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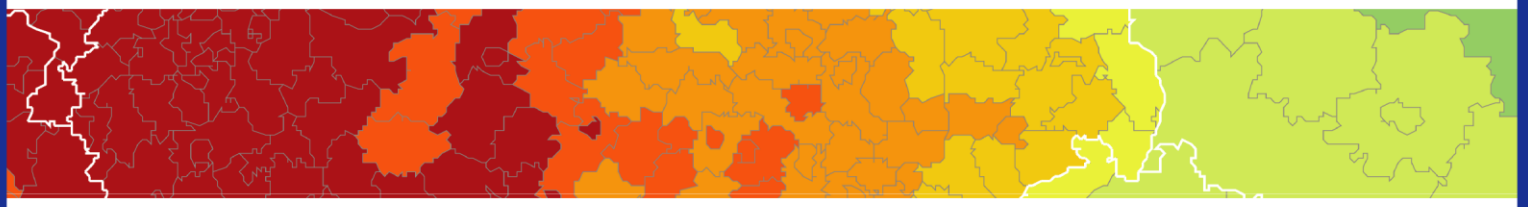

The Geography of New Employment Dynamics in Europe

Applied Research

Annexes to Chapter 3
Data and statistical analysis

Final Version
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The Geography of New Employment Dynamics in Europe

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1 Methological Annex

1.1 Data Sources

One of the main tasks of this project is the creation of an appropriate database for the analysis of employment dynamics at the regional level. This is a challenge in terms of the time and the spatial coverage of the data, which ideally should cover NUTS-2/NUTS-3 territorial aggregation, over the period 1999-2014, for all EU-28 Countries, ESPON Partner countries, and Western Balkans and Candidate Countries.

As discussed in the Inception Report, due to data availability, the following countries are included in the analyses and the database of this project:

- EU-28 Countries
- ESPON Partner Countries (conditional on data availability)
- Turkey, FYROM, and Montenegro (conditional on data availability)

The two main data sources for the database construction are the Eurostat and ESPON Databases:

- Eurostat collects and publishes various statistics for the different regional levels, which are available online. The availability of the data varies with respect to the time frame: while some indicators cover a long period (such as 1977-2014), others are only available for one year (such as the Census in 2001). While there are important variables consistently available from this source to model the knowledge-based economic activity (in particular from patents and economic activity at NACE-2), the coverage of employment characteristics (e.g. ISCO-Codes) or levels of education at this level of aggregation are very incomplete. There is also the problem that many countries do not provide information prior to becoming a Member State (MS) and that some Eastern EU MS are covered with fewer data points than years in the EU. Also, while the dataset includes the EU Countries, the ESPON Partner Countries, and Turkey, other EU Candidate Countries and the Western Balkans Countries (Macedonia, Albania, Serbia, Montenegro, Bosnia Herzegovina, and Kosovo under UNSCR 1244/99) are partially or not at all included in the dataset.
- The ESPON Database Portal collects various data from different sources (Eurostat, previous ESPON projects, and others). The data is available for the EU 28 countries and for the 4 ESPON partner countries, but the EU candidate countries are not included. Generally, there is no availability of data at NUTS 3 level for the period after 2010, which then needs to be complemented with other sources of more recent data.
- Data from previous ESPON projects (e.g. KIT, DEMIFER, INTERCO) have been particularly used for the indicators of the knowledge economy.

1.2 Indicators

We have outlined a list of indicators to describe the NUTS-2 and NUTS-3 regions under the dimension in focus for the project. The selection was done following previous ESPON research and the previous literature reviewed. The indicators can then be grouped under the following broad categories:

Labour market, and education

- Employment by gender, age, economic activity/sector, citizenship
- Unemployment by gender, age, economic activity/sector, citizenship
- Early school leavers and NEETs
- Population by sex, age, and ISCED level
- Sector of activity with highest rate of employment change

Migration and diversity

- Migratory population change
- Net migration.by age group and gender
- Rate of population change

Geography and territorial conditions

- Population density
- Land area
- Railways
- Roads

Knowledge economy and Innovation

- Expenditure on R&D
- Human resources dedicated in science and technology
- Employment in knowledge-intensive activities
- Patent activity
- Cooperation
- Tertiary education

In addition to the above mentioned indicators, we have included Cohesion Policy Financial Indicators for the 2007-2013 and 2014-2020 programming periods. Financial indicators are the most robust for comparative analysis and thus we propose to use the following ones, as proxies for the intensity of Cohesion Policy intervention at the regional level:

We also have identified a number of contextual indicators, which will be used in the statistical analyses to control for the heterogeneity in the EU countries. A provisional list of these indicators is reported in Table 1.1 and might be extended or subject to change depending on the availability of data for the countries included in the analyses.

List of contextual indicators:

- GDP per capita in PPS
- Total land area
- Population density
- Railways
- Roads

Table 1.1: Indicators definition

Category	Indicator	Variable	Definition	Measurement Unit	Coverage	Source
Migration and Demography	Net migration rate	demo_r_gind3_CNMIGRATRT	Ratio of the net migration including statistical adjustment during the year to the average population in that year. The value is expressed per 1000 inhabitants. The crude rate of net migration is equal to the difference between the crude rate of population change and the crude rate of natural change (that is, net migration is considered as the part of population change not attributable to births and deaths).	Ratio per 1000 inhabitants	1999-2014	Eurostat
Migration and Demography	Population density	demo_r_d3dens	Inhabitants per km2	Units	1999-2014	Eurostat
Migration and Demography	Population 15+	tot_pop_over15	Population aged 15 and over	Thousands	1999-2014	Eurostat
Migration and Demography	Population 65+	tot_pop_over65	Population aged 65 and over	Thousands	1999-2014	Eurostat
Knowledge Economy and Innovation	Employment in tech/knowledge	empl_tech_knowledge	Percentage of total employment in technology and knowledge-intensive sectors	Percentage	2008-2014	Eurostat
Knowledge Economy and Innovation	Growth in employment in scient/profession	empl_growth_scientprof	Growth rate of employment in professional, scientific, and technical activities	Percentage	2007-2014	Eurostat
Knowledge Economy and Innovation	R&D expenditure	rd_expenditure	Intramural R&D expenditure as percentage of GDP	Percentage	2000-2014	Eurostat
Knowledge Economy and Innovation	Personnel in R&D	personnel_rd	Total R&D personnel and researchers as percentage of active population	Percentage	2000-2014	Eurostat
Knowledge Economy and Innovation	Active population in sc/tech with HE (%)	he_active_sciencetech	Persons employed in science and technology as percentage of active population	Percentage	1999-2014	Eurostat
Knowledge Economy and Innovation	Active population in sc/engin with HE (%)	he_active_scientengin	Scientists and engineers as percentage of active population	Percentage	1999-2014	Eurostat
Knowledge Economy and Innovation	Total patents	total_patents	Total patents applications to the EPO	Units	1999-2014	Eurostat

Category	Indicator	Variable	Definition	Measurement Unit	Coverage	Source
Knowledge Economy and Innovation	HE rate pop	he_rate_eapop	Ratio of the economically active population with tertiary education to the overall economically active pop.*100	Ratio	1999-2014	Eurostat
Knowledge Economy and Innovation	HE rate 30-34	he_rate_pop3034				Eurostat
Knowledge Economy and Innovation	HE rate 30-34	T_ED5_8_edatlfse12_	Population aged 30-34 with tertiary education	Percentage	1999-2014	Eurostat
Labour Market and Education	Population with tertiary edu (%)	pop_ED5_8	Population with tertiary education	Percentage	1999-2014	Eurostat
Labour Market and Education	Female population with tertiary edu (%)	pop_fem_ED5_8	Female population with tertiary education		1999-2014	Eurostat
	pop_30_cal	WRONG				Eurostat
Labour Market and Education	Students in tertiary education	student_ED5_8	Students enrolled in tertiary education	Units	2011-2014	Eurostat
Labour Market and Education	Employment rate 15-64	emprate_1564_T	Ratio of employed individuals to population	Ratio	1999-2014	Eurostat
Labour Market and Education	Unemployment rate 25+	unemprate_over25_T	Unemployment rate population aged 25 and over	Percentage	1999-2014	Eurostat
Labour Market and Education	Youth unemployment ratio	youth_unemp_ratio	Ratio of unemployed individuals aged 15-24 over population aged 15-24[1]	Ratio	1999-2014	Eurostat
Labour Market and Education	Economically active pop with tertiary education	ec_active_ED5_8_2564	Economically active population with tertiary education	Unit	1999-2014	Eurostat
Labour Market and Education	Economically active pop 15-64	ec_active_TOT_2564	Economically active population	Unit	1999-2014	Eurostat
Labour Market and Education	NEET 15-24	neet_1524_T	NEET rates	Percentage	1999-2014	Eurostat
Labour Market and Education	Early leavers 18-24	early_leavers_1824	Early leavers from education and training	Percentage	1999-2014	Eurostat
Labour Market and Education	Economically active pop 15-64	ec_active_TOT_2564	Economically active population	Unit	1999-2014	Eurostat

[1] For an explanation of the choice of this indicator, please see HADJIVASSILIOU, K., KIRCHNER SALA, L. & SPECKESSER, S. 2015. Key Indicators and Drivers of Youth Unemployment. *Policy Performance and Evaluation Methodologies.* STYLE.

Category	Indicator	Variable	Definition	Measurement Unit	Coverage	Source
Labour Market and Education	NEET 15-24	neet_1524_T	NEET rates	Percentage	1999-2014	Eurostat
Labour Market and Education	Early leavers 18-24	early_leavers_1824	Early leavers from education and training	Percentage	1999-2014	Eurostat
Labour Market and Education	Long term unemployment rate					Eurostat
Contextual Indicators	GDP per capita (PPS)	nama_10r_3gdp_PPS_HAB	GDP as purchasing power standard per inhabitant	Unit	1999-2014	Eurostat
Contextual Indicators	GDP per capita (PPS as EU percentage)	nama_10r_3gdp_PPS_HAB_EU	GDP as purchasing power standard per inhabitant in percentage of EU average	Percentage	1999-2014	Eurostat
Contextual Indicators	People in poverty/risk of social exclusion (%)	per_people_poverty	People at risk of poverty or social exclusion as percentage of total population	Percentage	2003-2014	Eurostat
Migration and Demography	Share of foreigners	share_foreigh_demif	Share of population with a foreign citizenship	Ratio	2007	ESPON
Migration and Demography	Share of EU nationals	share_popEU27_demif	Share of population with a foreign EU27 citizenship	Ratio	2007	ESPON
Migration and Demography	Share of non-EU nationals	share_popnonEU_demif	Share of population with a foreign non-EU27 citizenship	Ratio	2007	ESPON
Contextual Indicators	Life expectancy at 84	life_expectancy_84	mean number of years still to be lived by a person who has reached a certain age, if subjected throughout the rest of his or her life to the current mortality conditions (age-specific probabilities of dying)	Unit	1999-2014	Eurostat
Migration and Demography	Elderly rate	elderly_rate	Ratio of population aged 65 and over to overall population	Ratio	2012-2014	Own elaboration on EUROSTAT
Migration and Demography	Rate of natural change in population	rate_nat_change_pop	Ratio of natural change over a period to the average population of the area in question during that period. Value expressed per 1000 inhabitants	Ratio	1999-2014	Eurostat
Contextual Indicators	Railways (in 1000 KM)	resc_railway	Railway network	Unit	1999-2014	Eurostat
Contextual Indicators	Roads (in 1000 KM)	resc_roads	Road network	Unit	1999-2014	Eurostat
Contextual Indicators	Land area (in 1000 KM2)	resc_area	Total land area	Unit	1999-2014	Eurostat

As defined by Eurostat[2], high-technology sectors (high-technology manufacturing and knowledge-intensive high-technology services) include:

- Manufacture of basic pharmaceutical products and pharmaceutical preparations
- Manufacture of computer, electronic and optical products
- Water transport; Air transport;
- Publishing activities; Motion picture, video and television programme production, sound recording and music publish activities; Programming and broadcasting activities; Telecommunications; Computer programming, consultancy and related activities; Information service activities,
- Financial and insurance activities,
- Legal and accounting activities; Activities of head offices, management consultancy activities; Architectural and engineering activities, technical testing and analysis; Scientific research and development; Advertising and market research; Other professional, scientific and technical activities; Veterinary activities,
- Employment activities,
- Security and investigation activities,
- Public administration and defence, Compulsory social security; Education, Human health and social work activities; Arts, entertainment and recreation.

1.3 Harmonisation and imputation processes

NUTS Harmonisation

The NUTS (Nomenclature of territorial units for statistics) classification has been developed by Eurostat to identify the territorial aggregations in Europe[3]. It is a hierarchical system, based on the population size as well as on administrative and geographical criteria, with the following levels:

1. NUTS-0: Countries
2. NUTS-1: Major socio-economic regions (average size of the population between 3m-7m)
3. NUTS-2: Basic regions (average size of the population between 800,000-3m)
4. NUTS-3: Smaller regions (average size of the population between 150,000-800,000)

[2] http://ec.europa.eu/eurostat/cache/metadata/en/htec_esms.htm

[3] See http://ec.europa.eu/eurostat/documents/3859598/6948381/KS-GQ-14-006-EN-N.pdf/b9ba3339-b121-4775-9991-d88e807628e3

The classification is revised and amended (if necessary) every three years or more: it has been updated (from the initial version of NUTS 2003), in 2006, 2010, and 2013 (current version).

This creates an issue for the comparability of some data over time, in particular when aiming to create a panel data structure for data reported with different NUTS versions. We have therefore implemented an harmonisation routine for the NUTS classification.

An historical mapping of the NUTS classification has been created, mapping all the NUTS-versions between one another. There are three types of possible changes:

1. Change of code for the same territorial aggregation
2. Change of code due to merging of previously separated aggregations
3. Change of code due to split of previously merged aggregations

We then harmonised the NUTS classification, modifying the data according to the changes happended:

1. Data are kept as they are
2. An average of the data from the two previously separated aggregations is created
3. The data are allocated to the two new aggregations, as appropriate according to the variable type (either divided by the number of aggregation, or allocated as they are)

The result of this effort is a database with the latest version of the NUTS classification (2013)

Missing Data Imputation

The downloaded datasets from the sources present a relevant percentage of missing data, which in some cases might cause the lost of a substantial number of observations. This is particular relevant for earlier years observations.

Thus, to reduce the impact on the analysis performed, a linear imputation technique was applied to the data, since random imputation was considered not appropriate, considering the spatial and time dimension of the data. This imputation allows to increase the availability of the data, and to include more regions in the estimations.

Imputation was done through linear extrapolation, through the ipolate, epolate command in Stata, based on the formula:

$$y = \frac{y_1 - y_0}{x_1 - x_0}(x - x_0) + y_0$$

Where x are the years, and y are the indicators.

To avoid distorsion and bias in the data due to imputation, we have limited the application only to the following cases:

- Gaps in between observations of maximum three years
- Data missing for two years preceding the first observation

- Data missing for two years following the last observation

After the imputation, the data were then double checked to verify the consistency of the imputed values. Whenever the values resulted as inconsistent with the trend, the imputed value was discarded, and the missing one kept. From the preliminary summary statistics conducted, this was particularly true for the 2015 and 2016 years, and this is the main reason why these years were excluded from the analysis (even though the two years are still included in the provisional database for the reference).

However, the process did not fill all the missing values in the dataset, and some of them still remains, affecting some variables to a higher extent than other.

2 Results: main trends and patterns of KE employment in Europe

2.1 How the KE shapes employment patterns over the EU regions

The empirical analysis is based on the database created during the Task 1 phase of the project. The database includes data for 420 NUTS-2 regions, including extra-Regio territories and undefined territories[4], or 359 NUTS-2 when these are excluded. It covers the period 1999-2014, even though the completeness of the data varies across indicators and regions. Table 2.6 in Section 2.3 of this Annex reports the number of regions for each country included in the analysis.

There are no clear conventions on either how the KE can be measured robustly or which indicators would be appropriate to describe it. Much of the identified literature focuses on specific characteristics, rather than on a global measure, or a set of indicators. For instance, Caruso's (2016) definition of the knowledge-based economy identifies the use of knowledge-intensive activities in the production of goods and services as a main characteristic of a KE. This involves 'a greater reliance on intellectual capabilities than on physical inputs or natural resources, combined with efforts to integrate improvements at every stage of the production process', but also implies a high rate of knowledge obsolescence, due to technological and scientific advancement. A similar approach is given by the World Bank: '*A knowledge-based economy relies primarily on the use of ideas rather than physical abilities and on the application of technology rather than the transformation of raw materials or the exploitation of cheap labor. It is an economy in which knowledge is created, acquired, transmitted, and used more effectively by individuals, enterprises, organizations, and communities to promote economic and social development*' (World Bank 2003). A closely related concept is the term 'knowledge society' as introduced by Peter Drucker in the late 1960s, which identifies knowledge as the foundation, not only for economic activity, but more widely for social activity and interaction. Furthermore, knowledge economies are dynamic by nature (World Bank, 2003), and require an active participation in lifelong learning since the skill depreciation rate increases over time '*Lifelong learning is of crucial importance in sustaining the global knowledge economy and in promoting active citizenship, social cohesion, the quality of community life and personal development*' (Ogawa, 2009). Codified as well as tacit knowledge is part of this definition of lifelong learning. Another key characteristic of the knowledge economy is the spatial proximity of its main actors, such as firms, institutions, and individuals.

The common feature of all these definitions is that they are generic and represent a research framework, rather than a model offering quantifiable/measureable indicators and causal relations between variables. Indeed, the KE's as such can cover many areas, e.g. education, information infrastructure and systems of innovation (ibid). Using such a research framework

[4] These are territories that have a special status in the EU due to historical, cultural, or geographical reasons.

requires the identification of the appropriate empirical measures for latent dimensions, e.g. the education system, labour market or business decision making to obtain empirical evidence

As underlined by the OECD (1996), the two main challenges for the measurement of the KE relate to:

- The difficulty of appropriately and completely measuring knowledge (which has always been challenging to quantify and price)
- The difficulty of measuring the impact of knowledge on production outcomes

Should these difficulties be overcome in a satisfactory way, it would then be possible to obtain causal evidence on the economic impact of the persistent increase of knowledge in economic activity, and to infer how policy can/should intervene in order to overcome allocative inefficiencies, or to facilitate growth/prosperity.

Kujath (2015, p.20) emphasises that the development of knowledge and innovation is a key element for economic growth, and that the diffusion of knowledge is fundamental for innovation as well. This development and diffusion of knowledge is facilitated by effective communication, including e.g. through geographical proximity, and thus highlights the role of cities in the KE. Indeed, a wide array of studies exists on the territorial characteristics related to the concept of the KE; e.g. the relation to territorial proximity and urban areas (e.g. Gans, 2015, p.23), but also on specificities in smaller cities (Kujath, 2015, p.39). The potential and capacity for regional innovation can also be understood through the accumulation of knowledge via institutions such as universities and a fully-fledged business environment (Capello et al., 2012, Van Winden, 2010).

For the purposes of this project, we follow Lee et al. (2007) who categorised sectors as part of the KE using three main criteria:

- knowledge-intensive sectors (which Eurostat and the OECD consider as being: high-tech manufacturing, finance and insurance, telecommunications, business services, education and health, amongst others);
- skill level data (using e.g. ISCED data);
- measures of innovation and productivity at firm-, individual-, and sector-level.

These different measures provide a detailed and varied picture of ‘knowledge’ and numerous ways of measuring it through a reasonable and usable scale, which were analysed as separate dimensions and in combination using the data for NUTS-3 (where available) and NUTS-2 territorial level in descriptions and for maps. Section 1 of this Annex provides a detailed description of the available indicators, in which we follow other empirical descriptions, e.g. those presented in D'Andrea (2010), to look into the relevant indicators of the KE such as: employment in critical sectors and occupations (e.g. professional and associate-professional technician levels); tertiary education rates; STEM/ICT skills and sectoral size; number and size

of scientific and higher education institutions; R&D spending (public and private sector) and relation to overall economic activity; application of patents, etc.

The main indicators of interest for the purposes of this project were selected on the basis of this classification, and are grouped in the following categories:

- Migration and Demography
- Knowledge Economy and Innovation
- Labour Market and Education
- Geography and Territorial Conditions[5]
- Contextual Indicators

The indicators included in the empirical analysis have been chosen between those indicators highlighted by the literature, applying a 'completeness' criterion: priority was given to those indicators more complete in terms of both the geographic and time dimension. Also, since indicators in the same category are very correlated, in particular when measuring different aspects of the same feature, only a small number of them was selected to avoid issues of multicollinearity.

2.1.1 Migration and Demography

Net migration rate

Over the period 1999-2014, net migration in Europe has been overall positive, with more immigrants entering the European regions than emigrants leaving. However, the overall net migration rate shows a dynamic behaviour, fluctuating across the years.

To simplify the description of the statistics, the NUTS-2 regions were classified in groups of regions, following the UN macro geographical categorisation[6], and leaving aside the ESPON Partners countries, as well as Turkey, the former Yugoslav Republic of Macedonia (FYROM), and Montenegro. The groups were clustered as follows:

i) Eastern Europe: Bulgaria, the Czech Republic, Hungary, Poland, Romania, Slovakia;

ii) Northern Europe: Denmark, Finland, Ireland, Lithuania, Sweden, the UK;

iii) Southern Europe: Croatia, Greece, Italy, Malta, Portugal, Spain;

iv) Western Europe: Austria, Belgium, France, Germany, Luxembourg, the Netherlands;

v) ESPON Partners: Norway, Switzerland, Iceland, Liechtenstein;

vi) Turkey;

[5] Geography and territorial conditions indicators are not described in this report, but they will be described in the Final Report draft.

[6] See https://unstats.un.org/unsd/methods/m49/m49regin.htm

vii) FYROM and Montenegro.

The net migration rate, per 1,000 inhabitants, varies across the macro-regions identified, with Eastern EU, Turkey, and FYROM/Montenegro regions reporting a substantially negative net migration rate, while Northern, Western, and ESPON Partners regions report a substantially positive rate instead. Southern European regions have experienced a decline in the rate over the period (see Figure 2.1 below).

Table 2.8 (Section 2.3 of this Annex) reports the average rates for each year by the macro regions in Europe. There has been some change between the 2000's and the 2010's: for the purposes of this analysis, 2004 and 2014 have been chosen as the main two reference years: these years were selected as they are distant enough from the 2008 peak of the global financial crisis and the European dept crisis to represent the situation before, and after, when recovery was starting. In 2004, the average net migration rate in the entire area was 3.34 per thousand inhabitants, ranging from a minimum of -9.8 (Vidin Province, Bulgaria) to a maximum of 25.4 (Comunidad Valenciana, Spain), while in 2014 it was 2.12 per thousand inhabitants, with a minimum of -26.9 (Ağrı Subregion, Turkey) and a maximum of 19.9 (Luxembourg).

In this report, the regions with a negative net migration rate are defined as 'sending' regions, while the regions with a positive net migration rate are dubbed as 'receiving' regions. This classification is dynamic in nature, since regions can change their status over time: Table 2.1 below shows the number of regions by sending/receiving status in 2004 and 2014: a great majority of regions maintain their status as receiving regions. Some regions, such as in Spain, Ireland, and Finland, had positive migration rates in 2004, and then had negative migration rates in 2014.

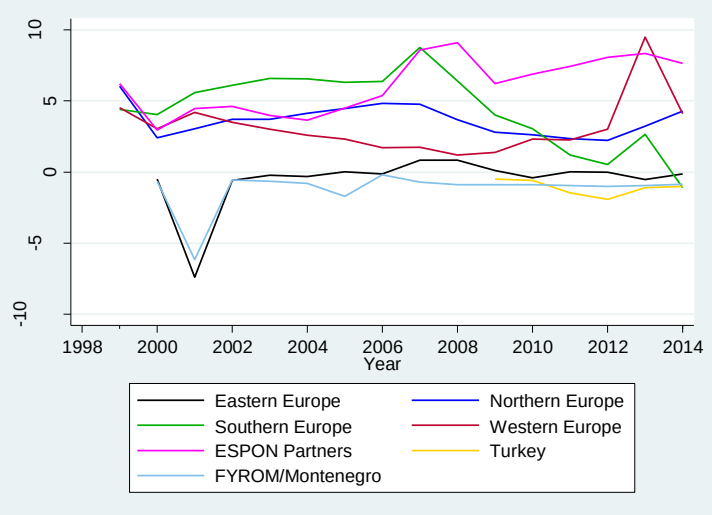
Table 2.1: Sending and receiving regions (2004 vs 2014)

	Sending (2014)	**Receiving (2014)**
Sending (2004)	46 (13%)	28 (8%)
Receiving (2004)	60 (17%)	218 (62%)

Source: Own elaboration on project database. The numbers in parenthesis are percentage of the total number of regions (352).

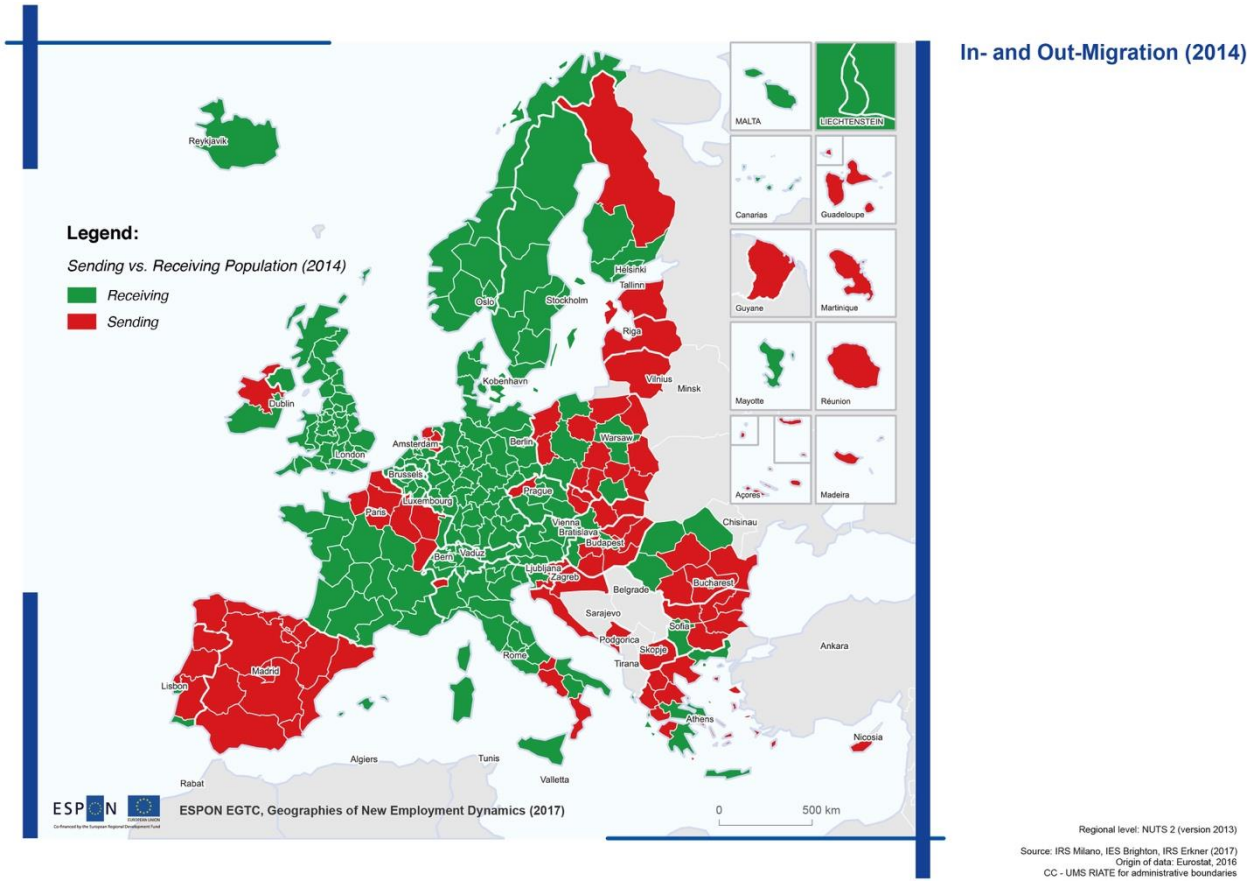
Map 2.1 below shows the sending and receiving regions in 2014 (Map 2.6 for 2004 is available in Section 2.3). It is particularly interesting to notice the geographical distribution of the few regions (8%) that switched from a sending status to a receiving one between 2004 and 2014 (such as regions in Spain and Portugal), while many regions switched from receiving to sending (17%). Overall, sending regions tend to be concentrated at the periphery of the area considered.

Figure 2.1: Net migration rate (per 1000 inhabitants), by macro regions, 1999-2014



Source: Project database, indicator demo_r_gind3_CNMIGRATR.

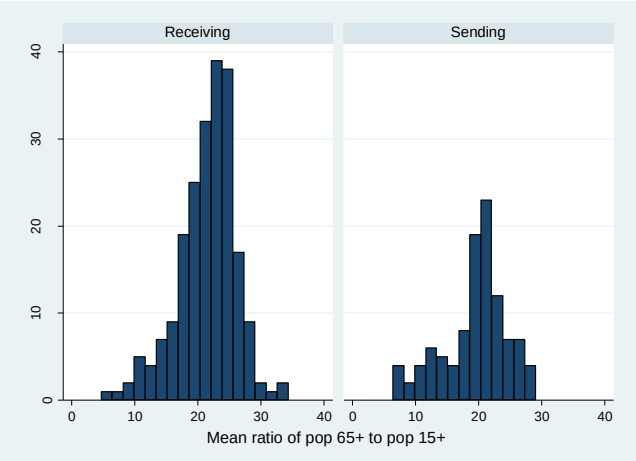
Map 2.1: Sending vs receiving regions, 2014



Population size

In 2014, the average population size of all regions was 1,545,000 ranging from a minimum of 27,000 usual residents to a maximum of 10,982,000. The distribution did not substantially change from 2004, as shown by Figure 2.9 in Section 2.3 of this Annex (which is not surprising considering that population size is one of the criteria for the definition of the NUTS aggregation). In 2014, receiving regions, i.e. regions with a positive net migration rate, have on average a higher density of older population than sending regions, i.e. regions with a negative net migration rate (see Figure 2.2 below). This finding is consistent with the literature: migrants tend to be attracted by regions with an ageing workforce.

Figure 2.2: Mean ratios of population 65+ to population 15+ (2014), sending vs receiving regions.



Source: Project database, indicator old_per. The graph show the mean values separated by regions with a positive net migration rate (receiving), and a negative net migration rate (sending).

Population structure by age group

Overall, there were 492 million inhabitants in the area considered in this analysis. The youth age groups (15-24 and 25-34) constituted 14% and 16% of the total population over 15 respectively.

Table 2.2 below reports the working age population structure in the areas considered for the analysis by age group (median values reported), comparing 2004 and 2014: there is an indication of an ageing process happening, since the figures for younger groups are decreasing, while the ones for older groups are increasing.

Table 2.2: Working age population structure by age group (in 1,000), 2004 vs 2014

Age group	2004	2014
15-24	176	167
25-34	195	189
35-44	208	197
45-54	198	210
55-64	158	182

Source: Own elaboration on project database.Figures are in thousands.

Figures 2.11-2.15 in the Section 2.3 show the trends in the population structure by age group over time, comparing the groups of regions. Regions in Turkey, FYROM and Montenegro show substantially higher levels of youth population (age groups 15-24 and 25-34) than sending regions, while Easter European and Southern European regions show an ageing trend in the population.

Figure 2.16 (Section 2.3) shows the youth population (15-34) totals by groups of regions, comparing 2004 and 2014. The distributions do not show substantial differences between the two years, with only small increases in the mean for Turkey and ESPON partners regions, and a small decrease for the Easter European regions.

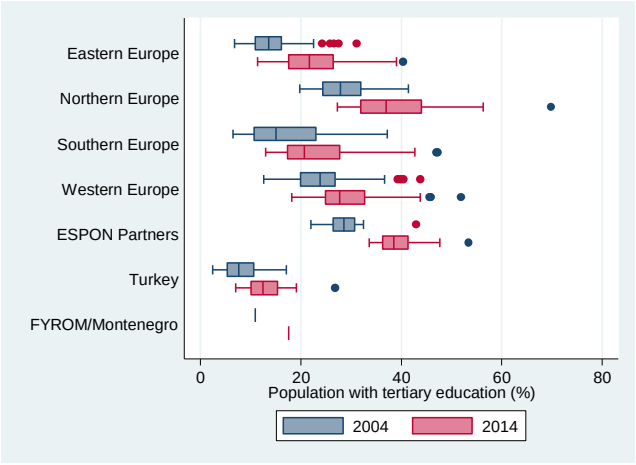
2.1.2 Knowledge Economy and Innovation

The KE has been typically identified in the literature as a key factor for the migration patterns and the new employment dynamics in Europe. While there is no clear consensus on how to precisely measure and analyse the knowledge economy activities and sectors, there is a general agreement that the following indicators offer a good proxy of it: i) Population with tertiary education, ii) R&D expenditure and personnel working in R&D sectors, iii) Human resources in science and technology, iv) Patenting activity.

Population with tertiary education

The average tertiary education rate was 28% in 2014, ranging from a minimum of 7.6% (Şanlıurfa Subregion, Turkey) to a maximum of 69.8% (Inner London – West, UK). The rate has substantially increased from 2004, when the average was 20%, ranging from 2.4% (Samsun Subregion, and Van Subregion, Turkey) to 43.8% (Walloon Brabant, Belgium). The average difference is 0.28, which is statistically significant at the 1% level. Figure 2.3 shows the rates by the groups of regions. Comparing values in 2004 and 2014: all groups of regions have increased their tertiary education percentages over the period. The highest averages are presented by Northern European and ESPON partners regions. However, these numbers show a wide dispersion of the rate, and thus there is variation within the groups of regions. Figure 2.17 in Section 2.3 compares the rates for the overall population with those for the 30-34 age group, showing that the 30-34 group has higher rates of tertiary education across all the groups of regions, with the highest rates recorded in Northern, Western European, and ESPON partners regions.

Figure 2.3: Population with tertiary education (%), by groups of regions, 2004 and 2014



Source: Project database, indicators pop_ED5_8, percentage of population with tertiary education (multiplied by 100).

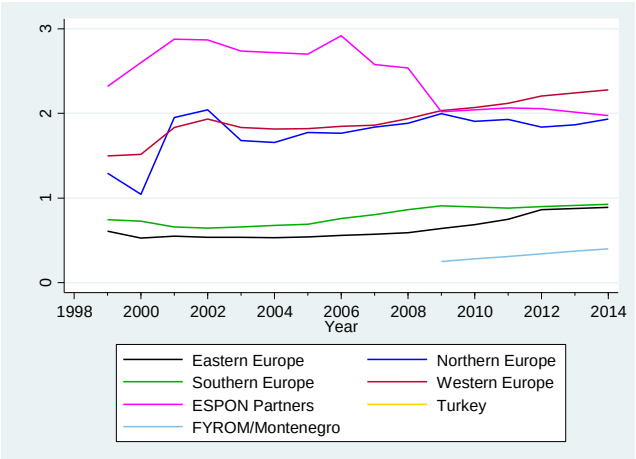
R&D expenditure and personnel working in R&D sectors

The average R&D expenditure (as a percentage of GDP) in 2014 was 1.6%, ranging from a minimum of 0.03% (RO12) to a maximum of 11.48% (Walloon Brabant, Belgium). There has been an average (statistically significant) reduction of around 18% from 2004.

Figure 2.4 shows the expenditure percentages by macro regions over the period: regions of Northern Europe Western Europe, and ESPON partner regions have higher percentages of R&D expenditure than others. Over the period 1999-2014, the R&D expenditure has increased only in the regions of Northern and Western Europe.

The average percentage of the workforce employed in R&D sectors was 1.24% in 2004 and 1.62% in 2014, ranging from a minimum of 0.07% (Ceuta, Spain) to a maximum of 5.29% (Prague, Czech Republic). In 2014, ESPON Partners regions, Western, and Northern European regions presented the highest average expenditure overall.

Figure 2.4: R&D Expenditure (as % of GDP), 1999-2014, by groups of regions



Source: Project database. Indicator: rd_expenditure. The indicator is calculated as the percentage of GDP devoted to R&D (multiplied by 100).

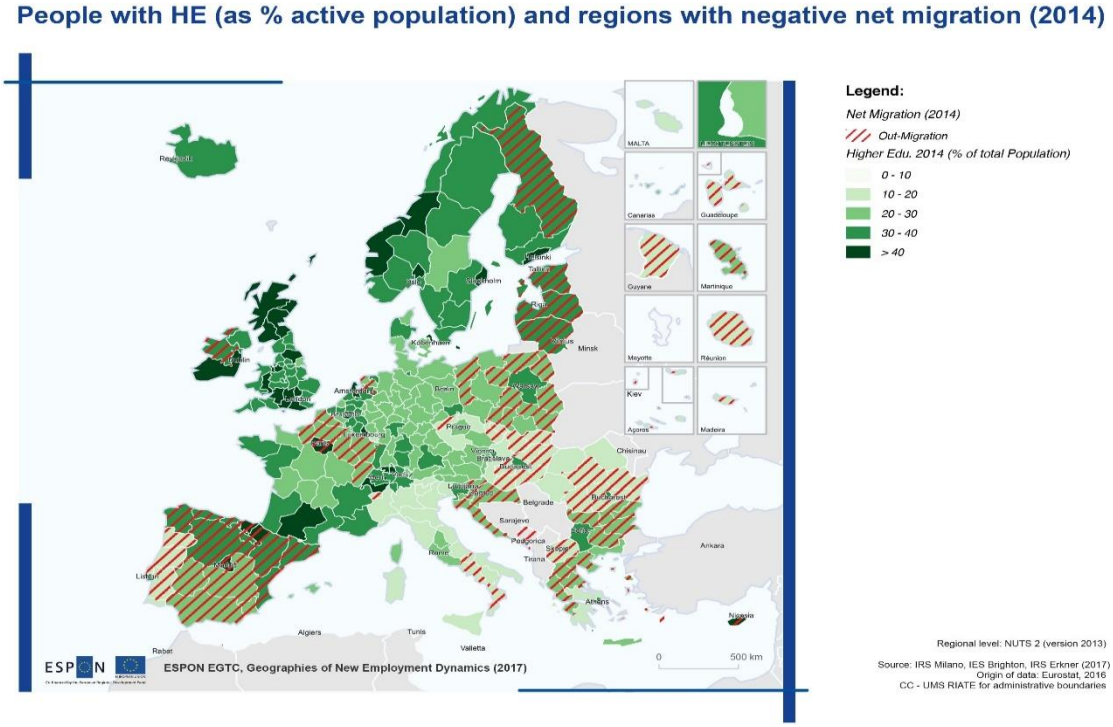
Human resources in science and technology

Human resources in science and technology are measured through a range of indicators, in particular 'employment in tech/knowledge, 'employment growth in scientific and professional occupations', and 'persons with HE in science and technology'.

Employment in technology and knowledge[7] in 2014 (Figure 2.18 in Section 2.3) was on average 3.34%, ranging from a minimum of 0.2% (Kırıkkale Subregion, Ağrı Subregion, Şanlıurfa Subregion, Turkey) to a maximum of 11% (Berkshire, Buckinghamshire, and Oxfordshire, UK), while the employment growth in scientific and professional occupations was 3.44%, with a minimum of -48.2% (Ionian Islands, Greece) and a maximum of 71% (Ipeiros, Greece). Northern European and ESPON partner regions show the highest average percentages of individual employed in technology and knowledge sectors.

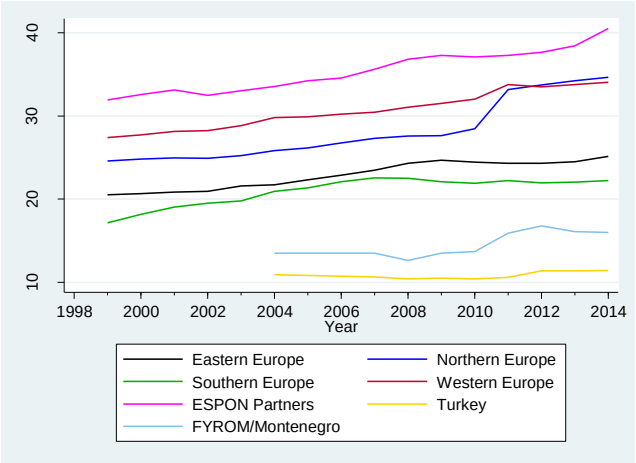
The percentage of people with higher education qualifications employed in science and technology in 2014 was on average 28%, ranging from a minimum of 6% (Van Subregion, Turkey) to a maximum of 56% (Luxembourg), with a slight increase from 2004, when the average was 24%. Figure 2.5 shows an increasing trend over time of the percentages over the period by the groups of regions. ESPON partners regions, Western European, and Northern European regions report the highest values throughout the entire period.

Map 2.2: People with Higher Education (as % active population) and regions with negative net migration (2014)



[7] This indicator includes employment in high-technology sectors (high-technology manufacturing and knowledge-intensive high-technology services) as defined by Eurostat (see Part 1 of this Annex)

Figure 2.5: People with HE qualifications in science and technology (% of employed population), by macro regions (199-2014)



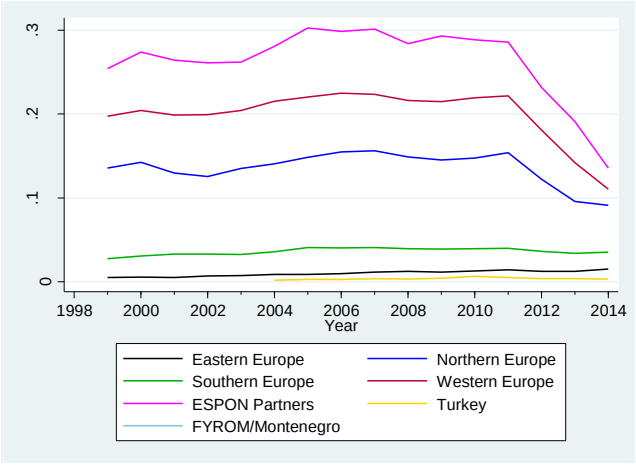
Source: Project database. Indicator he_active_sciencetech. The indicator is the percentage of employed individuals with HE working in science and technology (multiplied by 100).

Patenting activity

Patenting activity is widely accepted in the literature as one of the indicators of the knowledge economy activities in a territory. The average total number of patent applications to the European Patent Office (EPO) in 2014 was 105, with a significant decline from 2004, when the average was 169, even if the difference is only statistically significant at the 5% level (Table 2.14 in Section 2.3). ESPON Partners, Northern and Western European regions had the highest levels of patent applications, in both 2004 and 2014. Sending regions had substantially lower rates of patenting, as can be seen in Figure 2.6. The number of patents per 1,000 inhabitants was then created to take into account the different population sizes of the regions: the average was 0.12 in 2004, and 0.075 in 2014. Figure 2.6 show the number of patents per 1,000 inhabitants over the period 1999-2014: there is a remarkable difference in patenting activity between ESPON Partner, Western, and Northern European regions, and the other regions. It is also interesting to notice that there was an overall stark reduction in patents applications after 2011: this might be related to post-crisis policies and reduction in funding availability[8].

[8] This has been documented in various research papers; see for instance Izsak, K., Markianidou, P., Lukach, R., Wastyn, A. (2013). The impact of the crisis on research and innovation policies. Study for the European Commission DG Research by Technopolis Group Belgium and Idea Consult. Available at https://ec.europa.eu/research/innovation-union/pdf/expert-groups/ERIAB_pb-Impact_of_financial_crisis.pdf

Figure 2.6. Patents (per 1,000 inhabitants) by macro regions, 1999-2014

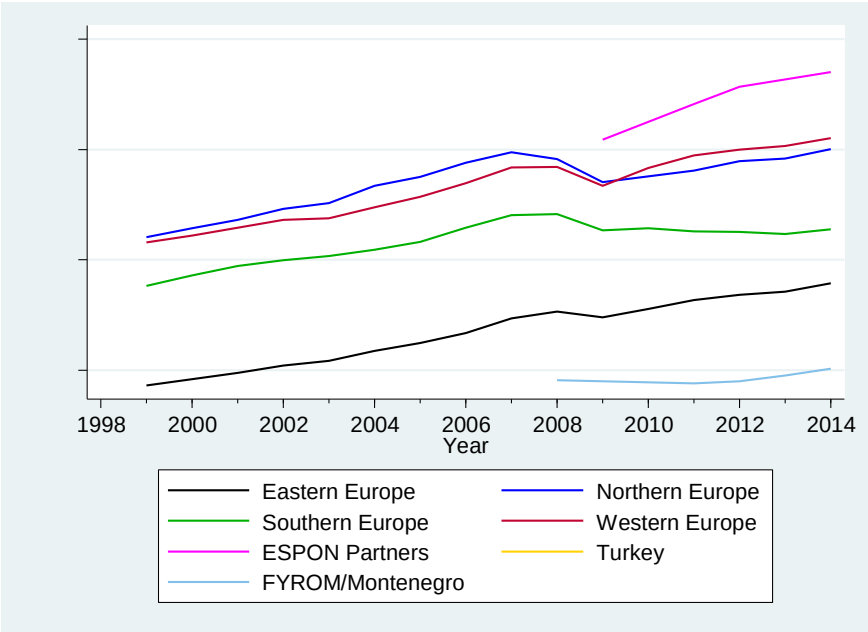


Source: Project database. Indicator total_patents. The indicator is defined as the number of patents applications to the EPO over the population (aged over 15) expressed in 1,000.

2.1.3 Contextual Indicators: GDP per capita and household income

The average GDP per capita in PPS was EUR 23,138 over the period, with a standard deviation of almost EUR 11,000. Figure 2.7 shows the figures by the macro regions. In general, there is an upward trend, but there is a substantial difference in the levels with Western Europe, Northern Europe, and ESPON Partners regions at the top of the distribution, and Southern Europe, Eastern Europe, and FYROM and Montenegro at the bottom. The inequality in terms of PPS per capita is also clearly shown by Maps 2.9 and 2.10 (Section 2.3), which highlights the differences between the European periphery, and the Northern and Central areas.

Figure 2.7: GDP per capita in PPS (EUR), by groups of regions, 1999-2014



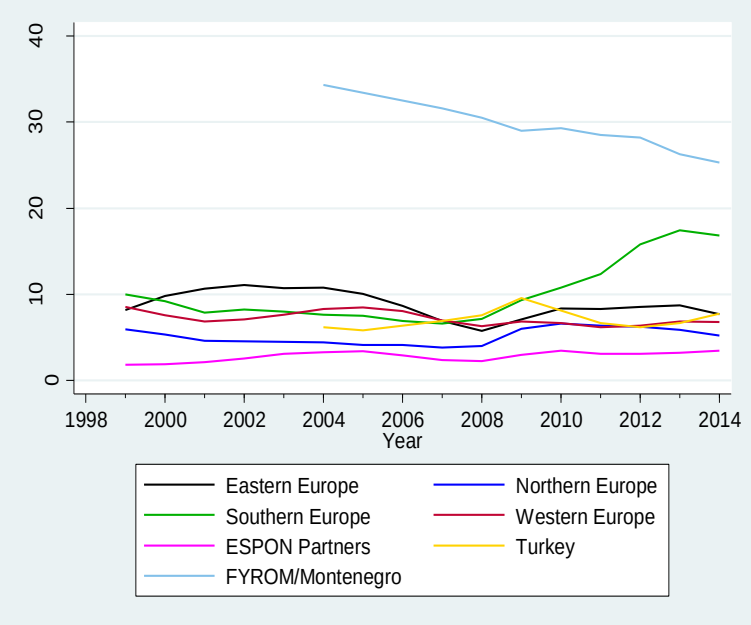
Source: Project database, indicator nama_10r_3gdp. Units on the y-axis are EUR. No data available for Turkey.

2.1.4 Labour Market and Education

Unemployment rate[9]

The unemployment rate for the population over 25 was on average 7.88% over the period 1999-2014, while the youth unemployment ratio for the age group 15-24 was 8.64%[10]. There was a decline in both the rate and the ratio between 1999 and 2008, and then a rapid increase after the crisis hit the area. Figure 2.8 shows the trend of the annual unemployment rate by groups of regions: FYROM, Montenegro, and Southern regions also have the highest unemployment rates of the entire area, in particular after 2008. This evidence is also confirmed by the maps presented, which shows that these regions had higher percentages of unemployment than other regions in Europe. Furthermore, the macro regions[11] with the highest unemployment rates also present the highest variation (as also noted by Tosun et al., 2016). Map 2.3 and 2.4 below show the geographical variation of the rates in 2004 and 2014: the rates have increased in terms of means and range for all the groups of regions, with the exception of Easter European and Western European regions. This is also true, but to a lesser extent, for the youth unemployment ratio (see Figure 2.21 in Section 2.3).

Figure 2.8: Unemployment rate (25-64), 1999-2014, by macro region



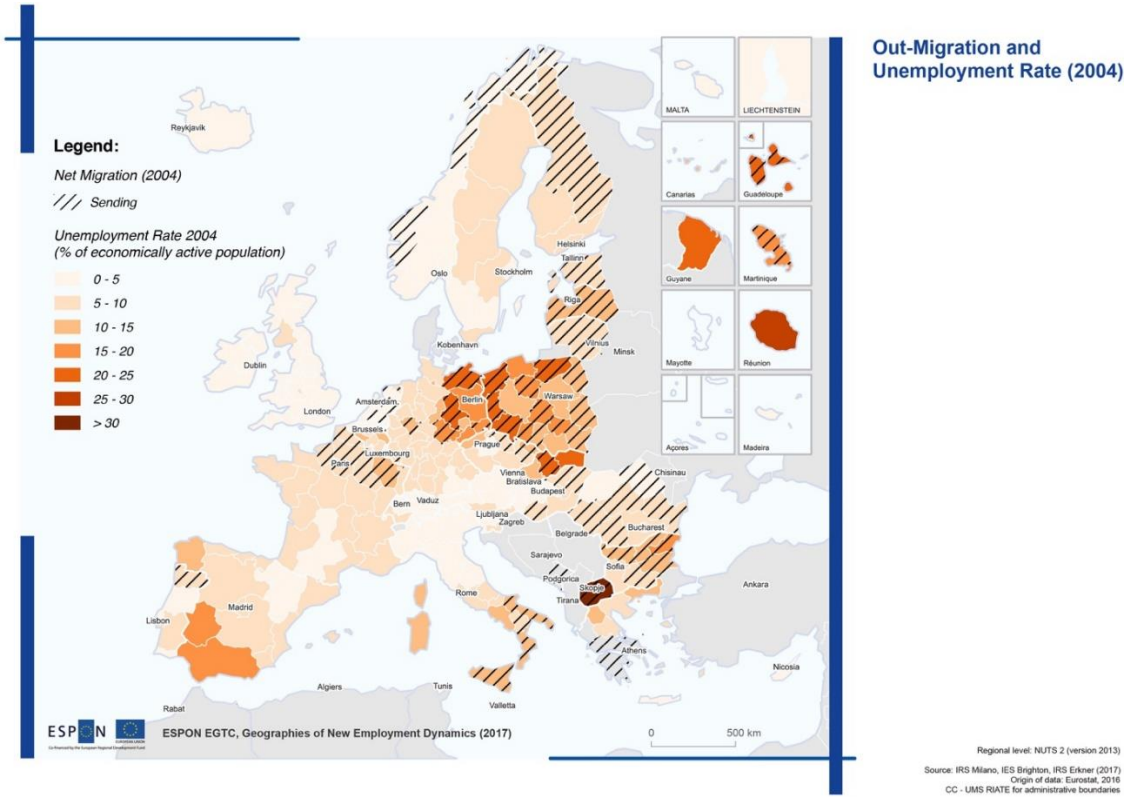
Source: Project database, indicator unemprate_over25_T=T_Y_GE25_lfu3rt. The indicator is the percentage of the active population aged 25-64 that is unemployed and actively looking for employment, multiplied by 100.

[9] Part 2.3 of this Annex reports a description of the employment rate as well.

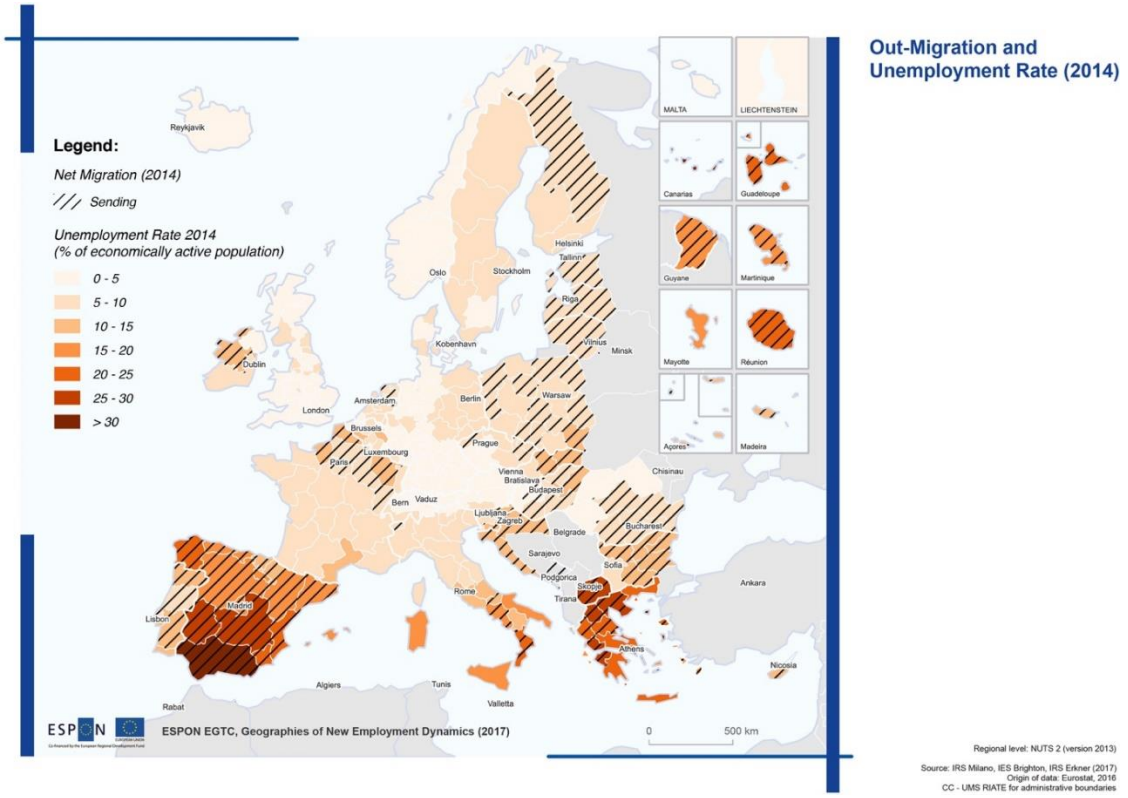
[10] See Part 1 of this Annex for the definition of the two indicators.

[11] The macro regions are the groups of regions as defined by the UN (see above).

Map 2.3: Migration: Sending Regions & Unemployment rate 25+, 2014



Map 2.4: Migration: Sending Regions & Unemployment rate 25+, 2004



Source: Project database, indicator unemprate_over25_T=T_Y_GE25_lfu3rt

2.2 Econometric Analysis

After having described the characteristics of the regions and the trends of the indicators over the period considered, this section investigates the relationship between them using statistical and econometric models. This allows to identify the main factors influencing migration trends in the area, as described earlier.

2.2.1 Exploratory analysis

The initial exploratory analysis reports the summary statistics on the variables included in the empirical model of choice. Table 2.15 in Section 2.3 reports the correlations between the variables included in the model: the covariates are not too highly correlated to prevent the model to be valid. The choice of the variables included was based on the literature review undertaken, and on the availability of data[12]: unemployment rate has been identified by various authors as an important push factor, while GDP per capita as a pull factors for migrants. The literature has also identified the important of the rural to urban migration, and the capital city effect: population density is a good identifier of regions with important urban areas, i.e. areas where the population density is relatively higher. The length of roads available in the region has been used in the literature as a measure of the physical infrastructure and thus of the level of investments in a region[13], which is another important driver for migration.

The database created for this project includes repeated observations for each territorial area considered over a period of time (1999-2014). Table 2.3 below reports the summary statistics of the main variables for the estimation, and shows that there is a significant variation of the variables, both within and between regions.

---

[12] We encountered data limitations at three levels: geographically, in terms of aggregation, and time period coverage. For example, data on government spending in education are available only at NUTS0 and NUTS1 levels and the available amount of information is not consistent over time; instead, data on students enrolled in tertiary education are available at NUTS3 level from 2011. The same issue can be found for data regarding working occupations in Europe and ESPON partners countries. We can obtain information on number of managers, professionals, technicians and low skilled workers only in 2011 for some NUTS1 regions. Additionally, we do not have data on country of origins of the migrants.

However, we use the available information to identify key factors defining migration choices. We use a time period for which a good set of variables is available and that allows to explore recent trends in migration. We further improve the dataset by managing to overcome missing values issues via imputation.

Although we provide an adequate response to data limitation, the results obtained in this analysis should be read with caution because the estimated association between the knowledge economy and net migration rate may be upward biased.

Furthermore, some gaps in the data are also present at NUTS2 level for the variables included in the analysis. In particular, the infrastructure indicator (road) presents missing values for the majority of the regions comprising the UK. We checked if this can affect the validity of our results by conducting our full analysis excluding the UK, and we can conclude that there is no impact on the validity of the analysis presented here.

[13] As done in European Commission (2014e), Infrastructure in the EU: Developments and Impact on Growth, Occasional Papers series 203.
Available at http://ec.europa.eu/economy_finance/publications/occasional_paper/2014/pdf/ocp203_en.pdf

The empirical model chosen was then a panel data model, more specifically a fixed-effects model, selected over the random effects one on the basis of a Hausman test. Table 2.16 in Section 2.3 shows the overall relationship between the knowledge economy indicator and the net migration rate: the trend shows a positive relationship, i.e. the higher the level of the knowledge economy, the higher the net migration rate.

Table 2.3: Panel summary statistics

Variable		**Mean**	**Std. Dev.**	**Min**	**Max**		**Obs.**
Net migration rate, per 1,000 inhabitants	overall	2.906	6.304	-45.2	61	N	4695
	between		4.616	-21.683	17.63125	n	324
	within		4.677	-34.374	55.259	T-bar	14.4907
Unemployment rate, 25-64	overall	7.513	5.031	0.3	34.3	N	4797
	between		4.278	2.094		n	322
	within		2.707	-6.238	29.9	T-bar	14.897
% individuals with HE employed in Science & Technology	overall	25.86203	8.29633	1.8	56.1	N	4789
	between		8.109	7.054	48.162	n	317
	within		2.898	1.262	41.006	T-bar	15.1073
Population Density	overall	345.9211	832.8797	1.9	12802.85	N	5068
	between		868.662	2.519	6,554.081	n	323
	within		232.706	-1,802.52	10,775.63	T-bar	15.6904
GDP per capita	overall	23,140.38	10,949.25	2900	148,000	N	4443
	between		10,581.22	5,918.75	127,587.5	n	284
	within		3,079.376	-1,747.122	43,552.88	T-bar	15.6444
Railway (1000 KM)	overall	1.203602	1.294428	0	8.486625	N	3778
	between		1.2181	0	5.916	n	238
	within		0.444	-0.885	8.074	T-bar	15.8739
Roads (1000 KM)	overall	13.07251	16.13976	0	94.879	N	4420
	between		15.763	0	91.292	n	278
	within		3.453	-8.613	36.724	T	15.8993
Land Area (1000 KM2)	overall	18.06567	23.74249	0.013	203.8746	N	3524
	between		22.889	0.013	203.535	n	253
	within		0.875	-0.673	40.419	T-bar	13.9289

Source: project database.

The empirical model can then be expressed as:

$$y_{it} = \alpha_i + \boldsymbol{x'_{it}}\boldsymbol{\beta} + \varepsilon_{it}$$

Where α_i are region-specific effects, Y is the net migration rate in each region and year considered, $\boldsymbol{x'_{it}}$ includes the adult unemployment rate (in logs), the KE variable (the percentage of the active population with HE in Science and Technology), population density, GDP (in logs), roads KM, and ε_{it} is an idiosyncratic error term.

Table 2.4 reports the estimated coefficients from the estimations, with their standard errors and their level of significance. Column (1) reports the results when the model includes only the KE variable, and regional and time fixed effects. The KE has a small positive and significant association with the dependent variable: an increase of 1% in the KE index is associated with an increase in the net migration rate of 0.177 per thousand inhabitants. The other columns in the table report the results when further controls are included, and show that the firstly estimated coefficient on the KE has an upward bias, probably due to an omitted variable bias (i.e. important determinants of the dependent variable should have been included in the specification).

Column (2) includes further controls, identified by the literature as pull and push factors for migrations flows: unemployment rate, GDP per capita, population density, and the length of available roads in the region. Following the literature, one would expect to observe (with respect to the dependent variable):

- a negative association with unemployment, since areas with high unemployment rates are more likely to observe higher emigration flows than immigration ones,
- a positive association with GDP per capita, since areas with higher level of income per capita are more attractive to immigrants,
- a positive association with population density, since higher density is likely to be present in urban areas, which are more attractive to immigrants,
- a positive association with the length of the available roads, which proxy the physical infrastructure and thus the level of investments and development of the region[14]: a more developed region is likely to be more attractive to immigrants.

The estimates show the expected results in terms of sign and magnitude: GDP per capita and unemployment rate are the most important driver of net migration. An increase of 1% in the unemployment rate is associated with a reduction in the net migration rate of around 0.07 per thousand inhabitants, while a similar increase in the GDP per capita is associated with an increase in the net migration rate of 0.046. The KE does not have a statistically significantly

[14] As done in European Commission (2014e), Infrastructure in the EU: Developments and Impact on Growth, Occasional Papers series 203.
Available at http://ec.europa.eu/economy_finance/publications/occasional_paper/2014/pdf/ocp203_en.pdf

relationship with the net migration rate when other fundamental factors are taken into account. However, the time period of the analysis includes the 2008 crisis, which has a substantial impact on the economic situation of the area considered. Therefore, additional variables were introduced to allow for a change in the determinants of migration after the crisis. The variables are constructed as an interaction between the variables and a post-crisis indicator[15]: doing so, the relationship between the variables is allowed to be different before and after the crisis. Trend variables, interacted with the UN-type groups of regions, were also included in the model, to control for the all the changes in the dependent variable that are due to the passing of time.

Column (3) reports the estimates obtained when these interactions terms are introduced. The KE variable is negative and slightly significant for the period before the crisis, and it is then positive and significant for the period after it: an increase in 1% in the KE indicator after 2008 is associated with an increase in the net migration rate of 0.18. The importance of the GDP per capita as an attraction factor for migrants was significantly decreased after the crisis: a 1% increase in GDP per capita after the crisis is associated with an increase in the net migration rate of 0.03. The association with the unemployment rate has instead become more pronounced, with the relationship after the crisis being significantly higher than before: a 1% increase in the unemployment rate is associated with a decrease in the net migration rate of 0.079.

Finally, Column (4) shows the estimates obtained when squared trend interacted with UN-type macro regions where added to the model. This is done to allow for the time trend to be quadratic, instead of linear, i.e. to allow the model to be more flexible. The results show minor changes for most of the coefficients, apart from GDP, which has a smaller association, and a slight decrease for the KE variable. Indeed, a 1% increase in the KE is associated with an increase in the net migration rate after the crisis of 0.15.

[15] This is a dummy variable with value 0 for the period before 2008, and 1 from 2008 afterwards.

Table 2.4: Panel models results

	(1)	(2)	(3)	(4)
Variables				
KE	0.177***	-0.020	-0.179*	-0.247**
	(0.066)	(0.097)	(0.092)	(0.096)
Log Unemployment rate (25-64)		-6.681***	-4.898***	-4.261***
		(0.765)	(0.659)	(0.645)
Log(GDP per capita)		4.570**	9.804***	7.813***
		(1.847)	(2.148)	(2.017)
Population density (Inhabitants per KM2)		0.003*	-0.006*	-0.006*
		(0.002)	(0.003)	(0.003)
Roads (1000 KM)		0.035	0.073***	0.064**
		(0.026)	(0.027)	(0.028)
KE * After 2008			0.361***	0.347***
			(0.071)	(0.074)
Unempl * After 2008			-2.894***	-2.630***
			(0.659)	(0.615)
Log(GDP per capita) * After 2008			-6.842***	-6.839***
			(1.226)	(1.272)
Population Density * After 2008			0.003***	0.002***
			(0.001)	(0.001)
Roads * After 2008			-0.019	-0.022*
			(0.013)	(0.012)
Constant	-0.892	-29.797	-77.800***	-58.700***
	(1.596)	(19.234)	(21.709)	(20.586)
Observations	4,503	3,410	3,410	3,410
R-squared	0.037	0.222	0.284	0.308
Number of regions	317	240	240	240
Year FE	YES	YES	YES	YES
Trend*MacroRegion	NO	NO	YES	YES
Trend^2*MacroRegion	NO	NO	NO	YES

*Note: Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0. St. errors clustered at NUTS 2 level*

Overall, the results obtained so far suggests that before the crisis, the knowledge economy was not a significant driver of net migration flows, once other factors were taken into account. The unemployment rate and the GDP per capita were fundamentally more important to explain the net migration pattern. However, the crisis has modified the association between these factors and migration, reducing the role of some pull factors, such as GDP per capita, and increasing the role of some push factors, such as the unemployment rate.

The 2008 crisis has also changed the importance of the KE as a determinant of migration rates: regions with a more developed KE experienced higher net migration rates. Due to limitations in the data availability, it is not possible to empirically investigate this process any further.

However, with some speculation, a potential explanation of the changing role of the KE might be related to the composition of net migration flows. It seems plausible to think that the crisis has pushed more highly skilled migrants towards areas with higher standards of living and where the KE is more developed, and thus where their human capital could be offered more satisfactory returns. An alternative potential explanation (which might also be complementary) could be related to changes in national legislations towards immigration[16], as documented in various research papers[17].

Table 2.5 below presents results from a multilevel (hierarchical) model analysis as an alternative approach to estimate the association between the knowledge economy and the net migration rate. This approach recognises the existence of hierarchies in the data. It allows the effects to vary by regions, thus accounting for the potential variation between regions.

The proposed model is formed by two sets of equations, level 1 and level 2 equations, which compose the following hierarchical model:

$$y_{it} = \theta_{0j} + \theta_{1i} KE_{it} + \theta_{2i} I(t \geq 2008) KE_{it} + \boldsymbol{x'_{it}\delta} + e_{it}$$

$$\theta_{0j} = \gamma_{00} + u_{0itj}$$

$$\theta_{1i} = \gamma_{10} + u_{1ti}$$

$$\theta_{2i} = \gamma_{20} + u_{2ti}$$

The model in the first equation specifies that knowledge economy and its interaction with the crisis indicator dummy can have a varying relationship with the regional net migration rate ($\theta_{1i,}\theta_{2i}$, with *i* representing region i), while the constant differs by country. In particular, the size of the knowledge economy indicators depend on the random error terms, u_{1ti}, u_{2ti}, which vary by regions *i* and years *t*. We exploit the multilevel dimension of the data by assuming that the intercept can vary by country rather than by regions , θ_{0j}, where *j* represents coutry j and *t* is the time dimesion Again, the value of the interecept depends on a constant and a random component which, in this case, varies over time and by country.

[16] Please note that the immigration figures do not allow to disentangle EU and non-EU migrants.

[17] See for instance Cerna, L. (2016), The crisis as an opportunity for change? High skilled immigration policies across Europe, Journal of Ethnic and Migration Studies, vol.42(10), p. 1610-1630

Table 2.5: Multilevel model results

	(1)	(2)	(3)	(4)
Variables				
KE	0.258***	-0.043	-0.146***	-0.147***
	(0.029)	(0.040)	(0.051)	(0.049)
Population density (Inhabitants per KM2)		0.002***	0.000	-0.001
		(0.000)	(0.000)	(0.000)
Log Unemployment rate 25+		-5.393***	-3.509***	-2.753***
		(0.322)	(0.397)	(0.403)
Log(GDP per capita)		3.297***	3.272***	8.215***
		(0.843)	(0.827)	(0.918)
Roads (1000 KM)		0.017	0.000	0.042**
		(0.014)	(0.017)	(0.017)
Trend			0.116	6.147***
			(0.093)	(0.611)
KE * After 2008			0.213***	0.215***
			(0.055)	(0.054)
Unempl * After 2008			-1.775***	-2.704***
			(0.493)	(0.491)
Log(GDP per capita) * After 2008			-0.529***	-8.729***
			(0.198)	(0.878)
Density * After 2008			0.002***	0.003***
			(0.000)	(0.000)
Roads * After 2008			0.009	-0.011
			(0.017)	(0.015)
Constant	-3.50***	-18.97**	-20.98***	-82.492***
	(0.968)	(8.198)	(7.936)	(9.505)
Observations	4503	3100	3100	3100
Year FE	YES	YES	YES	YES
Trend*MacroRegion	NO	NO	YES	YES
Trend^2*MacroRegion	NO	NO	NO	YES
ICC	0.784	0.497	0.422	0.51

*Note: *** p<0.01, ** p<0.05, * p<0.1*

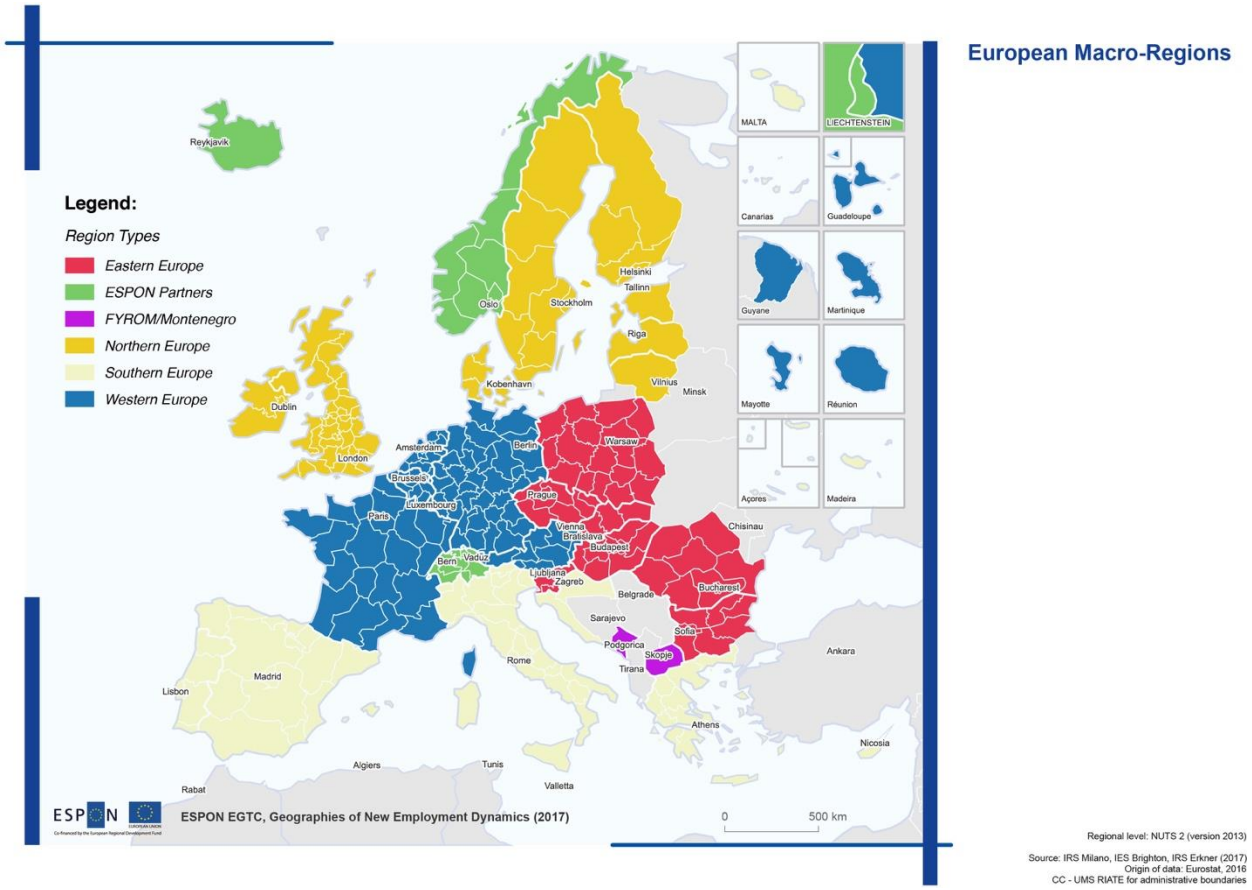
As in Table 2.4, the relationship with the knowledge economy changes in the different model specifications. It is initially positive and statistically significant (column(1)), but becomes negative when more covariates are added in the model. The positive association is registered again when the model accounts for the implications of the 2008 crisis. Moreover, the magnitude of the relationship is similar to what presented in table 2.4. The same is not true for unemployment rate; the latter has a stronger negative association with the net migration rate when estimated through the multilevel analysis.

We also report the Intraclass Correlation Coefficient for the different specifications of the model in Table 2.5. The ICC shows the amount of variation that is not explained by the covariates of the model and can be attributed to the grouping variable. Results suggest that ICC tend to decrease as the number of covariates increases, but a large portion of the overall variation is explained by clustering.

2.3 Additional tables, graphs, and maps

2.3.1 Statistical Analisys

Map 2.5: European Macro-Regions



Source: Project database, indicator un_type, derived from UN Classification

Table 2.6: Number of Regions by country

Country	N	Percent
AT	9	2.51
BE	11	3.06
BG	6	1.67
CH	7	1.95
CY	1	0.28
CZ	8	2.23
DE	38	10.58
DK	6	1.67
EA	3	0.84
EE	1	0.28
EF	1	0.28
EL	19	5.29
ES	19	5.29
EU	3	0.84
FI	7	1.95
FR	27	7.52
GR	13	3.62
HR	4	1.11
HU	7	1.95
IE	2	0.56
IS	1	0.28
IT	28	7.8
LI	1	0.28
LT	1	0.28
LU	1	0.28
LV	1	0.28
ME	1	0.28
MK	1	0.28
MT	1	0.28
NL	12	3.34
NO	7	1.95
PL	16	4.46
PT	7	1.95
RO	8	2.23
SE	8	2.23
SI	3	0.84
SK	4	1.11
TR	26	7.24
UK	40	11.14
Total	**359**	**100**

Source: Own elaboration on project database.

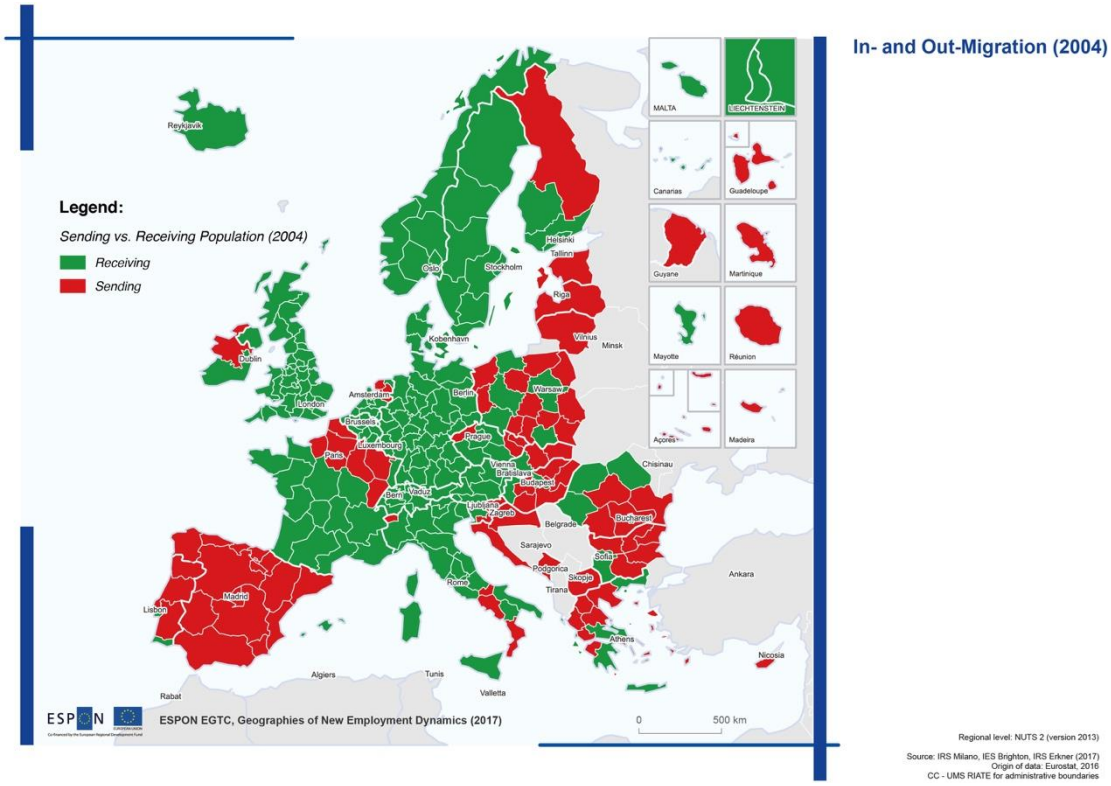
Table 2.7: Summary statistics

Indicator	Mean	Median	Min	Max	Sd	N	N missing
Net migration rate	2.91	2.40	-45.20	61.00	6.30	4695	1049
Population density	346	117	2	12803	833	5068	676
Population 15+	1485	1163	21	10982	1258	4851	893
Population 65+	281	219	4	2096	241	4857	887
Employment in tech/knowledge	3.35	3.00	0.00	18.20	2.01	2656	3088
Growth in employment in scient/profession	5.86	2.33	-51.40	316.50	18.41	1785	3959
R&D expenditure	1.37	1.04	0.00	12.19	1.20	3908	1836
Personnel in R&D	1.36	1.14	0.00	5.29	0.93	3613	2131
Active population in sc/tech with HE (%)	25.86	26.10	1.80	56.10	8.30	4789	955
Active population in sc/engin with HE (%)	4.67	4.30	0.10	16.40	2.27	4676	1068
Total patents	185.23	63.27	0.00	3341.41	353.87	4670	1074
HE rate pop	24.01	23.68	0.00	77.10	9.24	4825	919
HE rate 30-34	28.28	27.30	1.70	81.30	12.02	4650	1094
Population with tertiary edu (%)	22.95	22.80	1.30	69.90	9.64	4791	953
Female population with tertiary edu (%)	22.98	22.10	0.10	70.80	10.59	4793	951
pop_30_cal	100.24	100.00	68.84	180.96	2.79	4650	1094
Students in tertiary education	82412	49449	597	2592201	160671	960	4784
Employment rate 15-64	0.64	0.65	0.19	4.89	0.13	4849	895
Unemployment rate 25+	7.53	6.10	0.30	34.30	5.04	4802	942
Youth unemployment ratio	8.21	7.56	0.12	31.77	3.92	4603	1141
Economically active pop with tertiary education	195.18	141.40	0.60	2480.20	205.84	4828	916
Economically active pop 15-64	727.42	572.70	11.60	5278.70	619.10	4860	884
NEET 15-24	0.12	0.06	0.01	3.58	0.22	4690	1054
Early leavers 18-24	16.57	13.40	0.00	84.20	11.52	4700	1044
Long term unemployment rate 25+	7.53	6.10	0.30	34.30	5.04	4802	942
GDP per capita (PPS)	23138	22300	2900	148000	10950	4443	1301
GDP per capita (PPS as EU percentage)	97.24	95.00	17.00	556.00	44.63	4443	1301
People in poverty/risk of social exclusion (%)	24.35	19.70	0.80	65.30	12.24	1177	4567
Share of foreigners	4.05	3.19	0.00	41.51	4.89	192	5552
Share of EU nationals	1.55	0.76	0.00	38.28	3.27	191	5553
Share of non-EU nationals	2.43	1.49	0.00	15.80	2.82	186	5558
Life expectancy at 84	8.55	8.60	4.30	12.28	1.03	4749	995
Elderly rate	0.17	0.18	0.03	0.28	0.04	965	4779
Rate of natural change in population	1.10	0.50	-11.50	28.90	4.47	4755	989

Source: Own elaboration on project database.

Migration and Demography

Map 2.6: Sending vs receiving regions, 2004



Map 2.7: Comparison of R&D Expenditure and Net Migration 2004

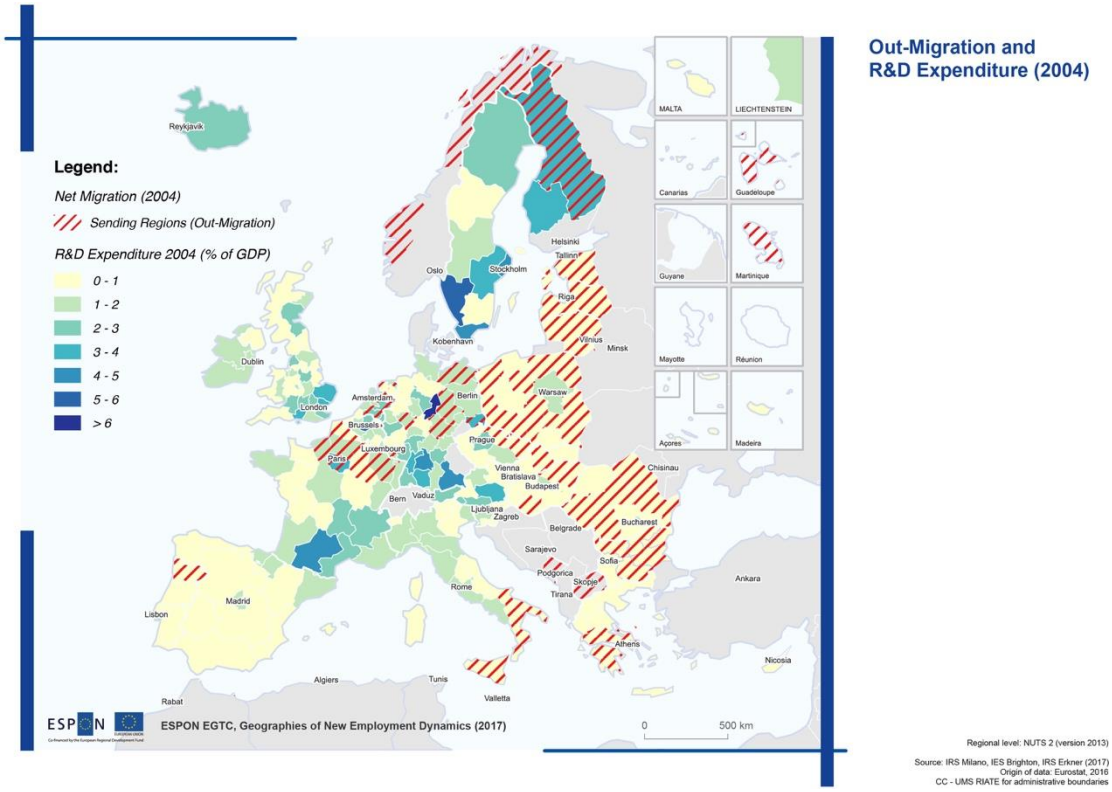
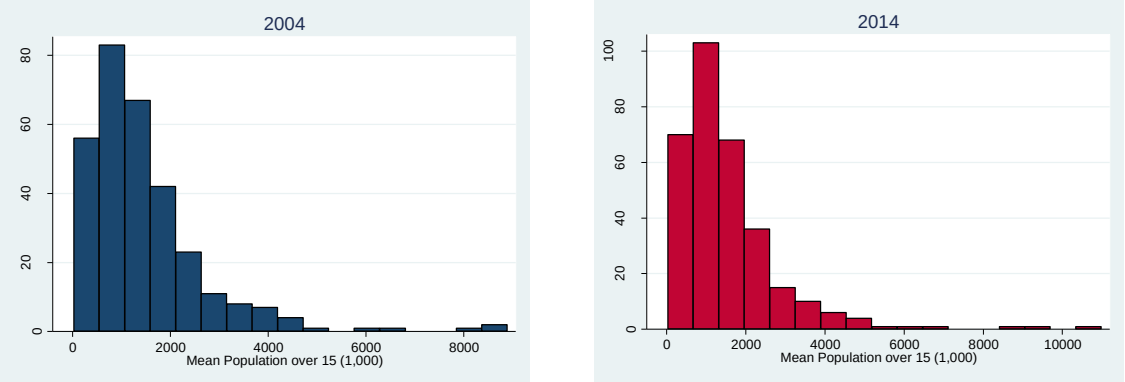


Figure 2.9: Population 15+ (in 1,000), 2004 vs 2014



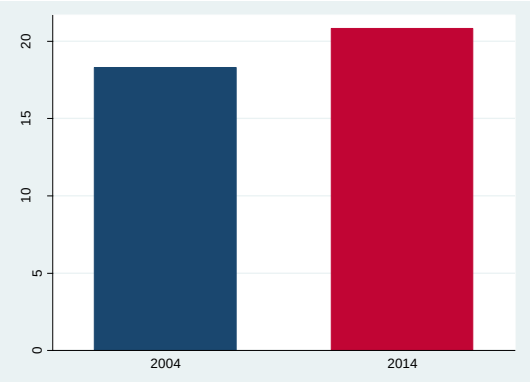
Source: Project database, indicator tot_pop_15. Units are thousands.

Table 2.8: Net migration rate, 1999-2014, by macro region

Year	Average	Eastern	Northern	Southern	Western	ESPON Partners	Turkey	FYROM and Montenegro
1999	4.86		6.08	4.37	4.47	6.21		
2000	2.50	-0.50	2.52	4.04	2.96	2.96		-0.65
2001	2.20	-7.39	3.12	5.59	4.12	4.48		-6.15
2002	3.44	-0.59	3.72	6.11	3.40	4.63		-0.55
2003	3.43	-0.24	3.73	6.60	2.93	3.98		-0.65
2004	3.32	-0.33	4.13	6.56	2.49	3.65		-0.80
2005	3.38	0.03	4.47	6.31	2.30	4.51		-1.70
2006	3.31	-0.12	4.82	6.39	1.71	5.37		-0.20
2007	4.22	0.84	4.78	8.77	1.73	8.60		-0.70
2008	3.29	0.84	3.67	6.41	1.21	9.11		-0.90
2009	2.08	0.10	2.80	4.02	1.36	6.24	-0.50	-0.90
2010	2.06	-0.40	2.61	3.05	2.30	6.89	-0.58	-0.90
2011	1.62	0.03	2.34	1.20	2.25	7.43	-1.47	-0.95
2012	1.67	-0.03	2.23	0.52	3.01	8.07	-1.92	-1.00
2013	4.28	-0.54	3.23	2.64	9.51	8.34	-1.10	-0.95
2014	2.13	-0.13	4.30	-1.09	4.12	7.64	-1.02	-0.85

Source: Project database, indicator demo_r_gind3_CNMIGRATR

Figure 2.10: Mean ratios of population 65+ to population 15+, 2004 vs 2014



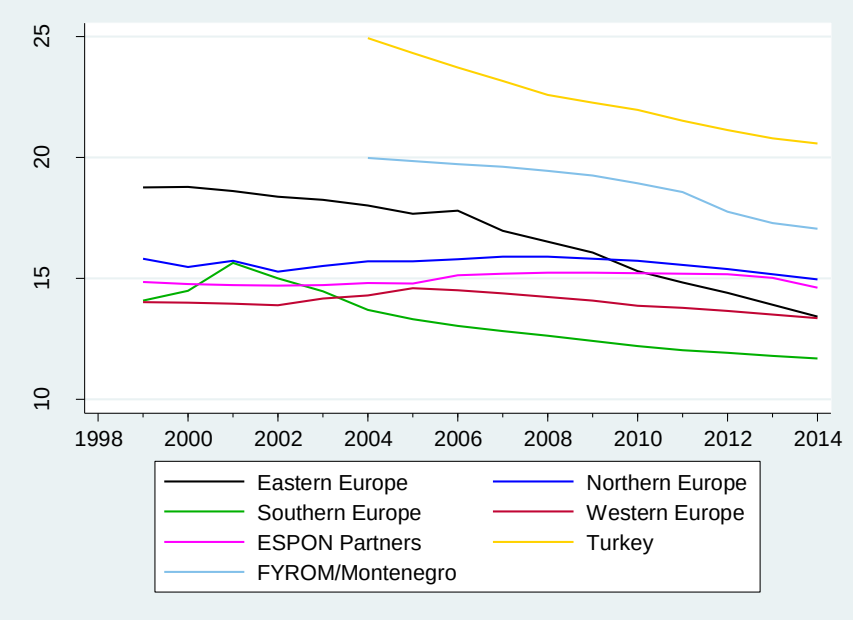
Source: Project database, indicator old_per. The graph show the mean values in the two years.

Table 2.9: Kolmogorov-Smirnov test results for population 15+

	D	P-value	Corrected
2004	0.2902	0.000	
2014	-0.0033	0.997	
Combined K-S	0.2902	0.000	0.000

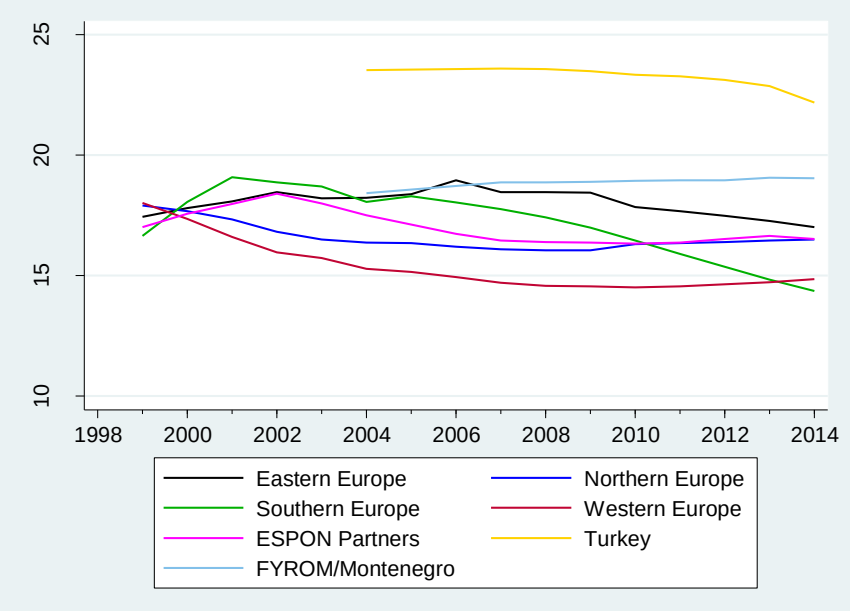
Source: Project database. Indicator tot_pop_15

Figure 2.11: Average Population 15-24 (% of total population over 15), 1999-2014



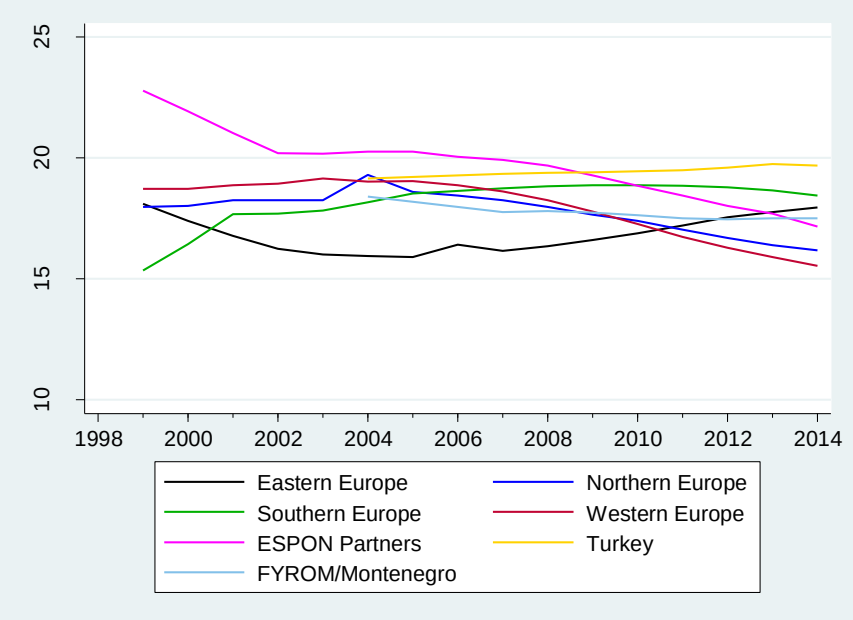
Source: Project database. The indicator is the average population 15-24 as a percentage of the average total population over 15, multiplied by 100.

Figure 2.12: Average population 25-34 (% of total population over 15), 1999-2014



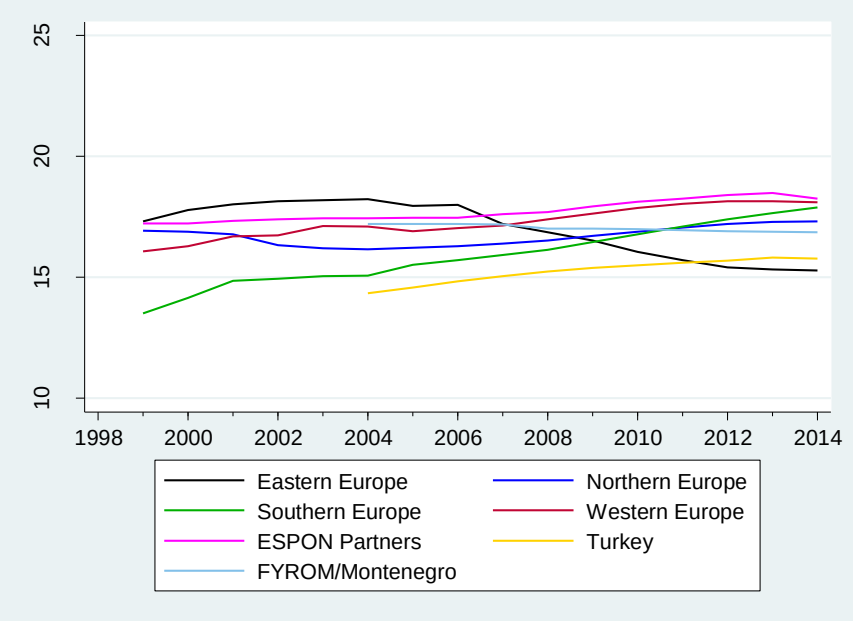
Source: Project database. The indicator is the average population 25-34 as a percentage of the average total population over 15, multiplied by 100.

Figure 2.13: Average population 35-44 (% of total population over 15), 1999-2014



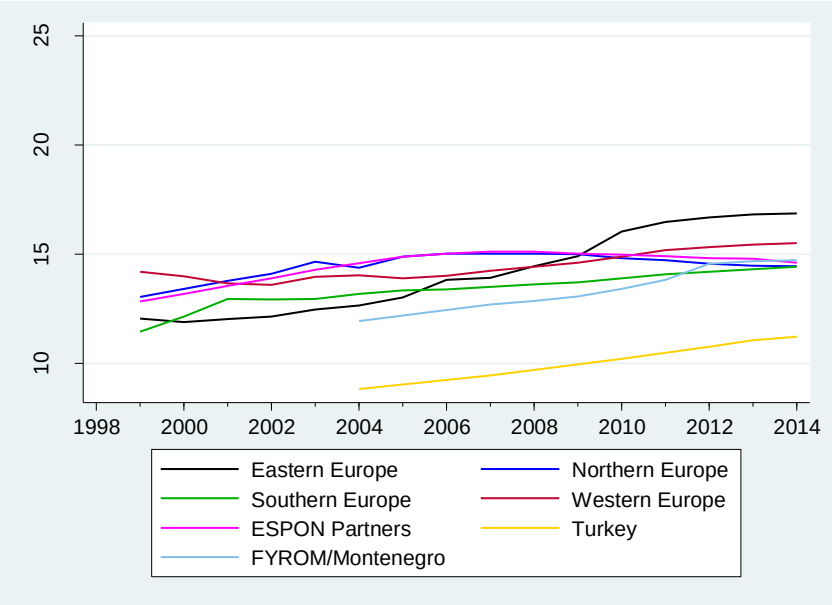
Source: Project database. The indicator is the average population 35-44 as a percentage of the average total population over 15, multiplied by 100.

Figure 2.14: Average population 45-54 (% of total population over 15), 1999-2014



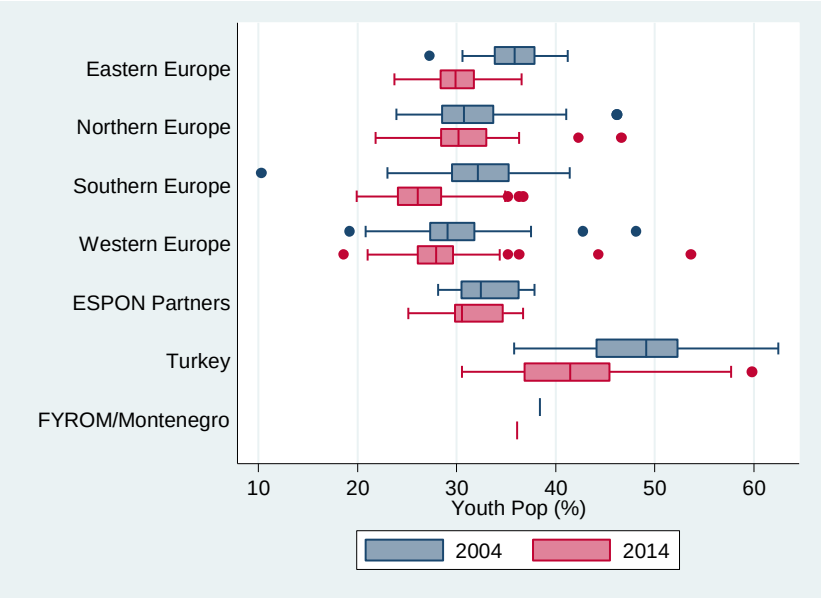
Source: Project database. The indicator is the average population 45-54 as a percentage of the average total population over 15, multiplied by 100.

Figure 2.15: Average population 55-64 (% of total population over 15), 1999-2014



Source: Project database. The indicator is the average population 55-64 as a percentage of the average total population over 15, multiplied by 100.

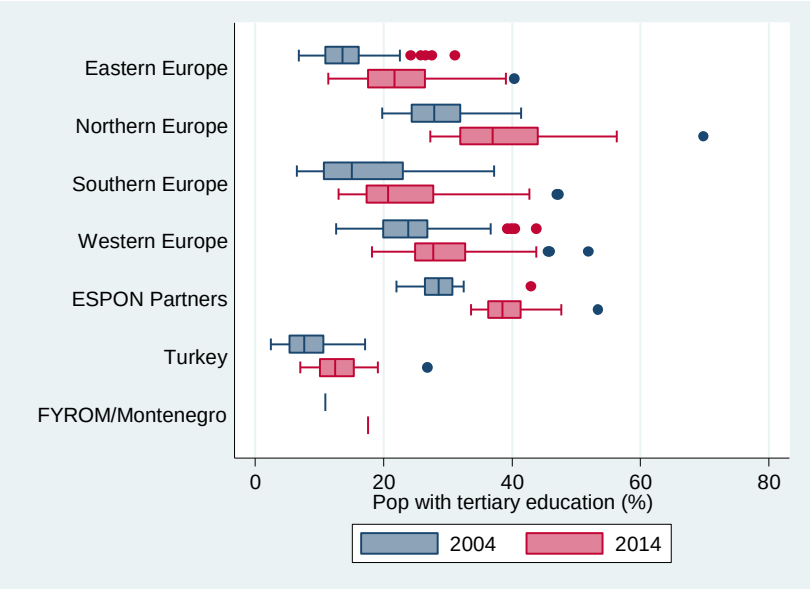
Figure 2.16: Average youth population, age 15-34 (% of total population over 15), by groups of regions, 2004 and 2014



Source: Own elaboration on project database. The box plots show the variation of the data, marking the median and the quartiles of the distribution. The indicator is the average population 15-34 as a percentage of the average total population over 15, multiplied by 100.

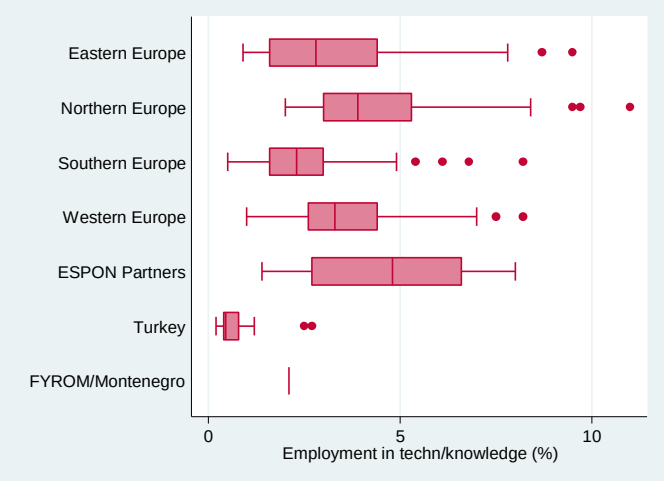
Knowledge Economy and Innovation

Figure 2.17: Population with tertiary education (%), age group 30-34, by macro regions, 2004 vs 2014



*Source: Project database. Indicator T_ED5_8_edatlfse12_*

Figure 2.18: Employment in tech/knowledge (% of employed population), 2014



Source: Project database, indicators empl_tech_knowledge=T_htec_emp_reg2_y_. The indicator is defined as the percentage of total employed persons that are in technical and knowledge sectors (multiplied by 100).

Map 2.8: Employment in tech/knowledge (2014)

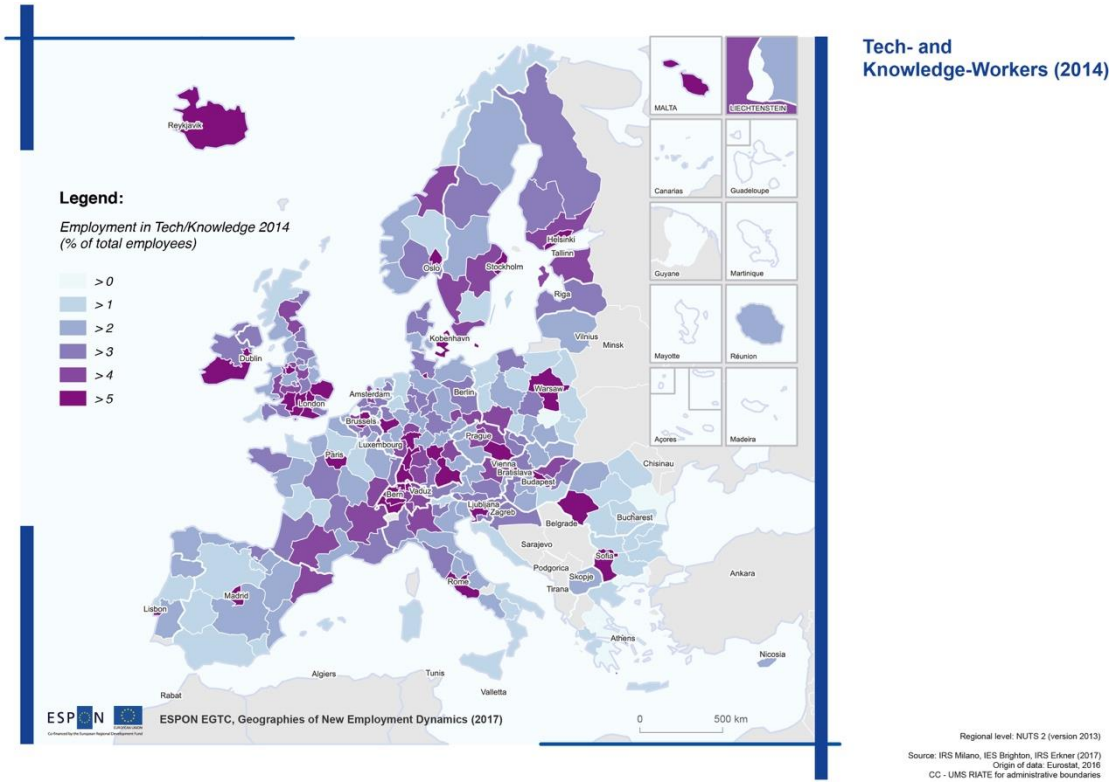


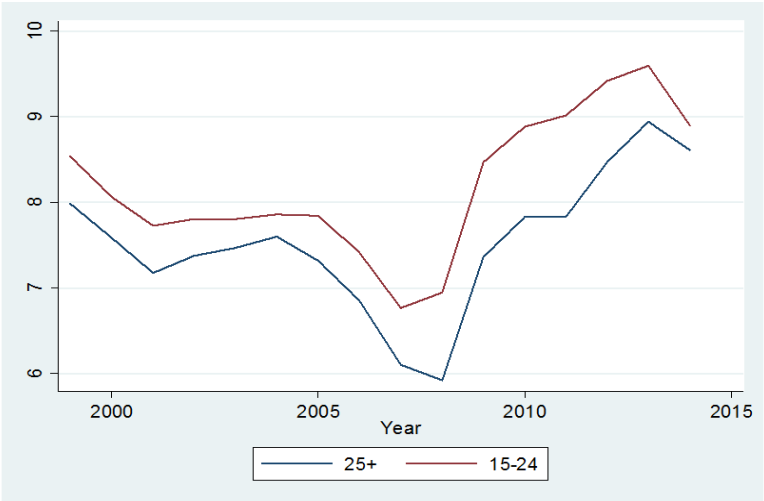
Table 2.10: Kolmogorov-Smirnov test results for Population with tertiary education rate

Smaller group	D	P-value	Corrected
2004	0.2787	0.000	
2014	0.0000	1.000	
Combined K-S	0.2787	0.000	0.000

Source: Project database. Indicator pop_ED5_8

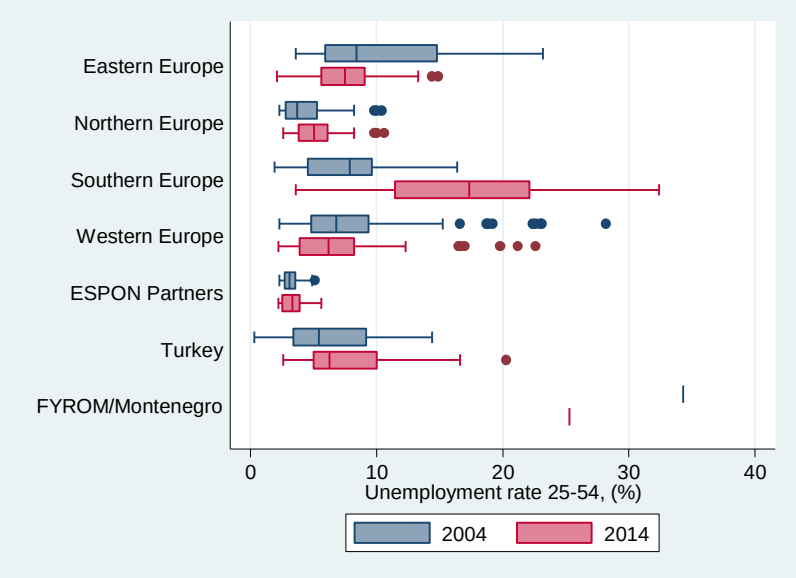
Labour Market and Education

Figure 2.19: Unemployment rate (%), entire area



Source: Project database, indicator unemprate_over25_T=T_Y_GE25_lfu3rt. The indicator is the unemployment rate multiplied by 100.

Figure 2.20: Unemployment rate 25-64 (%), by groups of regions,2004 and 2014



Source: Project database, indicator unemprate_over25_T=T_Y_GE25_lfu3rt. The indicator is the percentage of the active population aged 25-64 that is unemployed and actively looking for employment, multiplied by 100.

Table 2.11: Unemployment rate 25+, 1999-2014, by macro regions

Year	Average	Eastern	Northern	Southern	Western	ESPON Partners	Turkey	FYROM and Montenegro
1999	7.99	8.16	6.19	9.92	8.52	1.78		
2000	7.59	9.82	5.36	9.26	7.56	1.87		
2001	7.18	10.66	4.65	8.10	6.86	2.09		
2002	7.38	11.04	4.55	8.17	7.17	2.51		
2003	7.47	10.71	4.51	8.03	7.75	3.09		
2004	7.60	10.77	4.43	7.66	8.41	3.27	6.15	34.30
2005	7.32	10.06	4.11	7.51	8.46	3.35	5.82	33.40
2006	6.86	8.67	4.11	6.92	8.02	2.87	6.35	32.50
2007	6.10	6.86	3.79	6.56	6.92	2.33	6.88	31.60
2008	5.93	5.72	4.00	7.14	6.25	2.25	7.55	30.50
2009	7.36	7.07	6.01	9.31	6.83	2.93	9.53	29.00
2010	7.83	8.32	6.60	10.77	6.66	3.45	8.08	29.30
2011	7.83	8.27	6.35	12.35	6.18	3.08	6.62	28.50
2012	8.47	8.49	6.20	15.80	6.36	3.06	6.15	28.20
2013	8.94	8.69	5.84	17.44	6.80	3.19	6.65	26.30
2014	8.61	7.69	5.16	16.82	6.76	3.41	7.77	25.30

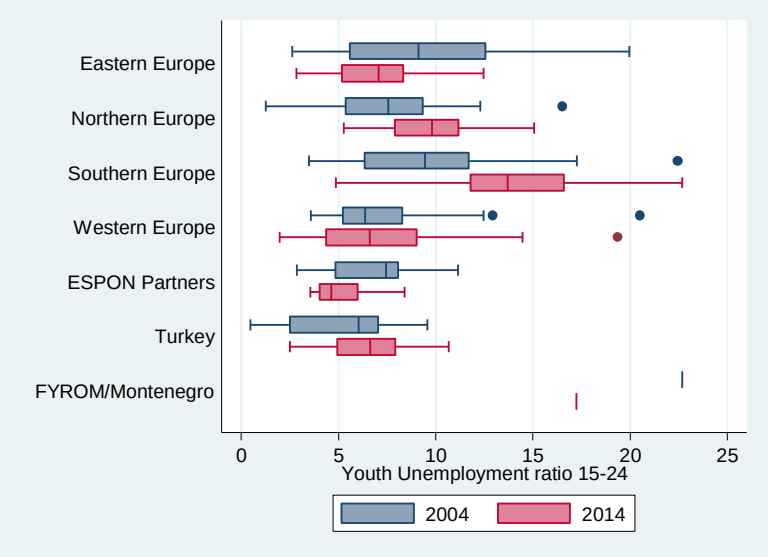
Source: Project database, indicator unemprate_over25_T=T_Y_GE25_lfu3rt

Table 2.12: Youth Unemployment Ratio 15-24, 1999-2014, by macro regions

Year	Average	Eastern	Northern	Southern	Western	ESPON Partners	Turkey	FYROM and Montenegro
1999	8.54	8.59	8.36	11.64	6.69	7.96		
2000	8.06	9.66	8.03	10.73	5.78	6.33		
2001	7.73	10.35	7.50	9.18	5.50	6.94		
2002	7.81	10.22	7.44	9.28	5.81	6.82		
2003	7.81	9.35	7.64	9.18	6.35	6.89		
2004	7.86	9.36	7.44	9.21	7.04	7.03	5.38	22.67
2005	7.84	8.62	7.87	8.70	7.68	6.38	5.22	22.02
2006	7.42	7.40	8.25	7.97	7.25	5.35	5.59	21.36
2007	6.77	5.64	8.24	7.33	6.50	4.73	5.99	20.71
2008	6.95	4.99	8.67	8.37	6.20	4.98	6.70	20.26
2009	8.47	6.41	11.21	10.17	7.10	5.98	7.99	19.32
2010	8.88	7.28	11.97	11.28	6.94	5.75	7.02	17.89
2011	9.02	7.50	12.03	12.50	6.58	5.53	6.20	17.75
2012	9.42	8.00	11.66	14.46	6.86	5.70	5.43	18.08
2013	9.60	8.01	11.15	14.91	7.30	5.65	6.05	17.45
2014	8.90	7.04	9.69	14.00	6.98	5.25	6.65	17.23

Source: Project database, indicator youth_unemp_ratio=lfu3pers_1524/T_Y15_24lfsd2pop_*100

Figure 2.21: Youth unemployment ratio 15-24, by macro regions, 2004 vs 2014



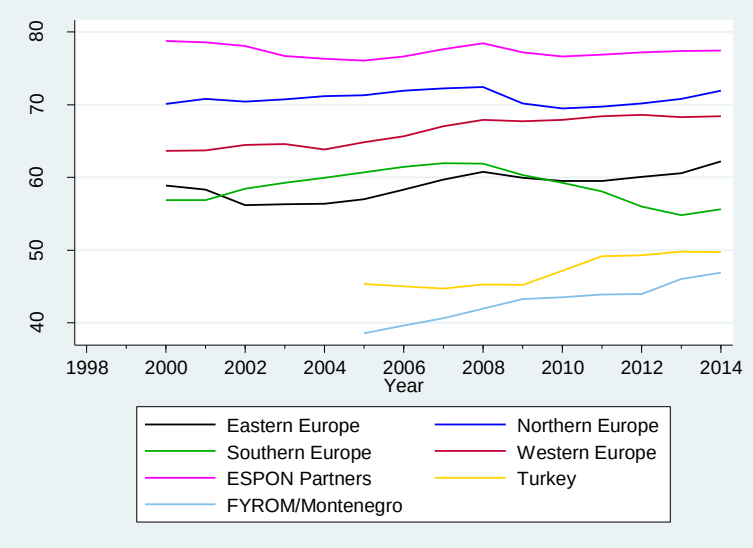
Source: Project database. Indicator youth_unemp_rati, defined as the ratio of unemployed indivduals aged 15-24 over the population aged 15-24.

Employment rate

The employment rate in 2014 was on average 64% over the period, with a minimum of 30% (Mardin Subregion, Turkey) and a maximum of 84% (Central Switzerland), with substantially stable figures compared to 2004. Figure 2.22 below shows the employment rates over the period considered, separated by the groups of regions. The trend is substantially stable over time, with a decrease in all rates after 2008, with the only exception of Western Europe, which shown resilience to the crisis. The decrease was particularly significant for Sourthern Europe regions, which experienced a downward trend since then.

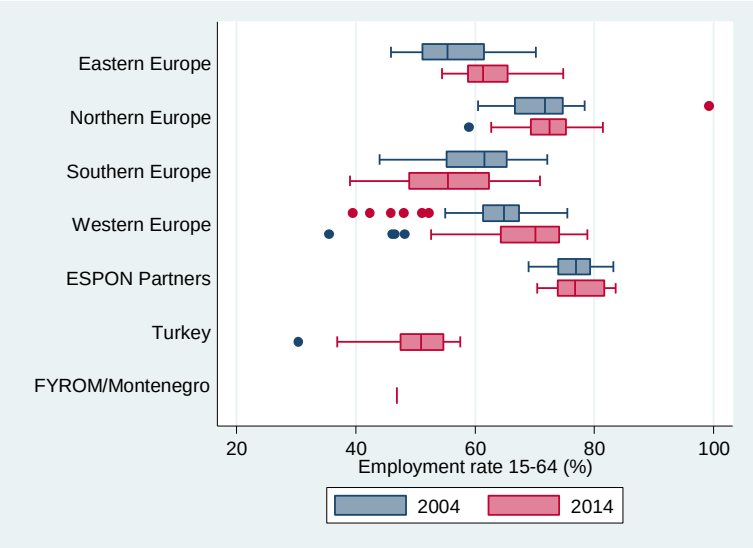
Figure 2.23 compares the employment rates in 2004 and 2014, across the groups of regions. The most interesting remark is that Eastern European and Western European regions have experienced a growth in their average employment rates over the period. However, this indicator does not take into account the potential reduction in population due to migration, which might have changed the available workforce in the regions.

Figure 2.22: Employment rate (15-64, %) by groups of regions



Source: Own elaboration on project database.The employment rate is defined as the percentage of people employed out of the total population. The rate is multiplied by 100.

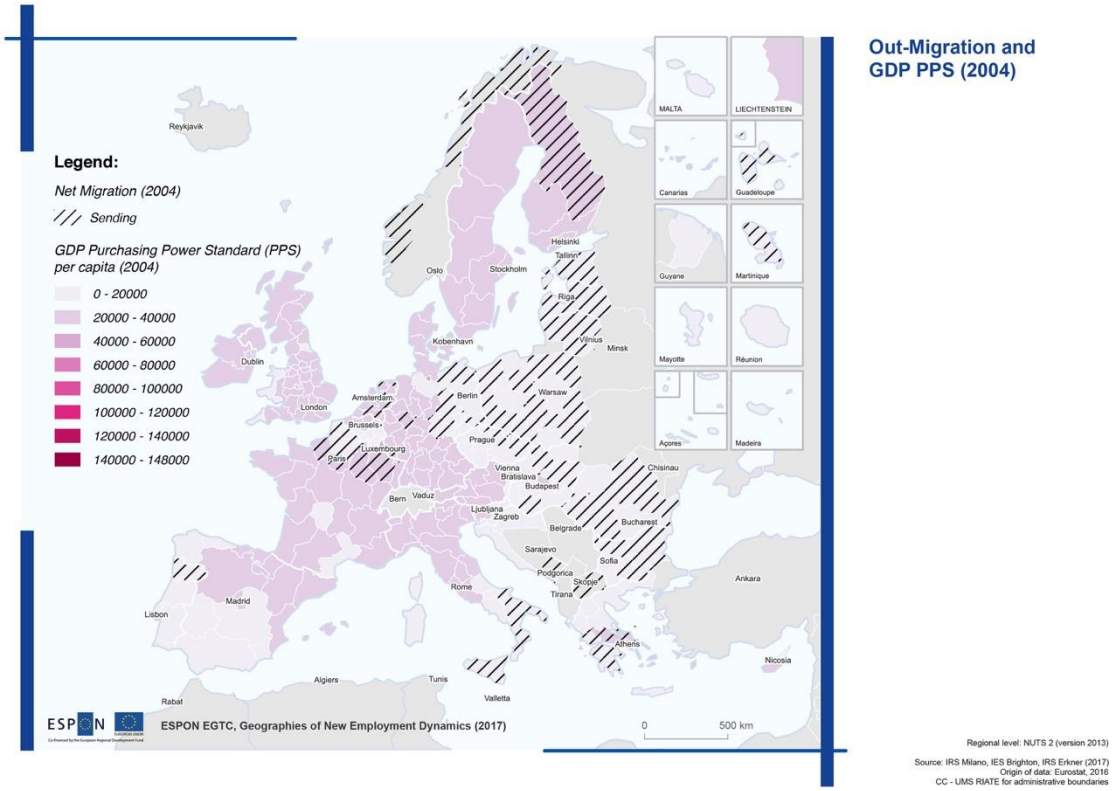
Figure 2.23: Employment rates (%) by groups of regions, 2004 and 2014



Source: Own elaboration on project database. The employment rate isdefined as the percentage of people employed out of the total population. The rate is multiplied by 100.

Contextual Indicators

Map 2.9: GDP PPS per capita and Net Migration, 2004



Map 2.10: GDP PPS per capita and Net Migration, 2014

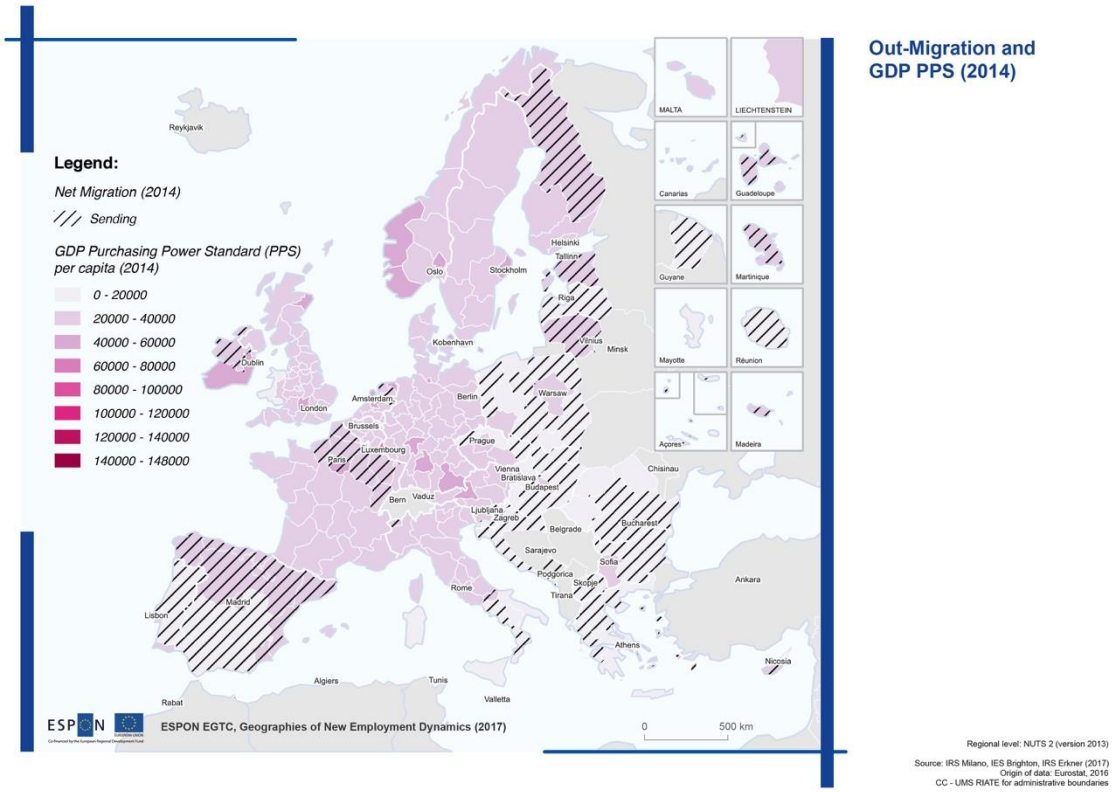
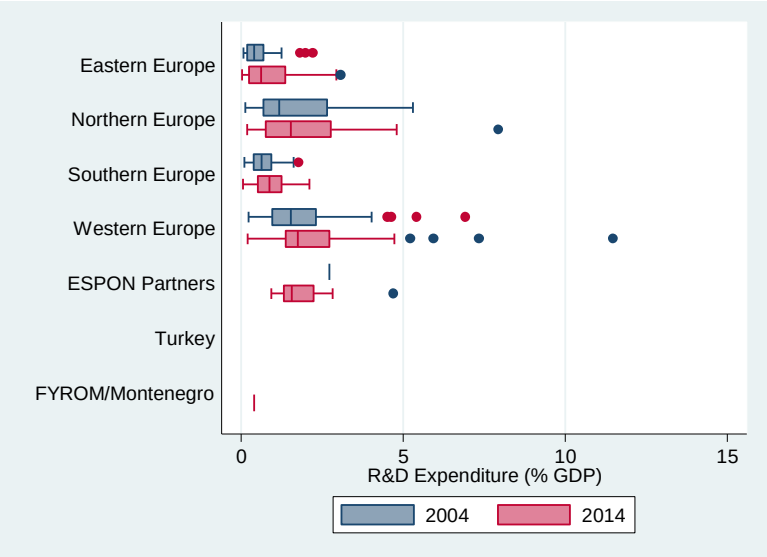


Table 2.13: Kolmogorov-Smirnov test results for R&D expenditure

	D	P-value	Corrected
2004	0.1839	0.000	
2014	-0.0109	0.969	
Combined K-S	0.1839	0.000	0.000

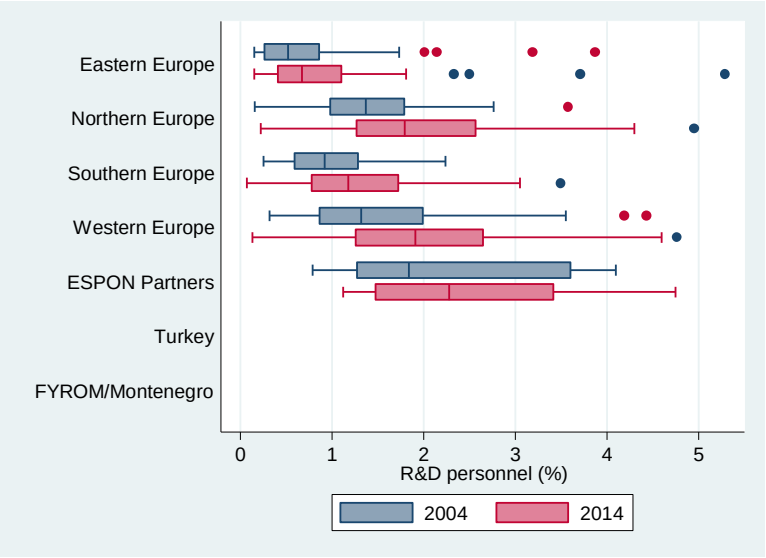
Source: Project database. Indicator rd_expenditure

Figure 2.24: R&D expenditure (as % of GDP), 2004 vs 2014



Source: Project database. Indicator R&D expenditure as percentage of GDP. The indicator is multiplied by 100.

Figure 2.25: Personnel working in R&D (%), 2004 vs 2014



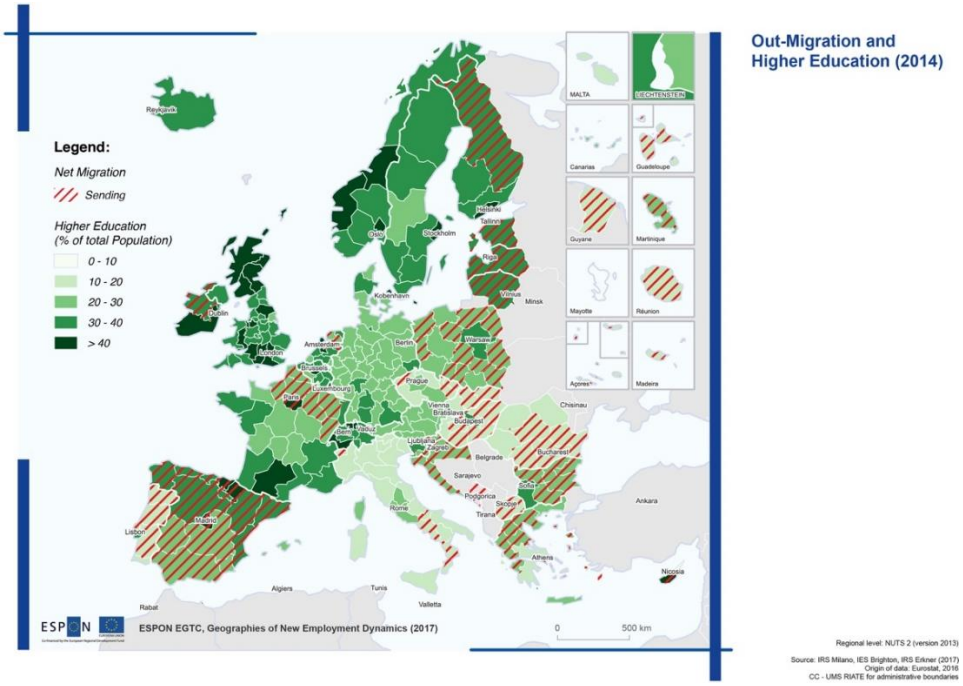
Source: Project database. Indicator personnel working in R&D as percentage of active population.

Table 2.14: Kolmogorov-Smirnov test results on patenting activity

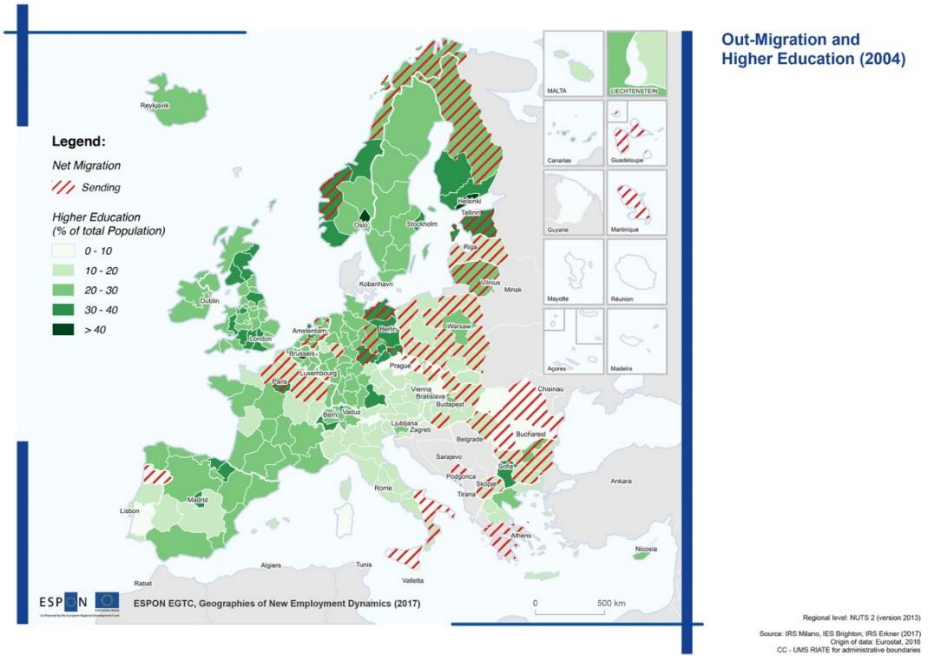
	D	P-value	Corrected
2004	0.1255	0.009	
2014	-0.0748	0.184	
Combined K-S	0.1255	0.017	0.013

Source: Project database. Indicator total_patents

Map 2.11: Population with tertiary education and regions with negative net migartion 2014



Map 2.12: Population with tertiary education and regions with negative net migartion 2004



2.3.2 Regression Analysis

Table 2.15: Correlation matrix of the selected variables

	Net migration rate	**Log Unemployment rate 25+**	**% active pop with HE in S&T**	**Population density (Inhabitants per KM2)**	**Log(GDP)**	**KE * After 2008**	**Unempl * After 2008**	**Log(GDP) * After 2008**	**Railway (1000 KM)**	**Roads (1000 KM**	**Land area (1000 KM2)**
Net migration rate	1										
Log Unemployment rate 25+	-0.2892	1									
% active pop with HE in S&T	0.2208	-0.3354	1								
Population density (Inhabitants per KM2)	0.0888	0.0922	0.2194	1							
Log(GDP)	0.3608	-0.4094	0.6961	0.3247	1						
KE * After 2008	0.0513	-0.033	0.4488	0.0717	0.35	1					
Unempl * After 2008	-0.1516	0.3318	0.0122	0.0319	0.0925	0.7687	1				
Log(GDP) * After 2008	-0.0451	0.0428	0.284	0.0276	0.2434	0.9522	0.9111	1			
Railway (1000 KM)	-0.0808	0.1724	0.0375	-0.1624	-0.1396	0.1184	0.0825	0.0926	1		
Roads (1000 KM)	-0.0847	0.0568	-0.0454	-0.1718	-0.0683	0.024	0.0249	0.0342	0.6123	1	
Land area (1000 KM2)	-0.1819	0.0995	-0.1641	-0.2373	-0.1685	-0.0368	0.0581	0.0316	0.4019	0.4582	1

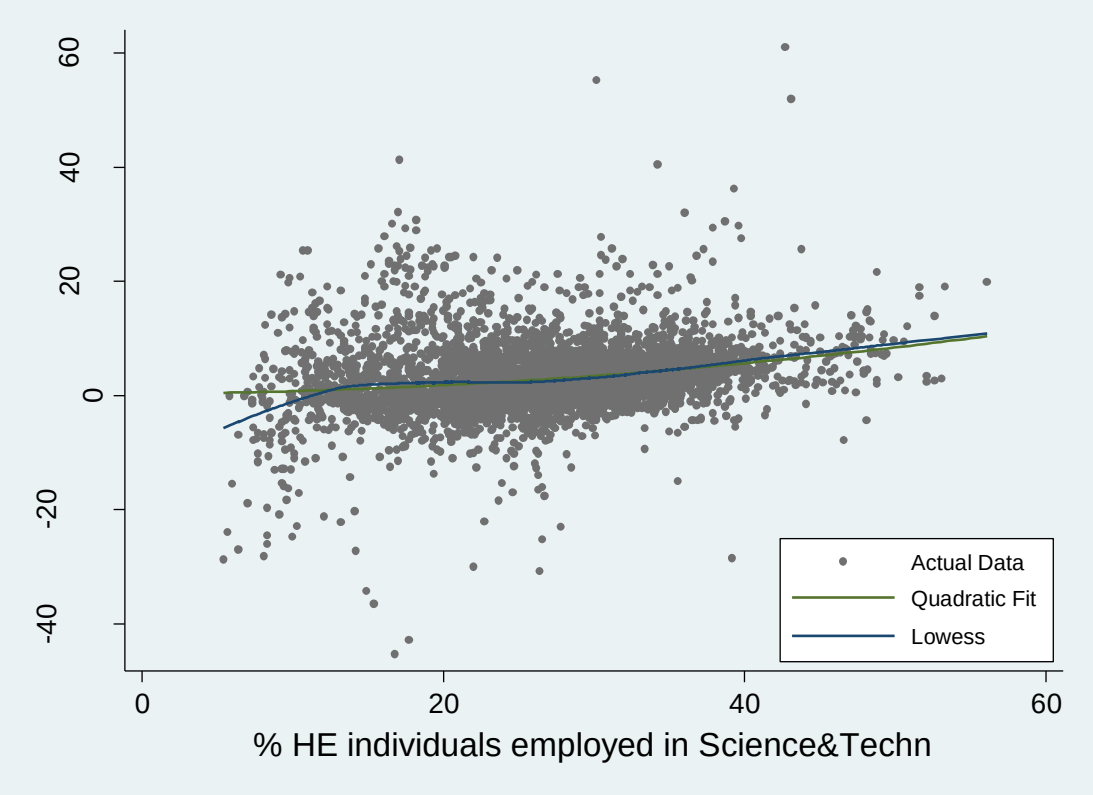
Source: project database.

Table 2.16: Hausman test result

chi2	82.6
Prob>chi2	0.0000

Source: project database.

Figure 2.26: Overall variation: Net migration rate vs knowledge economy



Source: Own elaboration on project database.

2.3.3 Cluster Analysis

The cluster analysis is a data classification methodology used to categorise n objects (in this case the European regions) into k (k>1) groups, called clusters, by using p (p>0) clustering variables.

In each cluster, observations are mutually replaceable with respect to the variables that are considered in the analysis, even if the entities (regions) assigned to a group do not necessarily have all the same attributes. Within each cluster, entities are therefore "similar".

We ran a K-means algorithm: given a set of observations (x1, x2, …, xn), where each observation is a p-dimensional real vector. K-means clustering aims to partition the n observations into fixed K (≤ n) sets S = {S1, S2, …, Sk} so as to minimise the within-cluster sum of squares (WCSS) (sum of distance functions of each point in the cluster to the K center).

Table 2.17: List of dimensions and indicators at NUTS 2 level

Dimension	Indicator	Source
Labour Market and Education	Early leavers from education and training by sex and NUTS-2 regions	Eurostat-Regional Statistics (edat_lfse_16)
	Young people neither in employment nor in education and training (NEET rates)	Eurostat-Regional Statistics (edat_lfse_22)
	Employment rate (15-64 years) and annual change in percentage points	Eurostat-Regional Statistics (lfst_r_lfe2emprt)
	Youth employment rate (15-34 years) and annual change in percentage points	Eurostat-Regional Statistics (lfst_r_lfe2emp)
	Long-term unemployment (12 months and more)	Eurostat-Regional Statistics (lfst_r_lfu2ltu)
	Youth unemployment rate (15-24 years) and annual change in percentage points	Eurostat-Regional Statistics lfst_r_lfu3pers
Migration and Diversity	Annual % change in the youth population (15-34 years)	Eurostat-Regional Statistics (demo_r_pjangroup)
	Crude rate of population change	Eurostat-Regional Statistics (tgs00099)
	Crude rate of net migration and natural change	Eurostat-Regional Statistics (tgs00099)
	% of employed people working in a foreign country	Eurostat-Regional Statistics (lfst_r_lfe2ecomm)
	% of employed people working in another region of the country of residence	Eurostat-Regional Statistics (lfst_r_lfe2ecomm)
Geography and Territorial Conditions	Population density	Eurostat-Regional Statistics (to be calculated by using Population and Area in KMQ at NUTS 3 level)
	Road, rail and navigable inland waterways networks	Eurostat-Regional Statistics (tran_r_net)
	Dispersion of regional employment rates	Eurostat-Regional Statistics (tsdec440)
Knowledge Economy role and potential	Total intramural R&D Expenditure (GERD) as a % of GDP	Eurostat-Regional Statistics (rd_e_gerdreg)
	Human resources (workers + inflow students) in science and technology (HRST)	Eurostat-Regional Statistics (tgs00038)
	Patent applications (per million inhabitants)	Eurostat-Regional Statistics (pat_ep_rtot)
	Students in tertiary education (ISCED 5-6) - as % of the population aged 20-24 years	Eurostat-Regional Statistics (educ_regind)
	% of population aged 30-34 with a tertiary education	Eurostat-Regional Statistics (edat_lfse_12)
Context indicator	Regional gross domestic product (PPS) per inhabitant	Regional gross domestic product (PPS) per inhabitant
	People at risk of poverty or social exclusion	Eurostat-Regional Statistics – (ilc_peps11)

Table 2.18: Correlation Matrix (2012-2015)

	Gross domestic product (GDP)	Early_leav	NEET_ 18_24	EMP_R _15_64	EMP_R_ 15_24	EMP_R_ 25_64	UNE_RATIO	UNE_R_15-24
Gross domestic product (GDP)	1							
Early_leav	-,268**	1						
NEET_18_24	-,492**	,726**	1					
EMP_R_15_64	,475**	-,614**	-,884**	1				
EMP_R_15_24	,385**	-,216**	-,639**	,801**	1			
EMP_R_25_64	,467**	-,648**	-,883**	,984**	,709**	1		
UNE_RATIO	-,415**	-,186**	,305**	-,384**	-,606**	-,339**	1	
UNE_R_15-24	-,377**	,150**	,614**	-,702**	-,797**	-,655**	,666**	1
UNE_R_25OVER	-,342**	,242**	,588**	-,709**	-,703**	-,688**	,640**	,914**
UNE_R_15OVER	-,357**	,255**	,615**	-,726**	-,708**	-,703**	,625**	,933**
EXP_R&D_%GDP	,414**	-,308**	-,488**	,464**	,375**	,470**	-,247**	-,386**
HUMAN_RES	,720**	-,691**	-,786**	,787**	,550**	,798**	-,214**	-,477**
PATENT	,463**	-,361**	-,556**	,595**	,530**	,577**	-,298**	-,461**
% TERTIARY	,535**	-,546**	-,536**	,492**	,284**	,521**	-,170**	-,121*
NET_MIGR	,451**	-,363**	-,475**	,512**	,405**	,480**	-,204**	-,411**
CRUDE_CHANGE	,583**	,120*	-,168**	,246**	,405**	,208**	-,486**	-,432**
NAT_CHANGE	,345**	,600**	,339**	-,278**	.074	-,293**	-,431**	-.109
OLD_AGE	-,117*	-,542**	-,334**	,375**	.066	,383**	,313**	.080
% WORK_NO_REGION	,161**	-,226**	-,258**	,327**	,289**	,332**	-.090	-,212**
RISK_POV	-,595**	,503**	,716**	-,670**	-,544**	-,689**	,570**	,554**

	UNE_R_ 15OVER	EXP_R&D_ %GDP	HUMAN_ RES	PATENT	% TERTIARY	NET_ MIGR	CRUDE_ CHANGE	NAT_ CHANGE	OLD_ AGE	% WORK_ NO_REGION	RISK_ POV
Gross domestic product (GDP)											
Early_leav											
NEET_18_24											
EMP_R_15_64											
EMP_R_15_24											
EMP_R_25_64											
UNE_RATIO											
UNE_R_15-24											
UNE_R_25OVER											
UNE_R_15OVER	1										
EXP_R&D_%GDP	-,358**	1									
HUMAN_RES	-,521**	,573**	1								
PATENT	-,419**	,646**	,609**	1							
% TERTIARY	-,141*	,390**	,698**	,282**	1						
NET_MIGR	-,453**	,420**	,570**	,467**	,182**	1					
CRUDE_CHANGE	-,381**	,377**	,381**	,403**	,176**	,712**	1				
NAT_CHANGE	.017	.019	-,168**	-.006	.022	-,223**	,525**	1			
OLD_AGE	-.028	,147**	,312**	,168**	.093	,291**	-,308**	-,790**	1		
% WORK_NO_ REGION	-,250**	,154**	,387**	,146*	,305**	,116*	,162**	.076	.029	1	
RISK_POV	,548**	-,445**	-,699**	-,450**	-,434**	-,356**	-,497**	-,342**	.007	-,241**	1

Table 2.19: Cluster analysis results (2004-2007)

	Highly competitive and KE-based economies (Cluster 1)	**Competitive and KE-related economy (Cluster 2)**	**Less competitive with potential in KE economy (Cluster 3)**	**Less competitive economy with low incidence of KE (Cluster 4)**	**Total**
GDP at current market prices (PPS in inhabitants)	37910	28848	23035	12632	24200
NEET rate (18-24)	11.1	11.0	14.3	19.7	14.3
Youth employment rate (15-24)	44.5	48.7	38.9	24.6	38.8
Employment rate (25-64)	75.7	74.8	71.1	64.8	71.2
Youth Unempoyment rate (15-24)	14.3	12.5	18.1	24.6	17.7
Unempoyment rate (25+)	5.9	5.0	6.3	9.0	6.5
Total intramural R&D Expenditure (GERD) as a % of GDP	2.7	1.6	1.2	0.5	1.4
Human resources (in science and technology (HRST, % of active population)	35.5	28.9	24.7	20.4	26.3
Patent Applications (per million of inhabintants)	258.8	159.0	67.0	6.0	102.9
% population 30-34 with tertiary education	39.1	27.8	30.2	19.0	28.6
Crude rate of net migration	4.4	3.0	5.8	-0.6	3.6
Crude rate of natutal change	3.2	0.3	0.6	-0.7	0.6
Old-age dependency ratio	23.2	27.1	26.9	22.7	25.5
Number of regions	**43**	**59**	**119**	**61**	**282**

Source: calculation on Project database

Table 2.20: List of Regions by Cluster (2012-2015)

Cluster 1 - Highly competitive and KE-based economy	
AT13	Wien
BE10	Région de BruxellesCapitale / Brussels Hoofdstedelijk Gewest
BE24	Prov. VlaamsBrabant
BE31	Prov. Brabant Wallon
DE11	Stuttgart
DE12	Karlsruhe
DE13	Freiburg
DE14	Tübingen
DE21	Oberbayern
DE25	Mittelfranken
DE30	Berlin
DE60	Hamburg
DE71	Darmstadt
DE91	Braunschweig
DEA2	Köln
DK01	Hovedstaden
FI1B	HelsinkiUusimaa
FR10	Île de France
IE02	Southern and Eastern
LU00	Luxembourg
NL31	Utrecht
NL32	NoordHolland
NL41	NoordBrabant
NO01	Oslo og Akershus
NO04	Agder og Rogaland
NO05	Vestlandet
NO06	Trøndelag
SE11	Stockholm
SE23	Västsverige
SK01	Bratislavský kraj
UKI3	Inner London West
UKI4	Inner London East
UKI5	Outer London East and North East
UKI6	Outer London South
UKI7	Outer London West and North West
Cluster 2 - Competitive and KE-related economy	
DED5	Leipzig
FR71	RhôneAlpes
NL23	Flevoland
SE12	Östra Mellansverige
SE22	Sydsverige
UKH2	Bedfordshire and Hertfordshire
UKJ1	Berkshire, Buckinghamshire and Oxfordshire
UKM5	North Eastern Scotland
AT12	Niederösterreich
AT22	Steiermark
AT31	Oberösterreich
AT32	Salzburg
AT33	Tirol
AT34	Vorarlberg
BE21	Prov. Antwerpen
BE25	Prov. WestVlaanderen
CZ01	Praha
DE22	Niederbayern
DE23	Oberpfalz
DE26	Unterfranken
DE27	Schwaben
DE50	Bremen
DE73	Kassel
DE80	Mecklenburg/Vorpommern
DE92	Hannover
DEA1	Düsseldorf
DEA4	Detmold
DEB3	RheinhessenPfalz
DEC0	Saarland

DK03	Syddanmark
DK04	Midtjylland
FI20	Åland
ITC1	Piemonte
ITC4	Lombardia
ITH1	Provincia Autonoma di Bolzano/Bozen
ITH2	Provincia Autonoma di Trento
ITH3	Veneto
ITH5	EmiliaRomagna
ITI4	Lazio
NL11	Groningen
NL22	Gelderland
NL33	ZuidHolland
NO07	NordNorge
SE32	Mellersta Norrland
SE33	Övre Norrland
UKD6	Cheshire
UKJ2	Surrey, East and West Sussex
UKJ3	Hampshire and Isle of Wight
UKK1	Gloucestershire, Wiltshire and Bristol/Bath area
AT21	Kärnten
DE24	Oberfranken
DE94	WeserEms
DEA5	Arnsberg
RO32	Bucuresti Ilfov
Cluster 3 - Less competitive with potential in KE economy	
DE40	Brandenburg
DE72	Gießen
DK05	Nordjylland
ITH4	FriuliVenezia Giulia
ITI1	Toscana
NL21	Overijssel
NL42	Limburg (NL)
PT17	Área Metropolitana de Lisboa
SE21	Småland med öarna
SE31	Norra Mellansverige
UKD3	Greater Manchester
UKE1	East Yorkshire and Northern Lincolnshire
UKE2	North Yorkshire
UKF1	Derbyshire and Nottinghamshire
UKF3	Lincolnshire
UKG3	West Midlands
UKK4	Devon
UKL2	East Wales
AT11	Burgenland (AT)
BE22	Prov. Limburg (BE)
BE23	Prov. OostVlaanderen
BE32	Prov. Hainaut
BE33	Prov. Liège
BE34	Prov. Luxembourg (BE)
BE35	Prov. Namur
CY00	Kypros
CZ06	Jihovýchod
DE93	Lüneburg
DEA3	Münster
DEB1	Koblenz
DEB2	Trier
DED2	Dresden
DED4	Chemnitz
DEE0	SachsenAnhalt
DEF0	SchleswigHolstein
DEG0	Thüringen
DK02	Sjælland
EL30	Attiki
EL42	Notio Aigaio
ES11	Galicia
ES12	Principado de Asturias
ES13	Cantabria

ES21	País Vasco
ES22	Comunidad Foral de Navarra
ES23	La Rioja
ES24	Aragón
ES30	Comunidad de Madrid
ES41	Castilla y León
ES51	Cataluña
ES52	Comunidad Valenciana
ES53	Illes Balears
ES70	Canarias (ES)
FI19	LänsiSuomi
FI1C	EteläSuomi
FI1D	Pohjois ja ItäSuomi
FR21	ChampagneArdenne
FR22	Picardie
FR23	HauteNormandie
FR24	Centre (FR)
FR25	BasseNormandie
FR26	Bourgogne
FR30	Nord PasdeCalais
FR41	Lorraine
FR42	Alsace
FR43	FrancheComté
FR51	Pays de la Loire
FR52	Bretagne
FR53	PoitouCharentes
FR61	Aquitaine
FR62	MidiPyrénées
FR63	Limousin
FR72	Auvergne
FR81	LanguedocRoussillon
FR82	ProvenceAlpesCôte d'Azur
FR83	Corse
HU10	KözépMagyarország
IE01	Border, Midland and Western
ITC2	Valle d'Aosta/Vallée d'Aoste
ITC3	Liguria
ITF1	Abruzzo
ITI2	Umbria
ITI3	Marche
MT00	Malta
NL12	Friesland (NL)
NL13	Drenthe
NL34	Zeeland
NO02	Hedmark og Oppland
NO03	SørØstlandet
PL12	Mazowieckie
PL21	Malopolskie
PT15	Algarve
SI04	Zahodna Slovenija
UKC2	Northumberland and Tyne and Wear
UKD1	Cumbria
UKD4	Lancashire
UKD7	Merseyside
UKE4	West Yorkshire
UKF2	Leicestershire, Rutland and Northamptonshire
UKG1	Herefordshire, Worcestershire and Warwickshire
UKG2	Shropshire and Staffordshire
UKH1	East Anglia
UKH3	Essex
UKJ4	Kent
UKK2	Dorset and Somerset
UKK3	Cornwall and Isles of Scilly
UKM2	Eastern Scotland
UKM3	South Western Scotland
UKM6	Highlands and Islands
UKN0	Northern Ireland (UK)
ITF2	Molise

Cluster 4 - Less competitive economy with low incidence of KE	
CZ02	Střední Cechy
CZ03	Jihozápad
EL41	Voreio Aigaio
EL43	Kriti
EL52	Kentriki Makedonia
EL53	Dytiki Makedonia
EL62	Ionia Nisia
EL63	Dytiki Ellada
EL64	Sterea Ellada
EL65	Peloponnisos
ES42	Castillala Mancha
ES61	Andalucía
ES62	Región de Murcia
ES63	Ciudad Autónoma de Ceuta (ES)
ES64	Ciudad Autónoma de Melilla (ES)
FRA2	Martinique
ITF5	Basilicata
ITG2	Sardegna
PT18	Alentejo
PT30	Região Autónoma da Madeira (PT)
UKC1	Tees Valley and Durham
UKE3	South Yorkshire
UKL1	West Wales and The Valleys
BG31	Severozapaden
BG32	Severen tsentralen
BG33	Severoiztochen
BG34	Yugoiztochen
BG41	Yugozapaden
BG42	Yuzhen tsentralen
CZ04	Severozápad
CZ05	Severovýchod
CZ07	Střední Morava
CZ08	Moravskoslezsko
EE00	Eesti
EL51	Anatoliki Makedonia, Thraki
EL54	Ipeiros
EL61	Thessalia
ES43	Extremadura
FRA1	Guadeloupe
FRA3	Guyane
FRA4	La Réunion
HR03	Jadranska Hrvatska
HR04	Kontinentalna Hrvatska
HU21	KözépDunántúl
HU22	NyugatDunántúl
HU23	DélDunántúl
HU31	ÉszakMagyarország
HU32	ÉszakAlföld
HU33	DélAlföld
ITF3	Campania
ITF4	Puglia
ITF6	Calabria
ITG1	Sicilia
LT00	Lietuva
LV00	Latvija
PL11	Lódzkie
PL22	Slaskie
PL31	Lubelskie
PL32	Podkarpackie
PL33	Swietokrzyskie
PL34	Podlaskie
PL41	Wielkopolskie
PL42	Zachodniopomorskie
PL43	Lubuskie
PL51	Dolnoslaskie
PL52	Opolskie
PL61	KujawskoPomorskie

PL62	WarminskoMazurskie
PL63	Pomorskie
PT11	Norte
PT16	Centro (PT)
PT20	Região Autónoma dos Açores (PT)
RO11	NordVest
RO12	Centru
RO21	NordEst
RO22	SudEst
RO31	Sud Muntenia
RO41	SudVest Oltenia
RO42	Vest
SI03	Vzhodna Slovenija
SK02	Západné Slovensko
SK03	Stredné Slovensko
SK04	Východné Slovensko

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