1, NUTS-2 and NUTS-3 regions are still under negotiation (Eurostat, 1999b; Korcelli and Komornicki, 2002a).

Table AIII.1. IASON system of regions

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Austria	1	Mittelburgenland	AT111	Member state	Güssing
	2	Nordburgenland	AT112	Member state	Eisenstadt
	3	Südburgenland	AT113	Member state	Oberwart
	4	Mostviertel-Eisenwurzen	AT121	Member state	Amstetten
	5	Niederöstereich-Süd	AT122	Member state	Wiener Neustadt
	6	Sankt-Pölden	AT123	Member state	St. Pölten
	7	Waldviertel	AT124	Member state	Zwettl
	8	Weinviertel	AT125	Member state	Poysdorf
	9	Wiener Umland/Nordteil	AT126	Member state	Klosterneuburg
	10	Wiener Umland/Südteil	AT127	Member state	Mödling
	11	Wien	AT13	Member state	Wien
	12	Klagenfurt-Villach	AT211	Member state	Klagenfurt
	13	Oberkärnten	AT212	Member state	Spittal
	14	Unterkärnten	AT213	Member state	St. Veit
	15	Graz	AT221	Member state	Graz
	16	Liezen	AT222	Member state	Liezen
	17	Östliche Obersteiermark	AT223	Member state	Kapfenberg
	18	Oststeiermark	AT224	Member state	Fürstenfeld
	19	West-Und Südsteiermark	AT225	Member state	Wolfsberg
	20	Westliche Obersteiermark	AT226	Member state	Murat
	21	Innviertel	AT311	Member state	Riet
	22	Linz-Wels	AT312	Member state	Linz
	23	Mühlviertel	AT313	Member state	Freistadt
	24	Steyr-Kirchdorf	AT314	Member state	Kirchdorf
	25	Traunviertel	AT315	Member state	Gmunden
	26	Lungau	AT321	Member state	Tamsweg
	27	Pinzgau-Pongau	AT322	Member state	Saalfelden
	28	Salzburg Und Umgebung	AT323	Member state	Salzburg
	29	Ausserfern	AT331	Member state	Reute
	30	Innsbruck	AT332	Member state	Innsbruck
	31	Osttirol	AT333	Member state	Lienz
	32	Tiroler Oberland	AT334	Member state	Landeck
	33	Tiroler Unterland	AT335	Member state	Kufstein
	34	Bludenz-Bregenzer Wald	AT341	Member state	Bludenz
	35	Rheintal-Bodenseegebiet	AT342	Member state	Dornbirn
Belgium	36	Bruxelles/Brussel	BE1	Member state	Bruxelles
	37	Antwerpen	BE211	Member state	Antwerpen
	38	Mechelen	BE212	Member state	Mechelen
	39	Turnhout	BE213	Member state	Turnhout
	40	Hasselt	BE221	Member state	Hasselt
	41	Maaseik	BE222	Member state	Maaseik
	42	Tongeren	BE223	Member state	Tongeren
	43	Aalst	BE231	Member state	Aalst

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Belgium (cont.)	44	Dendermonde	BE232	Member state	Dendermonde
	45	Eeklo	BE233	Member state	Eeklo
	46	Gent-Arrondissement	BE234	Member state	Gent
	47	Oudenaarde	BE235	Member state	Oudenaarde
	48	Sint-Niklaas	BE236	Member state	St.Niklaas
	49	Halle-Vilvoorde	BE241	Member state	Halle
	50	Leuven	BE242	Member state	Leuven
	51	Brugge	BE251	Member state	Brugge
	52	Diksmuide	BE252	Member state	Diksmuide
	53	Ieper	BE253	Member state	Ieper
	54	Kortrijk	BE254	Member state	Kortrijk
	55	Oostende	BE255	Member state	Oostende
	56	Roeselare	BE256	Member state	Roeselare
	57	Tielt	BE257	Member state	Tielt
	58	Veurne	BE258	Member state	Veurne
	59	Brabant Wallon	BE31	Member state	Wavre
	60	Ath	BE321	Member state	Ath
	61	Charleroi	BE322	Member state	Charleroi
	62	Mons	BE323	Member state	Mons
	63	Mouscron	BE324	Member state	Mouscron
	64	Soignies	BE325	Member state	La Louviere
	65	Thuin	BE326	Member state	Thuin
	66	Tournai	BE327	Member state	Tournai
	67	Huy	BE331	Member state	Huy
	68	Liege Arrondissement	BE332	Member state	Liege
	69	Verviers	BE333	Member state	Verviers
	70	Waremme	BE334	Member state	Waremme
	71	Arlon	BE341	Member state	Arlon
	72	Bastogne	BE342	Member state	Bastogne
	73	Marche-En-Famenne	BE343	Member state	Marche-En-Famenne
	74	Neufchateau	BE344	Member state	Neufchateau
	75	Virton	BE345	Member state	Virton
	76	Dinant	BE351	Member state	Dinant
	77	Namur Arrondissement	BE352	Member state	Namur
	78	Philippeville	BE353	Member state	Philippeville
Germany	79	Stuttgart	DE111	Member state	Stuttgart
	80	Böblingen	DE112	Member state	Böblingen
	81	Esslingen	DE113	Member state	Esslingen am Neckar
	82	Göppingen	DE114	Member state	Göppingen
	83	Ludwigsburg	DE115	Member state	Ludwigsburg
	84	Rems-Murr-Kreis	DE116	Member state	Waiblingen
	85	Heilbronn	DE117	Member state	Heilbronn
	86	Heilbronn	DE118	Member state	Heilbronn
	87	Hohenlohekreis	DE119	Member state	Künzelsau
	88	Schwäbisch Hall	DE11A	Member state	Schwõbisch Hall
	89	Main-Tauber-Kreis	DE11B	Member state	Tauberbischofsheim
	90	Heidenheim	DE11C	Member state	Heidenheim an der Br
	91	Ostalbkreis	DE11D	Member state	Aalen
	92	Baden-Baden	DE121	Member state	Baden-Baden
	93	Karlsruhe	DE122	Member state	Karlsruhe
	94	Karlsruhe, Landkreis	DE123	Member state	Karlsruhe
	95	Rastatt	DE124	Member state	Rastatt
	96	Heidelberg	DE125	Member state	Heidelberg
	97	Mannheim	DE126	Member state	Mannheim
	98	Neckar-Odenwald-Kreis	DE127	Member state	Mosbach
	99	Rhein-Neckar-Kreis	DE128	Member state	Heidelberg
	100	Pforzheim	DE129	Member state	Pforzheim
	101	Calw	DE12A	Member state	Calw
	102	Enzkreis	DE12B	Member state	Pforzheim
	103	Freudenstadt	DE12C	Member state	Freudenstadt
	104	Freiburg im Breisgau	DE131	Member state	Freiburg im Breisgau
	105	Breisgau-Hochschwarzwald	DE132	Member state	Freiburg
	106	Emmendingen	DE133	Member state	Emmendingen
	107	Ortenaukreis	DE134	Member state	Offenburg
	108	Rottweil	DE135	Member state	Rottweil
	109	Schwarzwald-Baar-Kreis	DE136	Member state	Villingen-Schwenning
	110	Tuttlingen	DE137	Member state	Tuttlingen

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Germany (cont.)	111	Konstanz	DE138	Member state	Konstanz
	112	Lörrach	DE139	Member state	Lörrach
	113	Waldshut	DE13A	Member state	Waldshut-Tiengen
	114	Reutlingen	DE141	Member state	Reutlingen
	115	Tübingen, Landkreis	DE142	Member state	Tübingen
	116	Zollernalbkreis	DE143	Member state	Balingen
	117	Ulm	DE144	Member state	Ulm
	118	Alb-Donau-Kreis	DE145	Member state	Ulm
	119	Biberach	DE146	Member state	Biberach
	120	Bodenseekreis	DE147	Member state	Friedrichshafen
	121	Ravensburg	DE148	Member state	Ravensburg
	122	Sigmaringen	DE149	Member state	Sigmaringen
	123	Ingolstadt	DE211	Member state	Ingolstadt
	124	München	DE212	Member state	München
	125	Rosenheim	DE213	Member state	Rosenheim
	126	Altötting	DE214	Member state	Altötting
	127	Berchtesgadener Land	DE215	Member state	Bad Reichenhall
	128	Bad Tölz-Wolfratshausen	DE216	Member state	Bad Tölz
	129	Dachau	DE217	Member state	Dachau
	130	Ebersberg	DE218	Member state	Ebersberg
	131	Eichstätt	DE219	Member state	Eichstätt
	132	Erding	DE21A	Member state	Erding
	133	Freising	DE21B	Member state	Freising
	134	Fürstenfeldbruck	DE21C	Member state	Fürstenfeldbruck
	135	Garmisch-Partenkirchen	DE21D	Member state	Garmisch-Partenkirchen
	136	Landsberg a. Lech	DE21E	Member state	Landsberg a.Lech
	137	Miesbach	DE21F	Member state	Miesbach
	138	Mühldorf am Inn	DE21G	Member state	Mühldorf amInn
	139	München, Landkreis	DE21H	Member state	München
	140	Neuburg-Schrobenhausen	DE21I	Member state	Neuburg a.d. Donau
	141	Pfaffenhofen a. d. Ilm	DE21J	Member state	Pfaffenhofen
	142	Rosenheim.	DE21K	Member state	Rosenheim
	143	Starnberg	DE21L	Member state	Starnberg
	144	Traunstein	DE21M	Member state	Traunstein
	145	Weilheim-Schongau	DE21N	Member state	Weilheim
	146	Landshut.	DE221	Member state	Landshut
	147	Passau	DE222	Member state	Passau
	148	Straubing	DE223	Member state	Straubing
	149	Deggendorf	DE224	Member state	Deggendorf
	150	Freyung-Grafenau	DE225	Member state	Freyung
	151	Kelheim	DE226	Member state	Kelheim
	152	Landshut, Landkreis	DE227	Member state	Landshut
	153	Passau, Landkreis	DE228	Member state	Passau
	154	Regen	DE229	Member state	Regen
	155	Rottal-Inn	DE22A	Member state	Pfarrkirchen
	156	Straubing-Bogen	DE22B	Member state	Straubing
	157	Dingolfing-Landau	DE22C	Member state	Dingolfing
	158	Amberg	DE231	Member state	Amberg
	159	Regensburg	DE232	Member state	Regensburg
	160	Weiden i. d. Opf.	DE233	Member state	Weiden i.d. Opf
	161	Amberg-Sulzbach	DE234	Member state	Amberg
	162	Cham	DE235	Member state	Cham
	163	Neumarkt i.d. Opf	DE236	Member state	Neumarkt i.d. Opf.
	164	Neustadt a.d Waldnaab	DE237	Member state	Neustadt a.d. Waldnaab
	165	Regensburg, Landkreis	DE238	Member state	Regensburg
	166	Schwandorf	DE239	Member state	Schwandorf
	167	Tirschenreuth	DE23A	Member state	Tirschenreuth
	168	Bamberg	DE241	Member state	Bamberg
	169	Bayreuth	DE242	Member state	Bayreuth
	170	Coburg	DE243	Member state	Coburg
	171	Hof	DE244	Member state	Hof
	172	Bamberg, Landkreis	DE245	Member state	Bamberg
	173	Bayreuth, Landkreis	DE246	Member state	Bayreuth
	174	Coburg, Landkreis	DE247	Member state	Coburg
	175	Forchheim	DE248	Member state	Forchheim
	176	Hof, Landkreis	DE249	Member state	Hof
	177	Kronach	DE24A	Member state	Kronach
	178	Kulmbach	DE24B	Member state	Kulmbach

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Germany (cont.)	179	Lichtenfels	DE24C	Member state	Lichtenfels
	180	Wunsiedel i. Fichtelgebirge	DE24D	Member state	Wunsiedel
	181	Ansbach	DE251	Member state	Ansbach
	182	Erlangen	DE252	Member state	Erlangen
	183	Fürth	DE253	Member state	Fürth
	184	Nürnberg	DE254	Member state	Nürnberg
	185	Schwabach	DE255	Member state	Schwabach
	186	Ansbach, Landkreis	DE256	Member state	Ansbach
	187	Erlangen-Höchstadt	DE257	Member state	Erlangen
	188	Fürth, Landkreis	DE258	Member state	Fürth
	189	Nürnberger Land	DE259	Member state	Lauf a.d. Pegnitz
	190	Neustadt a. d. Aisch-Bad	DE25A	Member state	Neustadt a. d. Aisch
	191	Roth	DE25B	Member state	Roth
	192	Weissenburg-Gunzenhausen	DE25C	Member state	Weissenburg in Bayern
	193	Aschaffenburg	DE261	Member state	Aschaffenburg
	194	Schweinfurt	DE262	Member state	Schweinfurt
	195	Würzburg	DE263	Member state	Würzburg
	196	Aschaffenburg, Landkreis	DE264	Member state	Aschaffenburg
	197	Bad Kissingen	DE265	Member state	Bad Kissingen
	198	Rhön-Grabfeld	DE266	Member state	Bad Neustadt a. d. S.
	199	Hassberge	DE267	Member state	Hassfurt
	200	Kitzingen	DE268	Member state	Kitzingen
	201	Miltenberg	DE269	Member state	Miltenberg
	202	Main-Spessart	DE26A	Member state	Karlstadt
	203	Schweinfurt, Landkreis	DE26B	Member state	Schweinfurt
	204	Würzburg, Landkreis	DE26C	Member state	Würzburg
	205	Augsburg	DE271	Member state	Augsburg
	206	Kaufbeuren	DE272	Member state	Kaufbeuren
	207	Kempten (Allgäu)	DE273	Member state	Kempten
	208	Memmingen	DE274	Member state	Memmingen
	209	Aichach-Friedberg	DE275	Member state	Aichach
	210	Augsburg, Landkreis	DE276	Member state	Augsburg
	211	Dillingen a.d. Donau	DE277	Member state	Dillingen a. d. Donau
	212	Günzburg	DE278	Member state	Günzburg
	213	Neu-Ulm	DE279	Member state	Neu-Ulm
	214	Lindau (Bodensee)	DE27A	Member state	Lindau
	215	Ostallgäu	DE27B	Member state	Marktoberdorf
	216	Unterallgäu	DE27C	Member state	Mindelheim
	217	Donau-Ries	DE27D	Member state	Donauwörth
	218	Oberallgäu	DE27E	Member state	Sonthofen
	219	Berlin-West, Stadt	DE301	Member state	Berlin
	220	Berlin-Ost, Stadt	DE302	Member state	Berlin
	221	Brandenburg a. d. Havel	DE401	Member state	Brandenburg a. d. Havel
	222	Cottbus	DE402	Member state	Cottbus
	223	Frankfurt (Oder)	DE403	Member state	Frankfurt/ Oder
	224	Potsdam	DE404	Member state	Potsdam
	225	Barnim	DE405	Member state	Eberswalde
	226	Dahme-Spreewald	DE406	Member state	Löbben-Spreewald
	227	Elbe-Elster	DE407	Member state	Herzberg-Elster
	228	Havelland	DE408	Member state	Rathenow
	229	Märkisch-Oderland	DE409	Member state	Seelow
	230	Oberhavel	DE40A	Member state	Oranienburg
	231	Oberspreewald-Lausitz	DE40B	Member state	Senftenberg
	232	Oder-Spree	DE40C	Member state	Beeskow
	233	Ostprignitz-Ruppin	DE40D	Member state	Neuruppin
	234	Potsdam-Mittelmark	DE40E	Member state	Belzig
	235	Prignitz	DE40F	Member state	Perleberg
	236	Spree-Neisse	DE40G	Member state	Forst-Lausitz
	237	Teltow-Fläming	DE40H	Member state	Luckenwalde
	238	Uckermark	DE40I	Member state	Prenzlau
	239	Bremen	DE501	Member state	Bremen
	240	Bremerhaven	DE502	Member state	Bremerhaven
	241	Hamburg	DE6	Member state	Hamburg
	242	Darmstadt	DE711	Member state	Darmstadt
	243	Frankfurt am Main	DE712	Member state	Frankfurt am Main
	244	Offenbach am Main	DE713	Member state	Offenbach am Main
	245	Wiesbaden	DE714	Member state	Wiesbaden

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Germany (cont.)	246	Bergstrasse	DE715	Member state	Heppenheim-Bergstrasse
	247	Darmstadt-Dieburg	DE716	Member state	Darmstadt
	248	Gross-Gerau	DE717	Member state	Gross-Gerau
	249	Hochtaunuskreis	DE718	Member state	Bad Homburg v. d. Höh
	250	Main-Kinzig-Kreis	DE719	Member state	Hanau
	251	Main-Taunus-Kreis	DE71A	Member state	Hofheim am Taunus
	252	Odenwaldkreis	DE71B	Member state	Erbach
	253	Offenbach, Landkreis	DE71C	Member state	Offenbach
	254	Rheingau-Taunus-Kreis	DE71D	Member state	Bad Schwalbach
	255	Wetteraukreis	DE71E	Member state	Friedberg Hessen
	256	Giessen, Landkreis	DE721	Member state	Giessen
	257	Lahn-Dill-Kreis	DE722	Member state	Wetzlar
	258	Limburg-Weilburg	DE723	Member state	Limburg an der Lahn
	259	Marburg-Biedenkopf	DE724	Member state	Marburg
	260	Vogelsbergkreis	DE725	Member state	Lauterbach
	261	Kassel	DE731	Member state	Kassel
	262	Fulda	DE732	Member state	Fulda
	263	Hersfeld-Rotenburg	DE733	Member state	Bad Hersfeld
	264	Kassel, Landkreis	DE734	Member state	Kassel
	265	Schwalm-Eder-Kreis	DE735	Member state	Homberg
	266	Waldeck-Frankenberg	DE736	Member state	Korbach
	267	Werra-Meissner-Kreis	DE737	Member state	Eschwege
	268	Greifswald	DE801	Member state	Greifswald
	269	Neubrandenburg	DE802	Member state	Neubrandenburg
	270	Rostock	DE803	Member state	Rostock
	271	Schwerin	DE804	Member state	Schwerin
	272	Stralsund	DE805	Member state	Stralsund
	273	Wismar	DE806	Member state	Wismar
	274	Bad Doberan	DE807	Member state	Bad Doberan
	275	Demmin	DE808	Member state	Demmin
	276	Güstrow	DE809	Member state	Güstrow
	277	Ludwigslust	DE80A	Member state	Ludwigslust
	278	Mecklenburg-Strelitz	DE80B	Member state	Neustrelitz
	279	Müritz	DE80C	Member state	Waren
	280	Nordvorpommern	DE80D	Member state	Grimmen
	281	Nordwestmecklenburg	DE80E	Member state	Grevesmühlen
	282	Ostvorpommern	DE80F	Member state	Anklam
	283	Parchim	DE80G	Member state	Parchim
	284	Rügen	DE80H	Member state	Bergen
	285	Ücker-Randow	DE80I	Member state	Pasewalk
	286	Braunschweig	DE911	Member state	Braunschweig
	287	Salzgitter	DE912	Member state	Salzgitter
	288	Wolfsburg	DE913	Member state	Wolfsburg
	289	Gifhorn	DE914	Member state	Gifhorn
	290	Göttingen	DE915	Member state	Göttingen
	291	Goslar	DE916	Member state	Goslar
	292	Helmstedt	DE917	Member state	Helmstedt
	293	Northeim	DE918	Member state	Northeim
	294	Osterode am Harz	DE919	Member state	Osterode
	295	Peine	DE91A	Member state	Peine
	296	Wolfenbüttel	DE91B	Member state	Wolfenbüttel
	297	Hannover	DE921	Member state	Hannover
	298	Diepholz	DE922	Member state	Diepholz
	299	Hameln-Pyrmont	DE923	Member state	Hameln
	300	Hannover, Landkreis	DE924	Member state	Hannover
	301	Hildesheim	DE925	Member state	Hildesheim
	302	Holzminden	DE926	Member state	Holzminden
	303	Nienburg (Weser)	DE927	Member state	Nienburg
	304	Schaumburg	DE928	Member state	Stadthagen
	305	Celle	DE931	Member state	Celle
	306	Cuxhaven	DE932	Member state	Cuxhaven
	307	Harburg	DE933	Member state	Winsen
	308	Lüchow-Dannenberg	DE934	Member state	Lüchow
	309	Lüneburg, Landkreis	DE935	Member state	Lüneburg
	310	Osterholz	DE936	Member state	Osterholz-Scharmbeck
	311	Rotenburg (Wümme)	DE937	Member state	Rotenburg
	312	Soltau-Fallingbostel	DE938	Member state	Fallingbostel

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Germany (cont.)	313	Stade	DE939	Member state	Stade
	314	Ülzen	DE93A	Member state	Ülzen
	315	Verden	DE93B	Member state	Verden
	316	Delmenhorst	DE941	Member state	Delmenhorst
	317	Emden	DE942	Member state	Emden
	318	Oldenburg	DE943	Member state	Oldenburg
	319	Osnabrück	DE944	Member state	Osnabrück
	320	Wilhelmshaven	DE945	Member state	Wilhelmshaven
	321	Ammerland	DE946	Member state	Westerstede
	322	Aurich	DE947	Member state	Aurich
	323	Cloppenburg	DE948	Member state	Cloppenburg
	324	Emsland	DE949	Member state	Meppen
	325	Friesland	DE94A	Member state	Jever
	326	Grafschaft Bentheim	DE94B	Member state	Nordhorn
	327	Leer	DE94C	Member state	Leer
	328	Oldenburg , Landkreis	DE94D	Member state	Oldenburg
	329	Osnabrück, Landkreis	DE94E	Member state	Osnabrück
	330	Vechta	DE94F	Member state	Vechta
	331	Wesermarsch	DE94G	Member state	Brake (Unterweser)
	332	Wittmund	DE94H	Member state	Wittmund
	333	Düsseldorf	DEA11	Member state	Düsseldorf
	334	Duisburg	DEA12	Member state	Duisburg
	335	Essen	DEA13	Member state	Essen
	336	Krefeld	DEA14	Member state	Krefeld
	337	Mönchengladbach	DEA15	Member state	Mönchengladbach
	338	Mülheim a.d.Ruhr	DEA16	Member state	Mülheim
	339	Oberhausen	DEA17	Member state	Oberhausen
	340	Remscheid	DEA18	Member state	Remscheid
	341	Solingen	DEA19	Member state	Solingen
	342	Wuppertal	DEA1A	Member state	Wuppertal
	343	Kleve	DEA1B	Member state	Kleve
	344	Mettmann	DEA1C	Member state	Mettmann
	345	Neuss	DEA1D	Member state	Neuss
	346	Viersen	DEA1E	Member state	Viersen
	347	Wesel	DEA1F	Member state	Wesel
	348	Aachen	DEA21	Member state	Aachen
	349	Bonn	DEA22	Member state	Bonn
	350	Köln	DEA23	Member state	Köln
	351	Leverkusen	DEA24	Member state	Leverkusen
	352	Aachen, Landkreis	DEA25	Member state	Aachen
	353	Düren	DEA26	Member state	Dueren
	354	Erftkreis	DEA27	Member state	Bergheim
	355	Euskirchen	DEA28	Member state	Euskirchen
	356	Heinsberg	DEA29	Member state	Heinsberg
	357	Oberbergischer Kreis	DEA2A	Member state	Gummersbach
	358	Rheinisch-Bergischer-Kreis	DEA2B	Member state	Bergisch-Gladbach
	359	Rhein-Sieg-Kreis	DEA2C	Member state	Siegburg
	360	Bottrop	DEA31	Member state	Bottrop
	361	Gelsenkirchen	DEA32	Member state	Gelsenkirchen
	362	Münster	DEA33	Member state	Münster
	363	Borken	DEA34	Member state	Borken
	364	Coesfeld	DEA35	Member state	Coesfeld
	365	Recklinghausen	DEA36	Member state	Recklinghausen
	366	Steinfurt	DEA37	Member state	Steinfurt
	367	Warendorf	DEA38	Member state	Warendorf
	368	Bielefeld	DEA41	Member state	Bielefeld
	369	Gütersloh	DEA42	Member state	Gütersloh
	370	Herford	DEA43	Member state	Herford
	371	Höxter	DEA44	Member state	Höxter
	372	Lippe	DEA45	Member state	Detmold
	373	Minden-Lübbecke	DEA46	Member state	Minden
	374	Paderborn	DEA47	Member state	Paderborn
	375	Bochum	DEA51	Member state	Bochum
	376	Dortmund	DEA52	Member state	Dortmund
	377	Hagen	DEA53	Member state	Hagen
	378	Hamm	DEA54	Member state	Hamm
	379	Herne	DEA55	Member state	Herne

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Germany (cont.)	380	Ennepe-Ruhr-Kreis	DEA56	Member state	Schwelm
	381	Hochsauerlandkreis	DEA57	Member state	Meschede
	382	Märkischer Kreis	DEA58	Member state	Lüdenscheid
	383	Olpe	DEA59	Member state	Olpe
	384	Siegen-Wittgenstein	DEA5A	Member state	Siegen
	385	Soest	DEA5B	Member state	Soest
	386	Unna	DEA5C	Member state	Unna
	387	Koblenz	DEB11	Member state	Koblenz
	388	Ahrweiler	DEB12	Member state	Bad Neuenahr-Ahrweiler
	389	Altenkirchen (Westerwald)	DEB13	Member state	Altenkirchen
	390	Bad Kreuznach	DEB14	Member state	Bad Kreuznach
	391	Birkenfeld	DEB15	Member state	Birkenfeld
	392	Cochem-Zell	DEB16	Member state	Cochem
	393	Mayen-Koblenz	DEB17	Member state	Koblenz
	394	Neuwied	DEB18	Member state	Neuwied
	395	Rhein-Hunsrück-Kreis	DEB19	Member state	Simmern(Hunsrück)
	396	Rhein-Lahn-Kreis	DEB1A	Member state	Bad Ems
	397	Westerwaldkreis	DEB1B	Member state	Montabaur
	398	Trier	DEB21	Member state	Trier
	399	Bernkastel-Wittlich	DEB22	Member state	Wittlich
	400	Bitburg-Prüm	DEB23	Member state	Bitburg
	401	Daun	DEB24	Member state	Daun
	402	Trier-Saarburg	DEB25	Member state	Trier
	403	Frankenthal(Pfalz)	DEB31	Member state	Frankenthal(Pfalz)
	404	Kaiserslautern	DEB32	Member state	Kaiserslautern
	405	Landau in der Pfalz	DEB33	Member state	Landau in der Pfalz
	406	Ludwigshafen am Rhein	DEB34	Member state	Ludwigshafen am Rhein
	407	Mainz	DEB35	Member state	Mainz
	408	Neustadt an der Weinstras	DEB36	Member state	Neustadt an der Wein
	409	Pirmasens	DEB37	Member state	Pirmasens
	410	Speyer	DEB38	Member state	Speyer
	411	Worms	DEB39	Member state	Worms
	412	Zweibrücken	DEB3A	Member state	Zweibrücken
	413	Alzey-Worms	DEB3B	Member state	Alzey-Worms
	414	Bad Dürkheim	DEB3C	Member state	Bad Dürkheim
	415	Donnersbergkreis	DEB3D	Member state	Kirchheim-Bolanden
	416	Germersheim	DEB3E	Member state	Germersheim
	417	Kaiserslautern, Landkreis	DEB3F	Member state	Kaiserslautern
	418	Kusel	DEB3G	Member state	Kusel
	419	Südliche Weinstrasse	DEB3H	Member state	Landau i. d. Pfalz
	420	Ludwigshafen, Landkreis	DEB3I	Member state	Ludwigshafen a. Rhein
	421	Mainz-Bingen	DEB3J	Member state	Mainz
	422	Südwestpfalz	DEB3K	Member state	Pirmasens
	423	Stadtverband Saarbrücken	DEC01	Member state	Saarbrücken
	424	Merzig-Wadern	DEC02	Member state	Merzig
	425	Neunkirchen	DEC03	Member state	Neunkirchen
	426	Saarlouis	DEC04	Member state	Saarlouis
	427	Saarpfalz-Kreis	DEC05	Member state	Homburg
	428	Sankt Wendel	DEC06	Member state	St. Wendel
	429	Chemnitz	DED11	Member state	Chemnitz
	430	Plauen	DED12	Member state	Plauen
	431	Zwickau	DED13	Member state	Zwickau
	432	Annaberg	DED14	Member state	Annaberg-Buchholz
	433	Chemnitzer Land	DED15	Member state	Glauchau
	434	Freiberg	DED16	Member state	Freiberg
	435	Vogtlandkreis	DED17	Member state	Reichenbach
	436	Mittlerer Erzgebirgkreis	DED18	Member state	Marienberg
	437	Mittweida	DED19	Member state	Mittweida
	438	Stollberg	DED1A	Member state	Stollberg (Erzgebirge)
	439	Aue-Schwarzenberg	DED1B	Member state	Aue
	440	Zwickauer Land	DED1C	Member state	Werdau
	441	Dresden	DED21	Member state	Dresden
	442	Görlitz	DED22	Member state	Görlitz
	443	Hoyerswerda	DED23	Member state	Hoyerswerda
	444	Bautzen	DED24	Member state	Bautzen
	445	Meissen	DED25	Member state	Meissen
	446	Niederschlesischer Oberla	DED26	Member state	Görlitz

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Germany (cont.)	447	Riesa-Grossenhain	DED27	Member state	Grossenhain
	448	Löbau-Zittau	DED28	Member state	Zittau
	449	Sächsische Schweiz	DED29	Member state	Pirna
	450	Weisseritzkreis	DED2A	Member state	Dippoldiswalde
	451	Kamenz	DED2B	Member state	Kamenz
	452	Leipzig	DED31	Member state	Leipzig
	453	Delitzsch	DED32	Member state	Delitzsch
	454	Döbeln	DED33	Member state	Döbeln
	455	Leipziger Land	DED34	Member state	Leipzig
	456	Muldentalkreis	DED35	Member state	Grimma
	457	Torgau-Oschatz	DED36	Member state	Torgau
	458	Dessau	DEE11	Member state	Dessau
	459	Anhalt-Zerbst	DEE12	Member state	Zerbst
	460	Bernburg	DEE13	Member state	Bernburg
	461	Bitterfeld	DEE14	Member state	Bitterfeld
	462	Köthen	DEE15	Member state	Köthen
	463	Wittenberg	DEE16	Member state	Wittenberg
	464	Halle/Saale Stadtkreis	DEE21	Member state	Halle
	465	Burgenlandkreis	DEE22	Member state	Naumburg
	466	Mansfelder Land	DEE23	Member state	Eisleben
	467	Merseburg-Querfurt	DEE24	Member state	Merseburg
	468	Saalkreis	DEE25	Member state	Halle
	469	Sangerhausen	DEE26	Member state	Sangerhausen
	470	Weissenfels	DEE27	Member state	Weissenfels
	471	Magdeburg	DEE31	Member state	Magdeburg
	472	Aschersleben-Stassfurt	DEE32	Member state	Aschersleben
	473	Bördekreis	DEE33	Member state	Oschersleben
	474	Halberstadt	DEE34	Member state	Halberstadt
	475	Jerichower Land	DEE35	Member state	Burg
	476	Ohrekreis	DEE36	Member state	Haldensleben
	477	Stendal	DEE37	Member state	Stendal
	478	Quedlinburg	DEE38	Member state	Quedlinburg
	479	Schönebeck	DEE39	Member state	Schönebeck
	480	Wernigerode	DEE3A	Member state	Wernigerode
	481	Altmarkkreis Salzwedel	DEE3B	Member state	Salzwedel
	482	Flensburg	DEF01	Member state	Flensburg
	483	Kiel	DEF02	Member state	Kiel
	484	Lübeck	DEF03	Member state	Lübeck
	485	Neumünster	DEF04	Member state	Neumünster
	486	Dithmarschen	DEF05	Member state	Heide
	487	Herzogtum Lauenburg	DEF06	Member state	Ratzeburg
	488	Nordfriesland	DEF07	Member state	Husum
	489	Ostholstein	DEF08	Member state	Eutin
	490	Pinneberg	DEF09	Member state	Pinneberg
	491	Plön	DEF0A	Member state	Plön
	492	Rendsburg-Eckernförde	DEF0B	Member state	Rendsburg
	493	Schleswig-Flensburg	DEF0C	Member state	Schleswig
	494	Segeberg	DEF0D	Member state	Bad Segeberg
	495	Steinburg	DEF0E	Member state	Itzehoe
	496	Stormarn	DEF0F	Member state	Bad Oldesloe
	497	Erfurt	DEG01	Member state	Saalfeld
	498	Gera	DEG02	Member state	Gera
	499	Jena	DEG03	Member state	Jena
	500	Suhl	DEG04	Member state	Suhl
	501	Weimar	DEG05	Member state	Weimar
	502	Eichsfeld	DEG06	Member state	Heiligenstadt
	503	Nordhausen	DEG07	Member state	Nordhausen
	504	Unstrut-Hainich-Kreis	DEG09	Member state	Mühlhausen/Th.
	505	Kyffhäuserkreis	DEG0A	Member state	Sondershausen
	506	Schmalkalden-Meiningen	DEG0B	Member state	Meiningen
	507	Gotha	DEG0C	Member state	Gotha
	508	Sömmerda	DEG0D	Member state	Sömmerda
	509	Hildburghausen	DEG0E	Member state	Hildburghausen
	510	Ilm-Kreis	DEG0F	Member state	Arnstadt
	511	Weimarer Land	DEG0G	Member state	Apolda
	512	Sonneberg	DEG0H	Member state	Sonneberg
	513	Saalfeld-Rudolstadt	DEG0I	Member state	Saalfeld/Saale

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Germany (cont.)	514	Saale-Holzland-Kreis	DEG0J	Member state	Eisenberg
	515	Saale-Orla-Kreis	DEG0K	Member state	Schleiz
	516	Greiz	DEG0L	Member state	Greiz
	517	Altenburger Land	DEG0M	Member state	Altenburg
	518	Eisenach	DEGON	Member state	Eisenach
	519	Wartburgkreis	DEGOP	Member state	Bad Salzungen
Denmark	520	København Og Frederiksbe	DK001	Member state	København
	521	Københavns Amt	DK002	Member state	København
	522	Frederiksborg Amt	DK003	Member state	Helsingoer
	523	Roskilde Amt	DK004	Member state	Roskilde
	524	Vestsjaellands Amt	DK005	Member state	Slagelse
	525	Storstroems Amt	DK006	Member state	Naestved
	526	Bornholms Amt	DK007	Member state	Roenne
	527	Fyns Amt	DK008	Member state	Odense
	528	Soenderjyllands Amt	DK009	Member state	Aabenraa
	529	Ribe Amt	DK00A	Member state	Esbjerg
	530	Vejle Amt	DK00B	Member state	Vejle
	531	Ringkoebing Amt	DK00C	Member state	Holstebro
	532	Aarhus Amt	DK00D	Member state	Arhus
	533	Viborg Amt	DK00E	Member state	Viborg
	534	Nordjyllands Amt	DK00F	Member state	Alborg
Spain	535	La Coruna	ES111	Member state	Santiago De Composte
	536	Lugo	ES112	Member state	Lugo
	537	Orense	ES113	Member state	Orense
	538	Pontevedra	ES114	Member state	Vigo
	539	Principado de Asturias	ES12	Member state	Oviedo
	540	Cantabria	ES13	Member state	Santander
	541	Alava	ES211	Member state	Vitoria
	542	Guipuzcoa	ES212	Member state	Donostia-San Sebastian
	543	Vizcaya	ES213	Member state	Bilbao
	544	Comunidad Foral De Navarr	ES22	Member state	Pamplona
	545	La Riocha	ES23	Member state	Logrono
	546	Huesca	ES241	Member state	Hueska
	547	Teruel	ES242	Member state	Teruel
	548	Zaragoza	ES243	Member state	Zaragoza
	549	Comunidad de Madrid	ES3	Member state	Madrid
	550	Avila	ES411	Member state	Avila
	551	Burgos	ES412	Member state	Burgos
	552	Leon	ES413	Member state	Leon
	553	Palencia	ES414	Member state	Palencia
	554	Salamanca	ES415	Member state	Salamanca
	555	Segovia	ES416	Member state	Segovia
	556	Soria	ES417	Member state	Soria
	557	Valladolid	ES418	Member state	Valladolid
	558	Zamora	ES419	Member state	Zamora
	559	Albacete	ES421	Member state	Albacete
	560	Ciudad Real	ES422	Member state	Ciudad Real
	561	Cuenca	ES423	Member state	Cuenca
	562	Guadalajara	ES424	Member state	Guadalajara
	563	Toledo	ES425	Member state	Toledo
	564	Badajoz	ES431	Member state	Badajoz
	565	Caceres	ES432	Member state	Caceres
	566	Barcelona	ES511	Member state	Barcelona
	567	Girona	ES512	Member state	Girona
	568	Lleida	ES513	Member state	Lleida
	569	Tarragona	ES514	Member state	Tarragona
	570	Alicante	ES521	Member state	Alicante
	571	Castellon de la Plana	ES522	Member state	Castellon de la Plana
	572	Valencia	ES523	Member state	Valencia
	573	Islas Baleares	ES53	Member state	Palma
	574	Almeria	ES611	Member state	Almeria
	575	Cadiz	ES612	Member state	Cadiz
	576	Cordoba	ES613	Member state	Cordoba
	577	Granada	ES614	Member state	Granada
	578	Huelva	ES615	Member state	Huelva
	579	Jaen	ES616	Member state	Jaen

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Spain (cont.)	580	Malaga	ES617	Member state	Malaga
	581	Sevilla	ES618	Member state	Sevilla
	582	Región de Murcia	ES62	Member state	Murcia
Finland	583	Etelae-Savo	FI131	Member state	Mikkeli
	584	Pohjois-Savo	FI132	Member state	Joensuu
	585	Pohjois-Karjala	FI133	Member state	Joensuu
	586	Kainuu	FI134	Member state	Kajaani
	587	Keski-Suomi	FI141	Member state	Jyvaeskyla
	588	Etelä-Pohjanmaa	FI142	Member state	Kajaani
	589	Pohjanmaa	FI143	Member state	Vaasa
	590	Keski-Pohjanmaa	FI144	Member state	Kokkola
	591	Pohjois-Pohjanmaa	FI151	Member state	Oulu
	592	Lappi	FI152	Member state	Rovaniemi
	593	Uusimaa	FI161	Member state	Helsinki
	594	Itä-Uusimaa	FI162	Member state	Kotka
	595	Varsinais-Suomi	FI171	Member state	Turku Abo
	596	Satakunta	FI172	Member state	Pori
	597	Kanta-Haeme	FI173	Member state	Hämeenlinna
	598	Pirkanmaa	FI174	Member state	Tampere
	599	Päijaet-Häme	FI175	Member state	Lahti
	600	Kymenlaakso	FI176	Member state	Kouvola
	601	Etelä-Karjala	FI177	Member state	Lappeenranta
	602	Åland	FI2	Member state	Mariehamn
France	603	Paris	FR101	Member state	Paris
	604	Seine-et-Marne	FR102	Member state	Melun
	605	Yvelines	FR103	Member state	Versailles
	606	Essonne	FR104	Member state	Evry
	607	Hauts-De-Seine	FR105	Member state	Boulogne-Billancourt
	608	Seine-Saint-Denis	FR106	Member state	St. Denis
	609	Val-de-Marne	FR107	Member state	Saint-Maur
	610	Val d´Oise	FR108	Member state	Pontoise
	611	Ardennes	FR211	Member state	Charleville-Mezieres
	612	Aube	FR212	Member state	Troyes
	613	Marne	FR213	Member state	Reims
	614	Haute-Marne	FR214	Member state	Chaumont
	615	Aisne	FR221	Member state	Saint-Quentin
	616	Oise	FR222	Member state	Beauvais
	617	Somme	FR223	Member state	Amiens
	618	Eure	FR231	Member state	Evreux
	619	Seine-Maritime	FR232	Member state	Le Havre
	620	Cher	FR241	Member state	Bourges
	621	Eure-et-Loir	FR242	Member state	Chartres
	622	Indre	FR243	Member state	Chateauroux
	623	Indre-et-Loire	FR244	Member state	Tours
	624	Loir-et-Cher	FR245	Member state	Blois
	625	Loiret	FR246	Member state	Orleans
	626	Calvados	FR251	Member state	Caen
	627	Manche	FR252	Member state	Saint-Lo
	628	Orne	FR253	Member state	Alencon
	629	Cote-d´Or	FR261	Member state	Dijon
	630	Nievre	FR262	Member state	Nevers
	631	Saone-Et-Loire	FR263	Member state	Macon
	632	Yonne	FR264	Member state	Auxerre
	633	Nord	FR301	Member state	Lille
	634	Pas-de-Calais	FR302	Member state	Aras
	635	Meurthe-et-Moselle	FR411	Member state	Nancy
	636	Meuse	FR412	Member state	Verdun-sur-Meuse
	637	Moselle	FR413	Member state	Metz
	638	Vosges	FR414	Member state	Epinal
	639	Bas-Rhin	FR421	Member state	Strasbourg
	640	Haut-Rhin	FR422	Member state	Colmar
	641	Doubs	FR431	Member state	Besancon
	642	Jura	FR432	Member state	Lons-Le-Saunier
	643	Haute-Saone	FR433	Member state	Vesoul
	644	Territoire de Belfort	FR434	Member state	Belfort
	645	Loire-Atlantique	FR511	Member state	Nantes

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
France (cont.)	646	Maine-et-Loire	FR512	Member state	Angers
	647	Mayenne	FR513	Member state	Laval
	648	Sarthe	FR514	Member state	Le Mans
	649	Vendee	FR515	Member state	La Roche-sur-Yon
	650	Cotes d´Amor	FR521	Member state	Saint-Brieuc
	651	Finistere	FR522	Member state	Brest
	652	Ille-et-Vilaine	FR523	Member state	Rennes
	653	Morbihan	FR524	Member state	Lorient
	654	Charente	FR531	Member state	Angouleme
	655	Charente-Maritime	FR532	Member state	La Rochelle
	656	Deux-Sevres	FR533	Member state	Niort
	657	Vienne	FR534	Member state	Poitiers
	658	Dordogne	FR611	Member state	Perigueux
	659	Gironde	FR612	Member state	Bordeaux
	660	Landes	FR613	Member state	Mont-De-Marsan
	661	Lot-et-Garonne	FR614	Member state	Agen
	662	Pyrenees-Atlantiques	FR615	Member state	Pau
	663	Ariege	FR621	Member state	Foix
	664	Aveyron	FR622	Member state	Rodez
	665	Haute-Garonne	FR623	Member state	Toulouse
	666	Gers	FR624	Member state	Auch
	667	Lot	FR625	Member state	Cahors
	668	Hautes-Pyrenees	FR626	Member state	Tarbes
	669	Tarn	FR627	Member state	Albi
	670	Tarn-et-Garonne	FR628	Member state	Montauban
	671	Correze	FR631	Member state	Brive-la-Gaillarde
	672	Creuse	FR632	Member state	Gueret
	673	Haute-Vienne	FR633	Member state	Limoges
	674	Ain	FR711	Member state	Bourg-En-Bresse
	675	Ardeche	FR712	Member state	Privas
	676	Drome	FR713	Member state	Valence
	677	Isere	FR714	Member state	Grenoble
	678	Loire	FR715	Member state	Saint-Etienne
	679	Rhone	FR716	Member state	Lyon
	680	Savoie	FR717	Member state	Chambery
	681	Haute-Savoie	FR718	Member state	Annecy
	682	Allier	FR721	Member state	Moulins
	683	Cantal	FR722	Member state	Aurillac
	684	Haute-Loire	FR723	Member state	Le Puy
	685	Puy-De-Dome	FR724	Member state	Clermont-Ferrant
	686	Aude	FR811	Member state	Carcassonne
	687	Gard	FR812	Member state	Nimes
	688	Herault	FR813	Member state	Montpellier
	689	Lozere	FR814	Member state	Mende
	690	Pyrenees-Orientales	FR815	Member state	Perpignan
	691	Alpes-de-Haute-Provence	FR821	Member state	Digne
	692	Hautes-Alpes	FR822	Member state	Gap
	693	Alpes-Maritimes	FR823	Member state	Nice
	694	Bouches-du-Rhone	FR824	Member state	Marseille
	695	Var	FR825	Member state	Toulon
	696	Vaucluse	FR826	Member state	Avignon
	697	Corse-du-Sud	FR831	Member state	Ajaccio
	698	Haute-Corse	FR832	Member state	Bastia
Greece	699	Evros	GR111	Member state	Alexandroupolis
	700	Xanthi	GR112	Member state	Xanthi
	701	Rodopi	GR113	Member state	Komotini
	702	Drama	GR114	Member state	Drama
	703	Kavala	GR115	Member state	Kavalla
	704	Imathia	GR121	Member state	Veroia
	705	Thessaloniki	GR122	Member state	Thessaloniki
	706	Kilkis	GR123	Member state	Kilkis
	707	Pella	GR124	Member state	Yiannitsa
	708	Pieria	GR125	Member state	Katerini
	709	Serres	GR126	Member state	Serres
	710	Chalkidiki	GR127	Member state	Salonika
	711	Grevena	GR131	Member state	Grevena

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Greece (cont.)	712	Kastoria	GR132	Member state	Kastoria
	713	Kozani	GR133	Member state	Kozani
	714	Florina	GR134	Member state	Florina
	715	Karditsa	GR141	Member state	Karditsa
	716	Larisa	GR142	Member state	Larisa
	717	Magnisia	GR143	Member state	Volos
	718	Trikala	GR144	Member state	Trikala
	719	Arta	GR211	Member state	Arta
	720	Thesprotia	GR212	Member state	Parga
	721	Ioannina	GR213	Member state	Ioannina
	722	Preveza	GR214	Member state	Preveza
	723	Zakynthos	GR221	Member state	Zakynthos
	724	Kerkyra	GR222	Member state	Liapathes
	725	Kefallinia	GR223	Member state	Argostolion
	726	Lefkada	GR224	Member state	Levkas
	727	Aitoloakarnania	GR231	Member state	Aitolikon
	728	Achaia	GR232	Member state	Patrai
	729	Ileia	GR233	Member state	Pirgos
	730	Voiotia	GR241	Member state	Amfiklia
	731	Evvoia	GR242	Member state	Chalkis
	732	Evrytania	GR243	Member state	Karpenision
	733	Fthoitida	GR244	Member state	Lamia
	734	Fokida	GR245	Member state	Amfissa
	735	Argolida	GR251	Member state	Navplion
	736	Arkadia	GR252	Member state	Tripolis
	737	Korinthia	GR253	Member state	Korinthos
	738	Lakonia	GR254	Member state	Sparti
	739	Messinia	GR255	Member state	Kalamai
	740	Attiki	GR3	Member state	Athinai
	741	Lesvos	GR411	Member state	Mytilini
	742	Samos	GR412	Member state	Samos
	743	Chios	GR413	Member state	Chios
	744	Dodekanisos	GR421	Member state	Rodos
	745	Kyklades	GR422	Member state	Ermupolis
	746	Irakleio	GR431	Member state	Iraklion
	747	Lasithi	GR432	Member state	Sitia
	748	Rethymni	GR433	Member state	Rethimnon
	749	Chania	GR434	Member state	Kissamos
Ireland	750	Border	IE011	Member state	Sligo
	751	Midland	IE012	Member state	Port Laoise
	752	West	IE013	Member state	Galway
	753	Dublin	IE021	Member state	Dublin
	754	Mid-East	IE022	Member state	Naas
	755	Mid-West	IE023	Member state	Limerick
	756	South-East	IE024	Member state	Waterford
	757	South-West	IE025	Member state	Cork
Italy	758	Torino	IT111	Member state	Torino
	759	Vercelli	IT112	Member state	Vercelli
	760	Biella	IT113	Member state	Biella
	761	Verbano-Cusio-Ossola	IT114	Member state	Verbania
	762	Novara	IT115	Member state	Novara
	763	Cuneo	IT116	Member state	Cuneo
	764	Asti	IT117	Member state	Asti
	765	Alessandria	IT118	Member state	Alessandria
	766	Valle d´Aosta	IT12	Member state	Aosta
	767	Imperia	IT131	Member state	San Remo
	768	Savona	IT132	Member state	Sanona
	769	Genova	IT133	Member state	Genova
	770	La Spezia	IT134	Member state	La Spezia
	771	Varese	IT201	Member state	Varese
	772	Como	IT202	Member state	Como
	773	Lecco	IT203	Member state	Lecco
	774	Sondrio	IT204	Member state	Sondrio
	775	Milano	IT205	Member state	Milano
	776	Bergamo	IT206	Member state	Bergamo

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Italy (cont.)	777	Brescia	IT207	Member state	Brescia
	778	Pavia	IT208	Member state	Pavia
	779	Lodi	IT209	Member state	Lodi
	780	Cremona	IT20A	Member state	Cremona
	781	Mantova	IT20B	Member state	Mantova
	782	Bolzano-Bozen	IT311	Member state	Bozen
	783	Trento	IT312	Member state	Trento
	784	Verona	IT321	Member state	Verona
	785	Vicenza	IT322	Member state	Vicenza
	786	Belluno	IT323	Member state	Belluno
	787	Treviso	IT324	Member state	Treviso
	788	Venezia	IT325	Member state	Venezia
	789	Padova	IT326	Member state	Padua
	790	Rovigo	IT327	Member state	Rovigo
	791	Pordenone	IT331	Member state	Pordenone
	792	Udine	IT332	Member state	Udine
	793	Gorizia	IT333	Member state	Gorizia
	794	Trieste	IT334	Member state	Trieste
	795	Piacenza	IT401	Member state	Piacenza
	796	Parma	IT402	Member state	Parma
	797	Reggio Nell`Emilia	IT403	Member state	Reggio
	798	Modena	IT404	Member state	Modena
	799	Bologna	IT405	Member state	Bologna
	800	Ferrara	IT406	Member state	Ferrara
	801	Ravenna	IT407	Member state	Ravenna
	802	Forli-Cesena	IT408	Member state	Forli
	803	Rimini	IT409	Member state	Rimini
	804	Massa-Carrara	IT511	Member state	Massa
	805	Lucca	IT512	Member state	Lucca
	806	Pistoia	IT513	Member state	Pistoia
	807	Firenze	IT514	Member state	Florenz
	808	Prato	IT515	Member state	Prato
	809	Livorno	IT516	Member state	Livorno
	810	Pisa	IT517	Member state	Pisa
	811	Arezzo	IT518	Member state	Arezzo
	812	Siena	IT519	Member state	Siena
	813	Grosseto	IT51A	Member state	Grosseto
	814	Perugia	IT521	Member state	Perugia
	815	Terni	IT522	Member state	Terni
	816	Pesaro E Urbino	IT531	Member state	Pesaro
	817	Ancona	IT532	Member state	Ancona
	818	Macerata	IT533	Member state	Macerata
	819	Ascoli Piceno	IT534	Member state	Ascoli Piceno
	820	Viterbo	IT601	Member state	Viterbo
	821	Rieti	IT602	Member state	Rieti
	822	Rom	IT603	Member state	Rom
	823	Latina	IT604	Member state	Latina
	824	Frosinone	IT605	Member state	Frosinone
	825	L´Aquila	IT711	Member state	L´Aquila
	826	Teramo	IT712	Member state	Teramo
	827	Pescara	IT713	Member state	Pescara
	828	Chieti	IT714	Member state	Chieti
	829	Isernia	IT721	Member state	Isernia
	830	Campobasso	IT722	Member state	Campobasso
	831	Caserta	IT801	Member state	Caserta
	832	Benevento	IT802	Member state	Benevento
	833	Napoli	IT803	Member state	Napoli
	834	Avellino	IT804	Member state	Avellino
	835	Salerno	IT805	Member state	Salerno
	836	Foggia	IT911	Member state	Foggia
	836	Foggia	IT911	Member state	Foggia
	837	Bari	IT912	Member state	Bari
	838	Taranto	IT913	Member state	Tarent
	839	Brindisi	IT914	Member state	Brindisi
	840	Lecce	IT915	Member state	Lecce
	841	Potenza	IT921	Member state	Potenza
	842	Matera	IT922	Member state	Matera

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Italy (cont.)	843	Cosenza	IT931	Member state	Cosenza
	844	Crotone	IT932	Member state	Crotone
	845	Catanzaro	IT933	Member state	Catanzaro
	846	Vibo Valentia	IT934	Member state	Vibo Valentia
	847	Reggio di Calabria	IT935	Member state	Reggio di Calabria
	848	Trapani	ITA01	Member state	Trapani
	849	Palermo	ITA02	Member state	Palermo
	850	Messina	ITA03	Member state	Messina
	851	Agrigento	ITA04	Member state	Agrigento
	852	Caltanissetta	ITA05	Member state	Caltanissetta
	853	Enna	ITA06	Member state	Enna
	854	Catania	ITA07	Member state	Catania
	855	Ragusa	ITA08	Member state	Ragusa
	856	Siracusa	ITA09	Member state	Siracusa
	857	Sassari	ITB01	Member state	Sassari
	858	Nuoro	ITB02	Member state	Nuoro
	859	Oristano	ITB03	Member state	Oristano
	860	Cagliari	ITB04	Member state	Cagliari
Luxembourg	861	Luxembourg	LU	Member state	Luxembourg
Netherlands	862	Oost-Groningen	NL111	Member state	Winschoten
	863	Delfzijl en Omgeving	NL112	Member state	Appingedam
	864	Overig Groningen	NL113	Member state	Haren
	865	Noord-Friesland	NL121	Member state	Leeuwarden
	866	Zuidwest-Friesland	NL122	Member state	Sneek
	867	Zuidoost-Friesland	NL123	Member state	Drachten
	868	Noord-Drenthe	NL131	Member state	Assen
	869	Zuidoost-Drenthe	NL132	Member state	Emmen
	870	Zuidwest-Drenthe	NL133	Member state	Hoogeveen
	871	Noord-Overijssel	NL211	Member state	Zwolle
	872	Zuidwest-Overijssel	NL212	Member state	Deventer
	873	Twente	NL213	Member state	Enschede
	874	Veluwe	NL221	Member state	Apeldoorn
	875	Achterhoek	NL222	Member state	Doetinchen
	876	Arnhem/Nijmegen	NL223	Member state	Arnhem
	877	Zuidwest-Gelderland	NL224	Member state	Hertogenbosch
	878	Flevoland	NL23	Member state	Lelystad
	879	Utrecht	NL31	Member state	Utrecht
	880	Kop Van Noord-Holland	NL321	Member state	Hoorn
	881	Alkmaar en Omgeving	NL322	Member state	Alkmaar
	882	Ijmond	NL323	Member state	Ijmuiden
	883	Agglomeratie Haarlem	NL324	Member state	Haarlem
	884	Zaanstreek	NL325	Member state	Zaanstadt
	885	Groot-Amsterdam	NL326	Member state	Amsterdam
	886	Het Gooi en Vechtstreek	NL327	Member state	Hilversum
	887	Aggl. Leiden en Bollenstr	NL331	Member state	Leiden
	888	Agglomeratie S-Gravenhage	NL332	Member state	Den Haag
	889	Delft en Westland	NL333	Member state	Delft
	890	Oost Zuid-Holland	NL334	Member state	Gouda
	891	Groot-Rijnmond	NL335	Member state	Rotterdam
	892	Zuidoost Zuid-Holland	NL336	Member state	Dodrecht
	893	Zeeuwsch-Vlaanderen	NL341	Member state	Terneuzen
	894	Overig Zeeland	NL342	Member state	Middelburg
	895	West-Noord-Brabant	NL411	Member state	Rosendaal en Nispen
	896	Midden-Noord-Brabant	NL412	Member state	Tilburg
	897	Noordoost-Noord-Brabant	NL413	Member state	Oss
	898	Zuidoost-Noord-Brabant	NL414	Member state	Eindhoven
	899	Noord-Limburg	NL421	Member state	Venlo
	900	Midden-Limburg	NL422	Member state	Roermond
	901	Zuid-Limburg	NL423	Member state	Maastricht
Portugal	902	Minho-Lima	PT111	Member state	Viana Do Castelo
	903	Cavado	PT112	Member state	Braga
	904	Ave	PT113	Member state	Santo Tirso
	904	Ave	PT113	Member state	Santo Tirso
	905	Grande Porto	PT114	Member state	Porto
	906	Tamega	PT115	Member state	Vila Real
	907	Entre Douro E Vouga	PT116	Member state	Sao Joao De Madeira

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Portugal (cont.)	908	Douro	PT117	Member state	Mirandela
	909	Alto Tras-Os-Montes	PT118	Member state	Braganca
	910	Baixo Vouga	PT121	Member state	Aveiro
	911	Baixo Mondego	PT122	Member state	Coimbra
	912	Pinhal Litoral	PT123	Member state	Pombal
	913	Pinhal Interior Norte	PT124	Member state	Penela
	914	Dao-Lafoes	PT125	Member state	Viseu
	915	Pinhal Interior Sul	PT126	Member state	Serta
	916	Serra da Estrela	PT127	Member state	Gois
	917	Beira Interior Norte	PT128	Member state	Guarda
	918	Beira Interior Sul	PT129	Member state	Castelo Branco
	919	Cova da Beira	PT12A	Member state	Covilha
	920	Oeste	PT131	Member state	Leiria
	921	Grande Lisboa	PT132	Member state	Lisboa
	922	Peninsula De Setubal	PT133	Member state	Setubal
	923	Medio Tejo	PT134	Member state	Abrantes
	924	Leziria do Tejo	PT135	Member state	Santarem
	925	Alentejo Litoral	PT141	Member state	Sines
	926	Alto Alentejo	PT142	Member state	Portalegre
	927	Alentejo Central	PT143	Member state	Evora
	928	Baixo Alentejo	PT144	Member state	Beja
	929	Algarve	PT15	Member state	Faro
Sweden	930	Stockholms Län	SE011	Member state	Stockholm
	931	Uppsala Län	SE021	Member state	Uppsala
	932	Södermanlands Län	SE022	Member state	Nyköping
	933	Östergötlands Län	SE023	Member state	Linköping
	934	Örebro Län	SE024	Member state	Örebro
	935	Västmanlands Län	SE025	Member state	Västeras
	936	Blekinge Län	SE041	Member state	Karlskrona
	937	Skane Län	SE044	Member state	Malmö
	938	Värmlands Län	SE061	Member state	Karlstadt
	939	Dalamas Län	SE062	Member state	Falun
	940	Gävleborgs Län	SE063	Member state	Gävle
	941	Västernorrlands Län	SE071	Member state	Örnsköldsvik
	942	Jämtlands Län	SE072	Member state	Östersund
	943	Västerbottens Län	SE081	Member state	Umea
	944	Norrbottens Län	SE082	Member state	Lulea
	945	Jönköpings Län	SE091	Member state	Jönköping
	946	Kronobergs Län	SE092	Member state	Växjö
	947	Kalmar Län	SE093	Member state	Kalmar
	948	Gotlands Län	SE094	Member state	Visby
	949	Hallands Län	SE0A1	Member state	Halmstad
	950	Västra Götalands Län	SE0A2	Member state	Göteborg
United Kingdom	951	Hartlepool a. Stockton-On	UKC11	Member state	Stockton-on-Tees
	952	South Teesside	UKC12	Member state	Middlesbrough
	953	Darlington	UKC13	Member state	Darlington
	954	Durham Cc	UKC14	Member state	Durham
	955	Northumberland	UKC21	Member state	Blyth
	956	Tyneside	UKC22	Member state	Newcastle upon Tyne
	957	Sunderland	UKC23	Member state	Sunderland
	958	West Cumbria	UKD11	Member state	Workington
	959	East Cumbria	UKD12	Member state	Carlisle
	960	Halton and Warrington	UKD21	Member state	Warrington
	961	Cheshire Cc	UKD22	Member state	Chester
	962	Greater Manchester South	UKD31	Member state	Manchester
	963	Greater Manchester North	UKD32	Member state	Bolton
	964	Blackburn with Darwen	UKD41	Member state	Blackburn
	965	Blackpool	UKD42	Member state	Blackpool
	966	Lancashire Cc	UKD43	Member state	Preston
	967	East Merseyside	UKD51	Member state	Kirkby
	968	Liverpool	UKD52	Member state	Liverpool
	969	Sefton	UKD53	Member state	Southport
	970	Wirral	UKD54	Member state	Birkenhead
	971	Kingston Upon Hull	UKE11	Member state	Kingston upon Hull
	972	East Riding of Yorkshire	UKE12	Member state	Bridlington

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
United Kingdom (cont.)	973	Lincolnshire	UKE13	Member state	Scunthorpe
	974	York	UKE21	Member state	York
	975	North Yorkshire	UKE22	Member state	Harrogate
	976	Barnsley, Doncaster, Roth	UKE31	Member state	Rotherham
	977	Sheffield	UKE32	Member state	Sheffield
	978	Bradford	UKE41	Member state	Bradford
	979	Leeds	UKE42	Member state	Leeds
	980	Calderdale, Kirklees, Wak	UKE43	Member state	Wakefield
	981	Derby	UKF11	Member state	Derby
	982	East Derbyshire	UKF12	Member state	Chesterfield
	983	South and West Derbyshire	UKF13	Member state	Buxton
	984	Nottingham	UKF14	Member state	Nottingham
	985	North Nottinghamshire	UKF15	Member state	Mansfield
	986	South Nottinghamshire	UKF16	Member state	Newark-on-Trent
	987	Leicester	UKF21	Member state	Leicester
	988	Leicestershire Cc, Rutlan	UKF22	Member state	Hinckley
	989	Northamptonshire	UKF23	Member state	Northampton
	990	Lincolnshire	UKF3	Member state	Lincoln
	991	Herefordshire	UKG11	Member state	Hereford
	992	Worcestershire	UKG12	Member state	Worcester
	993	Warwickshire	UKG13	Member state	Warwick
	994	Telford and Wrekin	UKG21	Member state	Telford
	995	Shropshire Cc	UKG22	Member state	Shrewsbury
	996	Stoke-on-Trent	UKG23	Member state	Stoke-on-Trent
	997	Staffordshire Cc	UKG24	Member state	Newcastle under-Lyme
	998	Birmingham	UKG31	Member state	Birmingham
	999	Solihull	UKG32	Member state	Solihull
	1000	Coventry	UKG33	Member state	Coventry
	1001	Dudley and Sandwell	UKG34	Member state	Dudley
	1002	Walsall and Wolverhampton	UKG35	Member state	Wolverhampton
	1003	Peterborough	UKH11	Member state	Peterborough
	1004	Cambridgeshire	UKH12	Member state	Cambridge
	1005	Norfolk	UKH13	Member state	Norwich
	1006	Suffolk	UKH14	Member state	Ipswich
	1007	Luton	UKH21	Member state	Luton
	1008	Bedfordshire Cc	UKH22	Member state	Bedford
	1009	Hertfordshire	UKH23	Member state	Watford
	1010	Southend-on-Sea	UKH31	Member state	Southend-on-Sea
	1011	Thurrok	UKH32	Member state	Grays
	1012	Essex Cc	UKH33	Member state	Chelmsford
	1013	Inner London-West	UKI11	Member state	London
	1014	Inner London-East	UKI12	Member state	London
	1015	Outer London-E.A.N. East	UKI21	Member state	London
	1016	Outher London-South	UKI22	Member state	London
	1017	Outer London-W.A. North W	UKI23	Member state	London
	1018	Berkshire	UKJ11	Member state	Reading
	1019	Milton Keynes	UKJ12	Member state	Milton Keynes
	1020	Buckinghamshire Cc	UKJ13	Member state	Aylesbury
	1021	Oxfordshire	UKJ14	Member state	Oxford
	1022	Brighton and Hove	UKJ21	Member state	Brighton
	1023	East Sussex Cc	UKJ22	Member state	Hastings
	1024	Surrey	UKJ23	Member state	Guildford
	1025	West Sussex	UKJ24	Member state	Chichester
	1026	Portsmouth	UKJ31	Member state	Portsmouth
	1027	Southampton	UKJ32	Member state	Southampton
	1028	Hampshire Cc	UKJ33	Member state	Winchester
	1029	Isle of Wight	UKJ34	Member state	Newport
	1030	Medway	UKJ41	Member state	Chatham
	1031	Kent	UKJ42	Member state	Maidstone
	1032	Bristol	UKK11	Member state	Bristol
	1033	N. A. Ne. Somerset, South	UKK12	Member state	Bath
	1034	Gloucestershire	UKK13	Member state	Gloucester
	1035	Swindon	UKK14	Member state	Swindon
	1036	Wiltshire Cc	UKK15	Member state	Salisbury
	1037	Bournemouth and Poole	UKK21	Member state	Bournemouth
	1038	Dorset	UKK22	Member state	Dorchester
	1039	Somerset	UKK23	Member state	Taunton
	1040	Cornwall, Isle Of Scilly	UKK3	Member state	Truro

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
United Kingdom (cont.)	1041	Plymouth	UKK41	Member state	Plymouth
	1042	Torbay	UKK42	Member state	Torquay
	1043	Devon Cc	UKK43	Member state	Exeter
	1044	Isle of Anglesey	UKL11	Member state	Holyhead
	1045	Gwynedd	UKL12	Member state	Caernarfon
	1046	Conwy and Denbighshire	UKL13	Member state	Colwyn Bay
	1047	South West Wales	UKL14	Member state	Llanelli
	1048	Central Valleys	UKL15	Member state	Rhondda
	1049	Gwent Valleys	UKL16	Member state	Abertillery
	1050	Bridgend, Neath Port Talb	UKL17	Member state	Neath
	1051	Swansea	UKL18	Member state	Swansea
	1052	Monmouthshire, Newport	UKL21	Member state	Monmouth
	1053	Cardiff, Vale of Glamorga	UKL22	Member state	Cardiff
	1054	Flintshire And Wraxham	UKL23	Member state	Wrexham
	1055	Powys	UKL24	Member state	Newtown
	1056	Aberdeenshire, North East	UKM11	Member state	Aberdeen
	1057	Angus, Dundee City	UKM21	Member state	Dundee
	1058	Clackmannanshire and Fife	UKM22	Member state	Dunfermline
	1059	East Lothian And Midlothi	UKM23	Member state	Dunbar
	1060	Scottish Borders	UKM24	Member state	Gordon
	1061	Edinburgh	UKM25	Member state	Edinburgh
	1062	Falkirk	UKM26	Member state	Falkirk
	1063	Perth, Kinross, Stirling	UKM27	Member state	Stirling
	1064	West Lothian	UKM28	Member state	Livingston
	1065	East A. West Dunbartonshi	UKM31	Member state	Dumbarton
	1066	Dumfries and Galloway	UKM32	Member state	Dumfries
	1067	E.A.N. Ayrshire, Mainland	UKM33	Member state	Kilmarnock
	1068	Glasgow City	UKM34	Member state	Glasgow
	1069	Inverclyde, East Renfrews	UKM35	Member state	Paisly
	1070	North Lanarkshire	UKM36	Member state	Coatbridge
	1071	South Ayrshire	UKM37	Member state	Ayr
	1072	South Lanarkshire	UKM38	Member state	East Kilbride
	1073	Caithness,Sutherland,Ross	UKM41	Member state	Wick
	1074	Badenoch, Strathspey, Loc	UKM42	Member state	Inverness
	1075	Lochaber,Skye,Lochalsh,Ar	UKM43	Member state	Oban
	1076	Eilean Siar (Western Isle	UKM44	Member state	Stornoway
	1077	Orkney Islands	UKM45	Member state	Kirkwall
	1078	Shetland Islands	UKM46	Member state	Lerwick
	1079	Belfast	UKN01	Member state	Belfast
	1080	Outer Belfast	UKN02	Member state	Lisburn
	1081	East of Northern Ireland	UKN03	Member state	Ballymena
	1082	North of Northern Ireland	UKN04	Member state	Londonderry
	1083	W.A.S. of Notrthern Ireand	UKN05	Member state	Omagh
Bulgaria	1084	Vidin	BG011	Candidate	Vidin
	1085	Vratsa	BG012	Candidate	Vratsa
	1086	Montana	BG013	Candidate	Montana
	1087	Veliko Tumovo	BG021	Candidate	Veliko Tumovo
	1088	Gabrovo	BG022	Candidate	Gabrovo
	1089	Lovech	BG023	Candidate	Lovech
	1090	Pleven	BG024	Candidate	Pleven
	1091	Ruse	BG025	Candidate	Ruse
	1092	Varna	BG031	Candidate	Varna
	1093	Dobrich	BG032	Candidate	Dobrich
	1094	Razgrad	BG033	Candidate	Razgrad
	1095	Silistra	BG034	Candidate	Silistra
	1096	Targovishte	BG035	Candidate	Targovishte
	1097	Shumen	BG036	Candidate	Shumen
	1098	Sofia stolitsa	BG041	Candidate	Sofia stolitsa
	1099	Blagoevgrad	BG042	Candidate	Blagoevgrad
	1100	Kyustendil	BG043	Candidate	Kyustendil
	1101	Pemik	BG044	Candidate	Pemik
	1102	Sofia	BG045	Candidate	Sofia
	1103	Kurdjali	BG051	Candidate	Kurdjali
	1104	Pazardzhik	BG052	Candidate	Pazardzhik
	1105	Plovdiv	BG053	Candidate	Plovdiv
	1106	Smolyan	BG054	Candidate	Smolyan
	1107	Stara Zagora	BG055	Candidate	Stara Zagora

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Bulgaria (cont.)	1108	Haskovo	BG056	Candidate	Haskovo
	1109	Burgas	BG061	Candidate	Burgas
	1110	Sliven	BG062	Candidate	Sliven
	1111	Yambol	BG063	Candidate	Yambol
Cyprus	1112	Cyprus	CY	Candidate	Nicosia
Czech Republic	1113	Praha	CZ01	Candidate	Praha
	1114	Stredocesky	CZ02	Candidate	Kladno
	1115	Ceskobudejovicky	CZ031	Candidate	Ceske Budejovice
	1116	Plzensky	CZ032	Candidate	Plzen
	1117	Karlovarsky	CZ041	Candidate	Karlovy Vary
	1118	Ustecky	CZ042	Candidate	Teplice
	1119	Liberecky	CZ051	Candidate	Liberec
	1120	Kralovehradecky	CZ052	Candidate	Hradec Kralove
	1121	Pardubicky	CZ053	Candidate	Pardubice
	1122	Jihlavsky	CZ061	Candidate	Jihlava
	1123	Brnensky	CZ062	Candidate	Brno
	1124	Olomoucky	CZ071	Candidate	Olomouc
	1125	Zlinsky	CZ072	Candidate	Zlin
	1126	Ostravsky	CZ08	Candidate	Ostrava
Estonia	1127	Pohja-Eesti	EE001	Candidate	Tallin
	1128	Kesk-Eesti	EE002	Candidate	Paide
	1129	Kirde-Eesti	EE003	Candidate	Kohtla-Jaerve
	1130	Laeaene-Eesti	EE004	Candidate	Paernu
	1131	Louna-Eesti	EE005	Candidate	Tartu
Hungary	1132	Budapest	HU011	Candidate	Budapest
	1133	Pest	HU012	Candidate	Goedoelloe
	1134	Fejer	HU021	Candidate	Szekesfehervar
	1135	Komarom-Esztergom	HU022	Candidate	Tatabanya
	1136	Veszprem	HU023	Candidate	Veszprem
	1137	Gyor-Moson-Sopron	HU031	Candidate	Gyoer
	1138	Vas	HU032	Candidate	Szombathely
	1139	Zala	HU033	Candidate	Zalaegerszeg
	1140	Baranya	HU041	Candidate	Pecs
	1141	Somogy	HU042	Candidate	Kaposvar
	1142	Tolna	HU043	Candidate	Szekszard
	1143	Borsod-Abauj-Zemplen	HU051	Candidate	Miskolc
	1144	Heves	HU052	Candidate	Eger
	1145	Nograd	HU053	Candidate	Salgotarjan
	1146	Hajdu-Bihar	HU061	Candidate	Debrecen
	1147	Jasz-Nagykun-Szolnok	HU062	Candidate	Szolnok
	1148	Szabolcs-Szatmar-Bereg	HU063	Candidate	Nyiregyhaza
	1149	Bacs-Kiskun	HU071	Candidate	Kecskemet
	1150	Bekes	HU072	Candidate	Bekescsaba
	1151	Csongrad	HU073	Candidate	Szeged
Lithuania	1152	Alytaus (Apskritis)	LT001	Candidate	Alytus
	1153	Kauno (Apskritis)	LT002	Candidate	Kaunas
	1154	Klaipedos (Apskritis)	LT003	Candidate	Klaipeda
	1155	Marijampoles (Apskritis)	LT004	Candidate	Marijampole
	1156	Panevezio (Apskritis)	LT005	Candidate	Panevezys
	1157	Siauliu (Apskritis)	LT006	Candidate	Siauliai
	1158	Taurages (Apskritis)	LT007	Candidate	Taurage
	1159	Telsiu (Apskritis)	LT008	Candidate	Plunge
	1160	Utenos (Apskritis)	LT009	Candidate	Utena
	1161	Vilniaus (Apskritis)	LT00A	Candidate	Vilnius
Latvia	1162	Riga	LV001	Candidate	Riga
	1163	Vidzeme	LV002	Candidate	Valmiera
	1164	Kurzeme	LV003	Candidate	Liepaja
	1165	Kurzeme	LV004	Candidate	Jelgava
	1166	Latgale	LV005	Candidate	Daugavpils
Malta	1167	Malta	MA	Candidate	Valetta
Poland	1168	Dolnoslaskie	PL01	Candidate	Wroclaw
	1169	Kujawsko-Pomorskie	PL02	Candidate	Torun

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Poland (cont.)	1170	Lubelskie	PL03	Candidate	Lublin
	1171	Lubuskie	PL04	Candidate	Zielona Gora
	1172	Lódzkie	PL05	Candidate	Lodz
	1173	Malopolskie	PL06	Candidate	Krakow
	1174	Mazowieckie	PL07	Candidate	Warszawa
	1175	Opolskie	PL08	Candidate	Opole
	1176	Podkarpackie	PL09	Candidate	Rzeszow
	1177	Podlaskie	PL0A	Candidate	Bialystok
	1178	Pomorskie	PL0B	Candidate	Gdansk
	1179	Slaskie	PL0C	Candidate	Katowice
	1180	Swietokrzyskie	PL0D	Candidate	Kielce
	1181	Warminsko-Mazurskie	PL0E	Candidate	Elblag
	1182	Wielkopolskie	PL0F	Candidate	Poznan
	1183	Zachodniopomorskie	PL0G	Candidate	Szczecin
Romania	1184	Bacau	RO011	Candidate	Bacau
	1185	Botosani	RO012	Candidate	Botosani
	1186	Iasi	RO013	Candidate	Iasi
	1187	Neamt	RO014	Candidate	Piatra-Neamt
	1188	Suceava	RO015	Candidate	Suceava
	1189	Vaslui	RO016	Candidate	Vaslui
	1190	Braila	RO021	Candidate	Braila
	1191	Buzau	RO022	Candidate	Buzau
	1192	Constanta	RO023	Candidate	Constanta
	1193	Galati	RO024	Candidate	Galati
	1194	Tulcea	RO025	Candidate	Tulcea
	1195	Vrancea	RO026	Candidate	Focsani
	1196	Arges	RO031	Candidate	Pitesti
	1197	Calarasi	RO032	Candidate	Calarasi
	1198	Dambovita	RO033	Candidate	Tirgoviste
	1199	Giurgiu	RO034	Candidate	Giurgiu
	1200	Ialomita	RO035	Candidate	Slobozia
	1201	Prahova	RO036	Candidate	Ploiesti
	1202	Teleorman	RO037	Candidate	Alexandria
	1203	Dolj	RO041	Candidate	Craiova
	1204	Gorj	RO042	Candidate	Tirgu Jiu
	1205	Mehedinti	RO043	Candidate	Drobeta-Turnu Severi
	1206	Olt	RO044	Candidate	Slatina
	1207	Valcea	RO045	Candidate	Rimnicu Vilcea
	1208	Arad	RO051	Candidate	Arad
	1209	Caras-Severin	RO052	Candidate	Resita
	1210	Hunedoara	RO053	Candidate	Deva
	1211	Timis	RO054	Candidate	Timisoara
	1212	Bihor	RO061	Candidate	Oradea
	1213	Bistrita-Nasaud	RO062	Candidate	Bistrita
	1214	Cluj	RO063	Candidate	Cluj-Napoca
	1215	Maramures	RO064	Candidate	Baia Mare
	1216	Satu Mare	RO065	Candidate	Satu Mare
	1217	Salaj	RO066	Candidate	Zalau
	1218	Alba	RO071	Candidate	Alba Iulia
	1219	Brasov	RO072	Candidate	Brasov
	1220	Covasna	RO073	Candidate	Sfintu Gheorghe
	1221	Harghita	RO074	Candidate	Miercurea-Ciuc
	1222	Mures	RO075	Candidate	Tirgu Mures
	1223	Sibiu	RO076	Candidate	Sibiu
	1224	Bucuresti	RO081	Candidate	Bucuresti
	1225	Ilfov	RO082	Candidate	Afumati
Slovenia	1226	Pomurska	SI001	Candidate	Murska Sobota
	1227	Podravska	SI002	Candidate	Maribor
	1228	Koroska	SI003	Candidate	Ravne Na Koroskem
	1229	Savinjska	SI004	Candidate	Celje
	1230	Zasavska	SI005	Candidate	Trbovlje
	1231	Spodnjeposavska	SI006	Candidate	Brezice
	1232	Dolenjska	SI007	Candidate	Novo Mesto
	1233	Osrednjeslovenska	SI008	Candidate	Ljubljana
	1234	Gorenjska	SI009	Candidate	Kranj

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Slovenia (cont.)	1235	Notranjsko-Kraska	SI00A	Candidate	Postojna
	1236	Goriska	SI00B	Candidate	Nova Gorica
	1237	Obalno-Kraska	SI00C	Candidate	Kozina
Slovakia	1238	Bratislavsky Kraj	SK01	Candidate	Bratislava
	1239	Tmavsky Kraj	SK021	Candidate	Trnava
	1240	Trenciansky Kraj	SK022	Candidate	Trencin
	1241	Nitriansky Kraj	SK023	Candidate	Nitra
	1242	Zilinsky Kraj	SK031	Candidate	Zilina
	1243	Banskobystricky Kraj	SK032	Candidate	Banska Bystrica
	1244	Presovsky Kraj	SK041	Candidate	Presov
	1245	Kosicky Kraj	SK042	Candidate	Kosice
Switzerland	1246	Vaud	CH011	OCCE	Lausanne
	1247	Valais	CH012	OCCE	Sion
	1248	Geneve	CH013	OCCE	Geneve
	1249	Bern	CH021	OCCE	Bern
	1250	Freiburg	CH022	OCCE	Fribourg
	1251	Solothurn	CH023	OCCE	Solothurn
	1252	Neuchatel	CH024	OCCE	Neuchatel
	1253	Jura	CH025	OCCE	Delemont
	1254	Basel-Stadt	CH031	OCCE	Basel
	1255	Basel-Landschaft	CH032	OCCE	Liestal
	1256	Aargau	CH033	OCCE	Aarau
	1257	Zuerich	CH04	OCCE	Zuerich
	1258	Glarus	CH051	OCCE	Glarus
	1259	Schaffhausen	CH052	OCCE	Schaffhausen
	1260	Appenzell-Ausserrhoden	CH053	OCCE	Herisau
	1261	Appenzell-Innerrhoden	CH054	OCCE	Appenzell
	1262	St.Gallen	CH055	OCCE	St.Gallen
	1263	Graubuenden	CH056	OCCE	Chur
	1264	Thurgau	CH057	OCCE	Frauenfeld
	1265	Luzern	CH061	OCCE	Luzern
	1266	Uri	CH062	OCCE	Altdorf
	1267	Schwyz	CH063	OCCE	Schwyz
	1268	Obwalden	CH064	OCCE	Sarnen
	1269	Nidwalden	CH065	OCCE	Stans
	1270	Zug	CH066	OCCE	Zug
	1271	Ticino	CH07	OCCE	Bellinzona
Liechtenstein	1272	Liechtenstein	LI	OCCE	Vaduz
Norway	1273	Oslo	NO011	OCCE	Oslo
	1274	Akershus	NO012	OCCE	Lillestroem
	1275	Hedmark	NO021	OCCE	Hamar
	1276	Oppland	NO022	OCCE	Lillehammer
	1277	Ïstfold	NO031	OCCE	Moss
	1278	Buskerud	NO032	OCCE	Drammen
	1279	Vestfold	NO033	OCCE	Tonsberg
	1280	Telemark	NO034	OCCE	Skien
	1281	Aust-Agder	NO041	OCCE	Arendal
	1282	Vest-Agder	NO042	OCCE	Kristiansand
	1283	Rogaland	NO043	OCCE	Stavanger
	1284	Hordaland	NO051	OCCE	Bergen
	1285	Sogn Og Fjordane	NO052	OCCE	Hermansverk
	1286	Mïre Og Romsdal	NO053	OCCE	Molde
	1287	Sïr-Trïndelag	NO061	OCCE	Trondheim
	1288	Nord-Trïndelag	NO062	OCCE	Steinkjer
	1289	Nordland	NO071	OCCE	Bodo
	1290	Troms	NO072	OCCE	Tromso
	1291	Finnmark	NO073	OCCE	Vadso
Albania	1292	Shqiperia	AL	External	Tirane
Bosnia and Herzegovina	1293	Bosna i Hercegovina	BA	External	Sarajevo

OCCE = Other country in central Europe

Table AIII.1. IASON system of regions (cont.)

Country	No	Region	NUTS-3 or equivalent code	Status	Centroid
Belarus	1294	Minsk	BY001	External	Minsk
	1295	Witebsk	BY002	External	Witebsk
	1296	Mogiljow	BY003	External	Mogiljow
	1297	Gomel	BY004	External	Gomel
	1298	Brest	BY005	External	Brest
	1299	Grodno	BY006	External	Grodno
Croatia	1300	Zagreb	HR001	External	Zagreb
	1301	Dalmatija	HR002	External	Split
Iceland	1302	Island	IS	External	Reykjavik
Moldova	1303	Moldova	MD	External	Chisinau
Macedonia	1304	Republica Makedonija	MK	External	Skopje
Russia	1305	Archangelskaja Oblast	RU101	External	Archangelsk
	1306	Vologodskaja Oblast	RU102	External	Vologda
	1307	Murmanskaja Oblast	RU103	External	Murmansk
	1308	Karelijal, Republika	RU104	External	Petrozavodsk
	1309	Komi, Respublika	RU105	External	Uchta
	1310	Neneckij avtonomnyi okrug	RU106	External	Narjan Mar
	1311	Leningradskaja Oblast	RU201	External	Petrodvorec
	1312	Sankt-Peterburg, gorod	RU202	External	Sankt Peterburg
	1313	Novgorodskaja Oblast	RU203	External	Novgorod
	1314	Pskovskaja Oblast	RU204	External	Pskov
	1315	Brjanskaja Oblast	RU301	External	Brjansk
	1316	Vladimirskaja Oblast	RU302	External	Vladimir
	1317	Ivanovskaja Oblast	RU303	External	Ivanovo
	1318	Kaluzskaja Oblast	RU304	External	Kaluga
	1319	Kostromskaja Oblast	RU305	External	Kostroma
	1320	Moskva Oblast	RU306	External	Podolsk
	1321	Moskva, gorod	RU307	External	Moskva
	1322	Orlovskaja Oblast	RU308	External	Orjol
	1323	Rjasan Oblast	RU309	External	Rjasan
	1324	Smolenskaja Oblast	RU310	External	Smolensk
	1325	Tverskaja Oblast	RU311	External	Tver
	1326	Tulskaja Oblast	RU312	External	Tula
	1327	Jaroslavskaja Oblast	RU313	External	Jaroslavl
	1328	Belgorodskaja Oblast	RU501	External	Belgorod
	1329	Kurskaja Oblast	RU502	External	Kursk
	1330	Lipeckaja Oblast	RU503	External	Lipetsk
	1331	Kaliningrad	RUA	External	Kaliningrad
	1332	Other Russia	RUB	External	Omsk
Turkey	1333	Tuerkiye	TR	External	Istanbul
Ukraine	1334	Suedwestliches Wirtschaftsgebiet	UA001	External	Kyiv
	1335	Suedliches Wirtschaftsgebiet	UA002	External	Odessa
	1336	Donezk-Dnepr-Gebiet	UA003	External	Dnepropetrowsk
	1337	Westliches Wirtschaftsgebiet	UA004	External	Lviv
Yugoslavia	1338	Serbia	YU001	External	Beograd
	1339	Voivodina	YU002	External	Novi Sad
	1340	Kosovo	YU003	External	Pristina
	1341	Montenegro	YU004	External	Podgorica
Rest of the world	1342	Rest of the world	RW	External	---