XXXIV CONFERENZA ITALIANA DI SCIENZE REGIONALI

HOW RURAL THE EU RDP IS? AN ANALYSIS THROUGH SPATIAL FUNDS ALLOCATION

B. CAMAIONI[1], R. ESPOSTI[2], A. LOBIANCO[2], F. PAGLIACCI[2], F. SOTTE[2]

SOMMARIO

Although RDP 2007-2013 expenditures represent less than 20% of total CAP expenditures, this policy is supposed to support rural areas in facing new challenges. Actually, EU rural areas are going through major transformations due to the very different development processes that rural areas have lately undertaken. Thus the urban-rural divide is now almost outdated (OECD, 2006). According to this framework, the paper first computes a comprehensive index of rural-peripherality (RP index) based on major rural features. On this basis, the paper then provides taxonomy of rural areas across Europe. Methodology follows a multivariate statistical approach: principal component analysis and cluster analysis are applied to the NUTS 3 regions in the EU-27. Moving from this regional taxonomy, the paper then assesses existing correlations between the intensity of Rural Development Policy expenditures and different profiles of rural-peripherality. According to these results, the analysis can help in better defining the consistency of the EU policy-makers' decisions with the real characteristics of EU rural areas.

[1] Inea, via Conte di Ruvo, 26, 65127, Pescara
[2] Università Politecnica delle Marche, Dipartimento di Scienze Economiche e Sociali, Facoltà di Economia, P.le Martelli 8, 60121 Ancona, e-mail: f.pagliacci@univpm.it

Introduction

This paper is intended to stress the relevance of EU rural areas and their links with the Rural Development Policy. Actually, rural areas play a major role within the EU: Europe is still a fairly rural continent, even though the strength and vitality of the network of its medium-sized cities has been often pointed out. Moreover, EU rural areas are also going through greater challenges and major transformations. After the Eastern enlargements of the EU (in 2004 and 2007), they are getting more and more heterogeneous, especially in terms of their main socio-economic features as well as of agricultural activities. According to this increasing heterogeneity, the traditional urban-rural divide can be now considered almost outdated (OECD, 2006): central rural regions in Continental countries sharply differ from more peripheral rural areas still facing major development issues.

Therefore, a new geography of EU rural areas has emerged. In previous studies on the development of rural areas, geographical issues have traditionally been ignored (Copus, 1996; Ballas et al., 2003; Bollman et al., 2005; Vidal et al., 2005; Copus et al., 2008). However, rural features are typically coupled with remoteness: thus, geography really matters in describing EU rural areas and a comprehensive peripherurality index (PR index) can be computed, in order to sum up these features. Moreover, according to these different characteristics, different typologies of rural areas can be observed across Europe.

Moreover, a regional analysis could help policymakers in better framing EU policies. In particular, the existence of a more complex pattern within rural areas should be taken into account when considering the distribution of funds from the second pillar of the CAP, financed by European Agricultural Fund for Rural Development (EAFRD) that supports the implementation of the rural development programmes (RDPs) across the EU. Actually, RDP 2007-2013 is supposed to support rural areas in facing new challenges (Sotte, 2009; Esposti, 2011): in particular, it is aimed at promoting their economic restructuring, at enhancing sustainable management of natural resources and at helping regions to meet future economic and environmental challenges. Thus, the analysis of the spatial allocation of RDP expenditures can help in better understanding the demand and supply of policies at a more disaggregated level than that affecting RDP programmes (i.e., either the national or the regional level). In particular, by considering data at the NUTS 3 level, this work provides a more detailed picture of the spatial allocation of these expenditures, by also considering programmes defined by each Member State. Moreover, this study is aimed at analysing real expenditures, thus providing a more innovative and detailed and truer picture about regional expenditures according to the RDPs.

The work is organised as follows. Section 2 provides some theoretical background about the definition of EU rural areas, moving from the typologies from OECD (2006) and Eurostat (2010). Then, the role of multidimensional approaches and the relevance of geographical issues is stressed. Section 3 provides an overview about data which are used to analyse peripherurality across Europe, as well as data about the RDP expenditures. Section 4 is a methodological section: the main adopted multivariate techniques (i.e., Principal Component Analysis and Cluster Analysis) are shown. Then, in Section 5 the main results of the analysis are provided. First, the main features of peripherurality are described. Then, a selection of clusters of rural regions is shown. Lastly, the distribution of EAFRD funds across the EU-27 is shown, by stressing their consistency with peripherurality index and rural areas' main typologies. Then, section 6 concludes the paper, by suggesting some insights for further researches.

1. DEFINING EU RURAL AREAS

1.1 The role of density in assessing rural areas

In spite of the wide debate on the definition of rural areas during the last decades, an official and homogeneous definition, which helps in distinguishing them from urban regions, is hard to find at the international level (Montresor, 2002; Anania and Tenuta, 2008). For example, the EC does not define any formal criterion to identify those areas where rural development policies can be implemented: each Member State is autonomously in charge of defining its own rural areas. This choice follows the existence of wide differences in terms of demographic, socio-economic, environmental conditions across EU rural areas (European Commission, 2006; Hoggart *et al.*, 1995; Copus *et al.*, 2008). Moreover, also the lack of comparable statistics, at a disaggregated level, is usually underlined as a key obstacle (Bertolini *et al.*, 2008; Bertolini and Montanari, 2009).

In spite of these critical issues, some efforts in providing a more homogeneous approach have been provided: the most widely cited urban-rural typologies are those from OECD (1994; 1996; 2006) and the EC and Eurostat (Eurostat, 2010). Both follow a very simple approach, simply based on demographic density and on the presence of major urban areas. Actually, density has been widely used in order to provide comparable definition about rural areas. According to the OECD-Eurostat methodologies, NUTS 3 regions in EU-27 Member States are classified as *predominantly urban* (PU), *intermediate* (IR) and *predominantly rural* (PR) regions.

However, both methodologies suffer from some major drawbacks[1]. First, they are just based on a single indicator (i.e., demographic density), which cannot encompass all the possible characteristics observed across EU rural areas. Moreover both typologies just provide dichotomised output (in spite of the introduction of the intermediate category). Such a dichotomy is largely outdated within the current EU rural framework, as rural areas are getting more and more diversified. Also, the concept of rural areas has widely changed. Since the 50s, linkages between rural areas and agricultural activities have radically changed and deep transformations have affected the structure of the local economies within those regions. In particular, it is possible to refer to an evolutionary pattern about the definitions of rural areas (Sotte *et al.*, 2012). Definitions have moved from the 'agrarian rurality' when CAP was first introduced (during the 50s and 60s) to the 'industrial rurality'[2] (during the 70s and 80s) to the 'post-industrial rurality' (from the 90s onward). The emergence of the post-industrial model of rurality makes the abovementioned measure of rurality (just based on density) largely outdated. Within the same OECD, and recently FAO, a new research line was opened, in order to identify new measures of rurality based on a qualified set of variables (FAO-OECD Report, 2007; The Wye Group, 2007).

---

[1] Eurostat methodology was intended to correct some major distortions, existing in the OECD methodology.

[2] This idea is largely widespread in the studies on Italian industrial districts (Paci, 1978; Beccatini, 1989; Beccatini and Rullani, 1993; Brusco, 1999; Brusco et al., 2007;), which are mainly located in the so-called 'Third Italy (Bagnasco, 1977; 1988).

1.2 Multi-dimensional approaches to identification of rural areas

Within the "post-industrial rurality" framework, the debate about rural areas across Europe has largely increased. Actually, broader definitions about rural areas have been suggested. They follow multi-dimensional approaches rather than one-dimensional and dichotomous approach. As suggested by the FAO-OECD Report (2007) and by The Wye Group (2007), a wider set of variables has to be taken into account in defining rural areas: e.g., socio-economic and demographic variables, as well as data about agricultural holdings and the use of land.

Within this framework, a critical review of multidimensional approaches is provided by Copus *et al.* (2008). The authors recall many methodologies which apply quantitative analysis on a list of socio-economic indicators in order to identify main typologies of rural areas across Europe. Some analysis focus on single EU Member States (Auber *et al.*, 2006; Buesa *et al.*, 2006; Kawka, 2007; Lowe and Ward 2009; Merlo and Zaccherini, 1992; Anania and Tenuta, 2008). Other works focus on small groups of EU Member States (Barjak, 2001; Psaltopoulos *et al.*, 2006). More interesting analyses focus on the rural areas belonging to the whole set of EU Member States. Terluin *et al.* (1995) analyse *less-favoured areas* in the EU-12. Copus (1996) analyses NUTS 3 regions in the EU-12, by comparing aggregative and disaggregative typology methods (factor analysis and K-means cluster analysis) adopting more than 45 socio-economic indicators. Ballas *et al.* (2003) apply factor analysis and cluster analysis on NUTS 3 regions in the EU-27, also suggesting a sort of peripherality index, by assessing. Bollman *et al.* (2005) move from the original OECD urban-rural typology, suggesting an additional subdivision within the group of rural areas (the categories of *leading, middle, lagging regions* are applied). Vidal *et al*. (2005) analyze the spatial features of rural areas in the EU-12, according to demographic, economic and labour market variables. Also some agricultural variables (farm labour force, agricultural land use…) are considered.

1.3 Geographical approaches to compute peripherurality

This paper follows the above-mentioned multidimensional approach in the analysis of the EU rural areas, suggesting some further improvements. The importance of different features in characterizing rural areas is stressed. In particular, a wider set of indicators is suggested, trying covering both socio-economic and geographical features. In particular, geography still matters in defining rural characteristics, deeply affecting rural development. The idea of the relevance of geographical issues was first stressed by Tobler, in its First Law of Geography (Tobler, 1970, 236): "Everything is related to everything else, but near things are more related than distant things". According to this idea, the current analysis is intended to mix together both the economic and the geographical features affecting rural areas. Such a methodological framework can be considered quite innovative, as, up to now, just few researches made the link between economic and geographical features explicit in defining EU rural areas (Ballas et al., 2003). In particular, a comprehensive peripherurality index is computed, following the idea that rural areas can be defined according to the relevance of the agricultural sector as well as according to remoteness, from major urban areas. Three main thematic areas are considered in computing the comprehensive peripherurality index:

- Economic indicators and role of agriculture (sector-based approach);

- Land use and landscape features, e.g., share of agricultural areas or forests on the total surface compared to share of artificial areas (territorial approach);
- Accessibility / remoteness, according to different territorial scales, e.g. EU level, national level, sub-national level (geographical approach)

Regional accessibility is a key issue: remoteness is still linked with rural areas, in spite of the strong increase in ICT and the efforts in reducing digital divides across EU regions. Thus, both the territorial and the geographical dimensions cannot be ignored, when analysing rural regions across Europe. In order to include geography into the analysis, two different approaches have been adopted: both the role of geographical distance in defining peripheries and a more multidimensional concept (potential accessibility) are taken into account.

Remoteness is first computed according to a comprehensive distance matrix between the centroids of the EU NUTS 3 regions, thus defining the distances between each region and any other regions in Europe. Due to the fact that remoteness usually refers to the distance between a region and some specific centres, the distance of each area from major urban areas has been computed. In particular, the concept of MEGA (Metropolitan *Economic Growth Area*) has been considered, aimed at identifying the most important urban areas within the set of European FUAs (Functional Urban Areas) according to population, transport, tourism, industry, knowledge economy, decision-making and public administration (ESPON – Project 1.1.1, 2005). Moreover, MEGAs have been compared to each other and then they have been divided into five sorted groups: global nodes, Category 1 MEGAs, Category 2 MEGAs, Category 3 MEGA and Category 4 MEGAs.

A different way to assess regional remoteness refers to the analysis of multimodal potential accessibility. The measure also takes into account the presence of infrastructures connecting regions. The main reference is to ESPON: several indicators are provided, measuring how easy people living in one region can reach people located in other regions. Both the multimodal accessibility index (measuring the minimum travel time between two regions by combining road, rail and air networks) and the air accessibility index (taking into account just the air network) are considered. Both these indexes are computed by summing up the population in all other European regions, weighted by the travel time to reach them[3] (ESPON – Project 1.1.1, 2005). According to this approach, potential accessibility takes geography into account in a more complex way. This indicator sheds light on the relevance of infrastructures, whose role cannot be considered in analyzing remoteness of rural areas when just observing the geographical distances from major urban areas. According to that, both these elements are included into the analysis in order to stress geographical perspectives.

2. DATASET AND DATA ABOUT EAFRD EXPENDITURES

As already stressed, this study follows a multidimensional approach: according to this purpose, 24 variables are collected, referring to four different thematic areas (Table 1): i) socio-demographic features focus on the demographic structure as well as major demographic trends; ii) structure of the economy refers to a sector-based analysis (share of agricultural activities, manufacturing sectors and services on total economy, per capita GDP…). Moreover a specific focus is devoted to the structure of agricultural holdings; iii) land use takes into account the physical landscape (agricultural areas, forests,

[3] In order to avoid "edge" effects, European regions just outside the territory covered by ESPON are also included in computing the index. A particular attention goes to people living in other Eastern European regions and in the Western Balkan.

artificial areas); iv) geographical dimension focuses on both the distance from MEGAs and the potential accessibility.

Table 1 - Variables according to the different thematic areas

	Variable	Definition	Year	Source
Socio-Demographic features	Population	Resident Population (000)	2010	Eurostat
	Population Variation	Average Annual Variation of the resident population	2000-2010	Eurostat
	Net Migration Rate	Ratio of the difference between immigrants and emigrants to the average population, including statistical adjustments	2010	Eurostat
	Density	Ratio of the resident population on the total surface of a given area (in km^2)	2010	Eurostat
	Unemployment Rate	Unemployed person(aged 15-74) as % of the total economically active population	2009	Eurostat
	Young-age dependency ratio	Ratio of the number of people aged 0-14 to the number of people aged 15-64	2010	Eurostat
	Aged dependency ratio	Ratio of the number of people aged 65+ to the number of people aged 15-64	2010	Eurostat
Structure of the economy	GVA Agriculture (%)	Share of GVA from sector A (NACE classification rev. 2) on the total	2009	Eurostat
	Employment Agriculture (%)	Share of employment in sector A (NACE classification rev. 2) on the total	2009	Eurostat
	Employment Manufacturing (%)	Share of employment in sectors C-E(NACE classification rev. 2) on the total	2009	Eurostat
	Employment Services (%)	Share of employment in sectors G-U(NACE classification rev. 2) on the total	2009	Eurostat
	Per capita GDP	GDP in Euro per inhabitant (PPS)	2009	Eurostat
	Average farm size	Average agricultural area (8in ha.) per agricultural holding	2007	Farm Structure Survey (Eurostat)
	Average SGM	Average Standard Gross Margin (in ESU) per agricultural holding	2007	Farm Structure Survey (Eurostat)
Land Use	Artificial areas (%)	Share of total surface which is covered by artificial areas (urban fabric, industrial and commercial units…)	2006	CORINE-Eurostat
	Agricultural areas (%)	Share of total surface which is covered by agricultural areas	2006	CORINE-Eurostat
	Forests (%)	Share of total surface which is covered by forests and other semi-natural areas	2006	CORINE-Eurostat
Spatial dimension	Air Accessibility	The index is calculated by summing up the population in all other EU NUTS 3 regions, weighted by the travel time to go there by air. Values are standardised with the EU average (EU27=100).	2006	ESPON Project 1.1.1
	Multimodal Accessibility	The index is calculated by summing up the population in all other EU NUTS 3 regions, weighted by the travel time to go there by road, rail and air. Values are standardised with the EU average (EU27=100).	2006	ESPON Project 1.1.1
	Multimodal Accessibility Change	Relative change of the Multimodal Accessibility Index in percentage (2001-2006).	2001-2006	ESPON Project 1.1.1
	Distance from MEGA1	Distance from closest MEGA1 (centroid)	-	-
	Distance from MEGA2	Distance from closest MEGA2 (centroid)	-	-
	Distance from MEGA3	Distance from closest MEGA3 (centroid)	-	-
	Distance from MEGA4	Distance from closest MEGA4 (centroid)	-	-

Source: own elaboration

In order to provide a comprehensive analysis of the EU rural areas, the abovementioned variables are collected for the whole set of EU-27 Member States, at a very disaggregated territorial level. Data actually refer to the level 3 in the NUTS (*Nomenclature of territorial units for statistics*) classification. Even though the NUTS 2010 classification is currently adopted (Commission Regulation (EC) No 105/2007), Eurostat database has not yet been fully updated: thus, the NUTS 2006 classification (Commission Regulation (EC) No 1059/2003), which was operating from 2008 to 2011, is adopted for the purpose of this work. Furthermore, some regions have been dropped out from the analysis, due to the lack of territorial contiguity with the European continent (e.g., the French

DOM *Departements d'outre-Mer*, and the NUTS 3 regions composing the Canary Islands). The final set of observations is thus composed by 1,288 NUTS 3 regions.

According to this territorial level, a detailed picture of the EU rural areas can be provided. Actually, NUTS 3 level is the only local dimension to which the definition of rural area can be applied at the EU scale. NUTS 2 regions are usually too wide to be homogenous in terms or rural features: they usually include both urban and more rural areas. From the opposite side, no data are available for LAUs (local administrative units) at the EU scale. However, this choice may suffer from some main drawbacks. First, a serious lack of information is observed at such a level of territorial disaggregation. Actually, not so many variables are available at this level of disaggregation for the whole set of EU countries. This analysis has also to deal with many missing data within the 24 selected variables. Missing values have been replaced with data at either the regional or the national level (that respectively means data at the NUTS 2, NUTS 1 and NUTS 0 level), when available. Then, a second drawback can be pointed out. As already stressed, a wide heterogeneity is observed across NUTS 3 regions in the EU-27 MSs: population, NUTS 3 regions show very different areas across Countries (NUTS 3 regions in peripheral and more sparsely-populated Countries are usually wider than NUTS 3 regions in more central Countries). Moreover, this level of analysis could not be the most appropriate one in order to detect the relevance and the effectiveness of the EU policies. For example, RDPs are implemented at different NUTS level (either NUTS 0 or NUTS 2 level).

According to time coverage, the analysis is carried on according to the last available figures: they generally refer to the years 2007 – 2010. The authors are aware that most of the selected variables are structural ones, so they are not really influenced by the economic trends (e.g, the share of either agricultural areas or forests). Just two variables are intended to consider somehow the decennial dynamic: the average annual variation of the total resident population, computed for the whole 2000-2010 period; the relative change of the Multimodal Accessibility Index, which refers to the period 2001 to 2006.

The abovementioned data are intended to examine the main characteristics of EU rural areas. Moreover, additional data have been collected in order to analyse the spatial allocation of the expenditures of the EAFRD, thus observing their territorial distribution. Collected data refer to the total expenditures of RDPs, from 2007 to 2009. Raw data have been collected at the NUTS 3 level (Source: European Commission).

Moreover, indexes of the intensity of the EAFRD expenditure have also been computed. In particular, intensity refers to three different indicators:

1. RDP expenditures per unit of utilized agricultural area (UAA in ha.);
2. RDP expenditures per unit of agricultural labour work (expressed in annual work unit, AWU);
3. RDP expenditures per unit of agricultural gross value added (GVA), expressed in thousands of Euros).

Data on utilized agricultural areas and average work unit are from Eurostat - Farm Structure Survey (2007). Data on GVA are from Eurostat – National Accounts (average values 2007-2010).

3. METHODOLOGY: DEFINING PERIPHERURALITY

3.1 Defining rural areas' features: a Principal Component Analysis and the identification of a 'Peripherurality Index'

First, a principal component analysis (PCA) has been performed, thus identifying the main features of peripherurality across Europe. PCA belongs to multivariate statistics: it is a variable reduction technique that helps in maximizing the amount of variance accounted for in the observed variables by a smaller group of variables, called principal components (PCs). Thus, this technique helps in reducing the number of variables of a system while preserving the most of the information, which is represented by the total variance (Pearson, 1901; Hotelling, 1933).

PCA is predominantly used in an exploratory way, as it is not concerned with modelling a specific factor structure. No strong assumptions on the model itself are requested[4]: therefore, PCA can deal with not optimal quality of data and indicators. This analysis has already been applied referring to the analysis of rural areas in the EU and in other European Countries (Nordregio *et al.*, 2007; NUI Maynooth, 2000; Ocana-Riola and Sánchez-Cantalejo, 2005; Vidal *et al.*, 2005; Bogdanov *et al.*, 2007; Monasterolo and Coppola, 2010).

The basic aim of PCA is to describe variation in a set of correlated variables (x_1, x_2, …, x_q), which are observed on a group of *n* statistical units, in terms of a new set of uncorrelated variables (y_1, y_2, …, y_q), each of which is a linear combination of the *x* original variables. New variables are derived in decreasing order of 'importance': y_1 accounts for as much of the variation in the original data amongst all linear combinations of x_1, x_2, …, x_q. Then y_2 is chosen to account for as much as possible of the remaining variation, subject to being uncorrelated with y_1 – and so on. Therefore, an orthogonal coordinate system is obtained. The new variables are the so-called principal components (PCs). The main idea is that the first few PCs will account for a substantial share of the variation in the original variables, thus providing a convenient lower-dimensional summary of the original variables. Thus, the loss of information is mostly avoided. Moreover, whereas the original indicators are highly correlated, the variables that are obtained are uncorrelated (Everitt and Hothorn, 2010). When the original variables are on very different scales, it is suggested standardizing them, in order to avoid a distorting influence coming from those indicators that show an higher variance. Therefore, PCA is carried out on the correlation matrix rather than the covariance matrix. Thus, the *k* principal components (where $k < p$, as already observed) come from the following linear combinations, expressed as a matrix:

$$Y = X A \qquad (1)$$

where:

- Y is the $n \times k$ matrix, containing the scores of the *n* statistical units in the *k* components;
- A is the vector matrix $p \times k$ of the normalized coefficients;
- X is the $n \times p$ matrix of the standardized data.

---

[4] Commonly, but very confusingly, PCA is called exploratory factor analysis (EFA), even though the word factor is inappropriate. Indeed, factor analysis is usually adopted to confirm a latent factor structure for a group of measured variables. Therefore, factor analysis is a model based technique and it is concerned with modelling the relationships between measured variables, latent factors, and errors. Moreover, factor analysis assumes that the covariation in the observed variables is due to the presence of one or more latent variables, exerting causal influence on the observed variables.

Principal components can then be orthogonally rotated, so maintaining the uncorrelation among the components (e.g., through the VARIMAX technique). Rotation helps in the interpretation of factor loadings, although it reduces the explained variance.

After having extracted the PCs (from either a covariance or a correlation matrix), it is possible to compute each component's scores for the whole set of statistical units (in this specific case, for each NUTS 3 region in the EU-27 Members States). On a standardized scale, each observation is assigned a score according to each extracted PC.

These scores can be used to compute a comprehensive "Peripherurality Index". In particular, the following innovative methodology is proposed. As a first step, an ideal region, which is characterized by very urban features, is identified. This ideal region represents a benchmark for urban features across Europe and it is defined moving from the EU global MEGAs: Paris and London (ESPON 1.1.1, 2005). The suggested methodology is really intuitive. For each selected PC, the average value of the scores obtained by the selected areas is computed[5]. Then, the distance between all NUTS 3 areas and this ideal urban benchmark is computed. The Euclidean distance for a generic n-dimensional space is assessed. Indeed, the distance is computed according to the selected PCs, as they represent specific features of both rurality and remoteness in both a socio-economic and a geographical way. Therefore, the Peripherurality Index can be computed as follows:

$$PRindex_i = \sqrt{\sum_p (x_{ip} - x_{ubp})^2} \qquad (2)$$

where:

X_{ip} represents the score of the *i*-th NUTS 3 region in the *p*-th component;

X_{ubp} represents the score of the urban benchmark in the *p*-th component.

3.2 Defining different rural typologies: a cluster analysis

The comprehensive peripherurality index sums up, within a single measure, both rurality and remoteness features. This synthetic measure is useful in order to sum up the extent of peripheral and rural features according to a single axis. However, the identification of different typologies of rural areas within Europe should take into account the whole mix of features. Thus a cluster analysis is applied to the extracted PCs, highlighting the wide variety lying within the EU regions. Among multivariate statistical techniques, cluster analysis provides a good synthesis of the structure of a dissimilarity matrix among observations (Tryon, 1939; Johnson, 1967), while preserving the most of the original information. From a methodological perspective, cluster analysis belongs to the unsupervised learning approaches, as it helps in finding hidden structures within unlabeled data. Indeed, through cluster analysis, a set of objects is grouped according to *p* measurable characteristics in such a way that objects in the same group (*i.e.*, a cluster) are more similar to each other than to those belonging to other clusters.

According to a chosen distance (e.g., the Minkowski distance, the Manhattan distance, the Euclidean distance), it is possible to convert a *n* x *p* data matrix into a *n* x *n* distance matrix, containing the distances, taken pairwise, of the set of points. Each element of the matrix d_{ij} is then the expression of the distance between the vectors considering all the *p* variables. Clustering algorithms can then be

[5] The choice of getting together two different urban areas as urban benchmark helps in finding more robust results and it follows the classification from ESPON (ESPON – Project 1.1.1, 2005).

categorized, according to clustering model. Two alternative approaches may be distinguished. Hierarchical approaches are based on the core idea of building a whole hierarchy of clusters. Strategies for hierarchical clustering usually fall into two opposite types: agglomerative clustering and divisive clustering. In both cases, the final output of the analysis can be graphically presented throughout a bi-dimensional diagram, known as dendrogram (Kaufmann and Rousseeuw, 1990). Partitioning approaches, on the other hand, are aimed at partitioning *n* observations into *k* non-overlapping cluster. These approaches are mainly based on iterative algorithms: each observation belongs to the cluster with the nearest mean (centroids). Usually, a specific objective-function is minimized throughout this allocation. K-means clustering (MacQueen, 1967) and k-medoids clustering techniques (Kaufman and Rousseeuw, 1990) are generally used, among partitioning approaches.

There are no objectively right clustering algorithms: both approaches share positive and negative features. In hierarchical methods, for example, it is not possible to reallocate an observation after the identification of a given group. On the opposite side, partitioning approaches are iterative ones. Moreover, partitioning approaches can handle larger dataset, even though they cannot managed outliers (observations that are numerically distant from the rest of the dataset) in a proper way. The main drawback in partitioning methods deals with the need for an *ex ante* specification of the number (*k*) of clusters to be extracted. Usually, this number is empirically identified. On the opposite side, hierarchical methods do not require any *ex ante* definition of the number *k*. Referring to the analysis of the urban-rural typologies, both the methodologies are suggested: Copus (1996) and Vidal *et al.* (2005) applied k-means cluster analysis; Buesa *et al.* (2006) and Dimara and Skuras (1996) referred to aggregative (hierarchical) cluster analyses.

According to this specific dataset and problem, a hierarchical cluster analysis will be applied to the extracted PCs, as it will be shown in the following section.

4. MAIN RESULTS: TERRITORIAL PATTERNS

4.1. PCs and the territorial patterns of the 'Peripherurality Index'

According to some preliminary analyses, standardizing is performed on the original variables and the correlation matrix is computed. The Kaiser-Meyer-Olkin test (or KMO test) is first applied to the selected variables. KMO's sampling adequacy criteria test the ratio of item-correlations to partial item correlations. If the partials are similar to the raw correlations, items do not share much variance with other items. The KMO test ranges from 0.0 to 1.0, whereas desired values are greater than 0.5[6]. According to the selected variables, test KMO is satisfactory (0.7375). Then, in order to establish the number of PCs to choose, different methods can be used: according to both the Guttman-Kaiser criterion[7], the analysis of the eigenvalues greater than 1 and analysis of the *elbow* in the scree plot are considered, 6 PCs should be selected. However, the 5th and 6th component are very contiguous to each others, showing very similar eigenvalues. Thus, in order to make the interpretation easier, just the first 5 PCs are selected. They account for 67.46% of cumulative variance and each of them shows an eigenvalue greater than 1.5 (Table 2). In order to move on with the interpretation of the extracted PCs,

[6] According to Kaiser (1974), scores lower than 0.5 are unacceptable, [0.5, 0.6) are miserable, [0.6, 0.7) are mediocre, [0.7, 0.8) are middling, [0.8, 0.9) are meritorious, [0.9, 1.0) are marvellous.

[7] The Guttman-Kaiser criterion suggests choosing those principal components which are able to explain at least 70-80% of the cumulative variance.

the analysis of the factor loadings is shown in Table 3. Factor loadings which are smaller than |.15| are not shown in the table, just to make the interpretation clearer. In order to preserve most of information, no rotation of factor loadings has been performed.

Table 2 - PCA: total variance explained and extracted PCs

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	**Total**	**% of variance**	**Cumulative (%)**	**Total**	**% of variance**	**Cumulative (%)**
1	7.61	31.71	31.71	7.61	31.71	31.71
2	2.82	11.74	43.45	2.82	11.74	43.45
3	2.08	8.66	52.11	2.08	8.66	52.11
4	1.90	7.92	60.03	1.90	7.92	60.03
5	1.78	7.44	67.46	1.78	7.44	67.46
6	1.20	4.99	72.46			
7	0.91	3.79	76.24			
8	0.84	3.50	79.74			
9	0.79	3.28	83.02			
10	0.68	2.84	85.86			
11	0.62	2.58	88.44			
12	0.52	2.16	90.59			
13	0.44	1.82	92.41			
14	0.39	1.62	94.03			
15	0.32	1.32	95.34			
16	0.24	0.98	96.33			
17	0.22	0.91	97.24			
18	0.20	0.81	98.06			
19	0.17	0.72	98.77			
20	0.14	0.57	99.34			
21	0.11	0.45	99.79			
22	0.02	0.10	99.89			
23	0.02	0.07	99.96			
24	0.01	0.04	100.00			

Source: own elaboration (R Software)

Table 3 - PCA factor loadings

	Variable	PC1	PC2	PC3	PC4	PC5
Socio-Demographic features	Population		-0.302		-0.175	
	Population Variation		-0.348			-0.401
	Net Migration Rate		-0.201			-0.327
	Density	0.176	-0.237	-0.317		0.35
	Unemployment Rate			-0.346	-0.231	
	Young-age dependency ratio		-0.27	0.199	-0.234	-0.286
	Aged dependency ratio		0.388		0.194	
Structure of the economy	GVA Agriculture (%)	-0.287				
	Employment Agriculture (%)	-0.29				
	Employment Manufacturing (%)			0.381	0.274	0.326
	Employment Services (%)	0.272		-0.29		-0.268
	Per capita GDP	0.248			0.165	
	Average farm size		0.412	-0.201	-0.214	
	Average Standard Gross Margin		0.383		-0.283	
Land Use	Artificial areas (%)	0.217	-0.186	-0.301		0.343
	Agricultural areas (%)			0.403	-0.479	
	Forests (%)				0.541	-0.229
Spatial dimension	Air Accessibility	0.314				
	Multimodal Accessibility	0.322				0.151
	Multimodal Accessibility Change					0.162
	Distance from MEGA1	-0.28	-0.168	-0.183		
	Distance from MEGA2	-0.296				
	Distance from MEGA3	-0.293		-0.157		
	Distance from MEGA4	-0.209		-0.226		-0.229
	% of variance	31.71	11.74	8.66	7.92	7.44
	Cumulative variance (%)	31.71	43.45	52.11	60.03	67.46

Source: own elaboration (R Software)

According to the figures shown in table, it is possible to identify and give a broader interpretation to the extracted PCs.

PC1 – Economic and geographical centrality: this PC is mainly related to the spatial dimension and to the structure of the economy. Indeed, it is positively related both to the accessibility indexes and to the share of the employment in services, per capita GDP, the share of artificial areas and demographic density. On the opposite side, PC1 is negatively related to the distance from MEGAs and to the relevance of the agricultural sector. Thus, PC1 sums up the extent of both economic centrality and accessibility.

PC2 – Demographic shrinking and ageing: this PC mainly refers to socio-demographic features. It is positively related to the aged dependency ratio, whereas it is negatively related to the annual population variation, to the young-aged dependency ratio and to the net migration rate. Also the average farm size and the average SGM are positively linked to this PC. Two interrelated social phenomena are described by this PC: demographic shrinking and population ageing. These issues deeply affect many rural regions across Europe (e.g., Eastern Germany Länder, rural areas in Central France, Scotland).

PC3 – Manufacturing in rural areas with well-performing labour market: this PC is linked with the relevance of manufacturing activities within rural areas. Indeed, positive values of the component are associated with larger shares of the employment in manufacturing activities as well as with larger share of agricultural areas on the total. Also the young-age dependency ratio is positively related to this component. Moreover, PC3 is negatively related to the unemployment rate: actually more manufacturing regions across Europe share a better performing labour market.

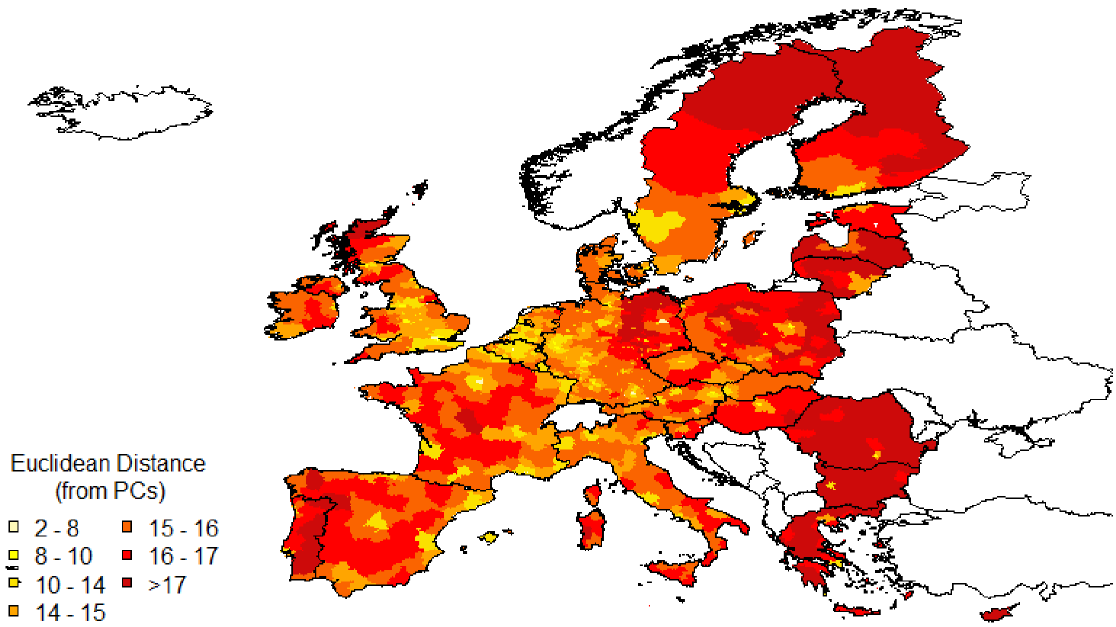
PC4 – Land Use: forests vs. agricultural areas: the PC focuses on land use and it is a typical dichotomous PC, which distinguishes agricultural regions from regions covered by forests. Recalling the factor loadings, PC4 is positively related to the share of forests, whereas it is negatively related to the share of agricultural areas on the total. Moreover, the average farm dimensions are negatively related with PC4. According to these characteristics, regions showing the highest values are mountain regions (e.g., the Alps, the Pyrenean region, Northern Scandinavia…). On the opposite side, the lowest values for the PC4 are assessed by North-western Europe plains.

PC5 – Urban dispersion: PC5 is positively related to the demographic density, the share of artificial areas on the total and the share of the employment in manufacturing activities. Thus, positive values for PC5 are usually assessed by urban and densely populated areas, with large industrial sectors. However, compared to PC1, PC5 is negatively related to the annual population variation and to the net migration rate. Also the young-age dependency ratio is negatively related to it. Thus, PC5 summarises very different features than a generic economic centrality of a given area (as PC1 does): it highlights a sort of urban dispersion from major urban and manufacturing areas across Europe. The regions which are affected by the greatest urban dispersion are those in Eastern Europe.

Moving from the 5 PCs, the comprehensive "*Peripherurality Index*" (PR Index) is then computed. As already stressed, the first step refers to the definition of an 'Urban benchmark'. According to each PC, the average scores which are assessed by the London and Paris are computed. Then the PR Index is computed for the whole set of EU NUTS 3 regions urban, just computing the Euclidean distance from this benchmark. By construction, the greater the PR Index is, the more rural and/or peripheral a given region is. In Figure 1, the values for the Index are shown (NUTS 3 level).

According to it, the lowest values of the index are observed in capital cities and in the larger metropolitan areas (strong urbanisation, high accessibility). On the other side, the highest values of the index affect Mediterranean regions, regions in the new Central Eastern Europe MSs, and regions in Northern Scandinavia. According to this measure, it is possible to define a range of context varying from the very urban contexts across the EU capital cities to very deep rural conditions, observed in the more peripheral areas within the EU.

Figure 1- PR Index across NUTS 3 regions in Europe



Source: own elaboration (R Software, EuroGeographics for administrative boundaries)

Actually, a new geography of EU regions starts emerging, by summing up very different but related features within a single and comprehensive measure. Such a very synthetic index mixes together territorial patterns at very different scales of the analysis: in particular, the EU, the national and the sub-national level of analysis.

4.2. Description of clusters

The selected PCs describes different dimension of the multidimensional concept of 'peripherurality'. However, they just provide a very broad picture about rural features of the EU regions. By applying cluster analysis on the selected PCs the analysis of the EU spatial development is deepened: actually, groups of homogeneous regions within the EU space can be addressed, thus providing an even richer geography of the EU rural and urban areas.

Cluster analysis has been applied on the scores assessed by each NUTS 3 region (1,288 observations) according to the 5 PCs. A hierarchical clustering techniques is adopted: the agglomerative algorithm AGNES[8] provides the whole hierarchy of clusters. The scores of the 5 PCs

[8] The acronym AGNES stands for AGglomerative NESting. According to this nesting procedure, single observations are merged in clusters until only one large cluster remains containing all the observations. The algorithm is included into the 'cluster' package in free Software R (R version 2.15.2 has been used).

are not standardized: thus, the different levels of variance among them are voluntarily taken into account.

According to the obtained dendrogram, seven different clusters can be identified. In order to describe them, the cluster centres can be shown according to the 5 PCs (Table 4). Moving from these results, the clusters can be labelled as follows: i) Peripheries; ii) EU green lungs; iii) Cities; iv) Remote regions; v) Agricultural districts; vi) Shrinking regions; vii) Industrial core.

Table 4 - Defining typologies: cluster centres according to the 5 PCs

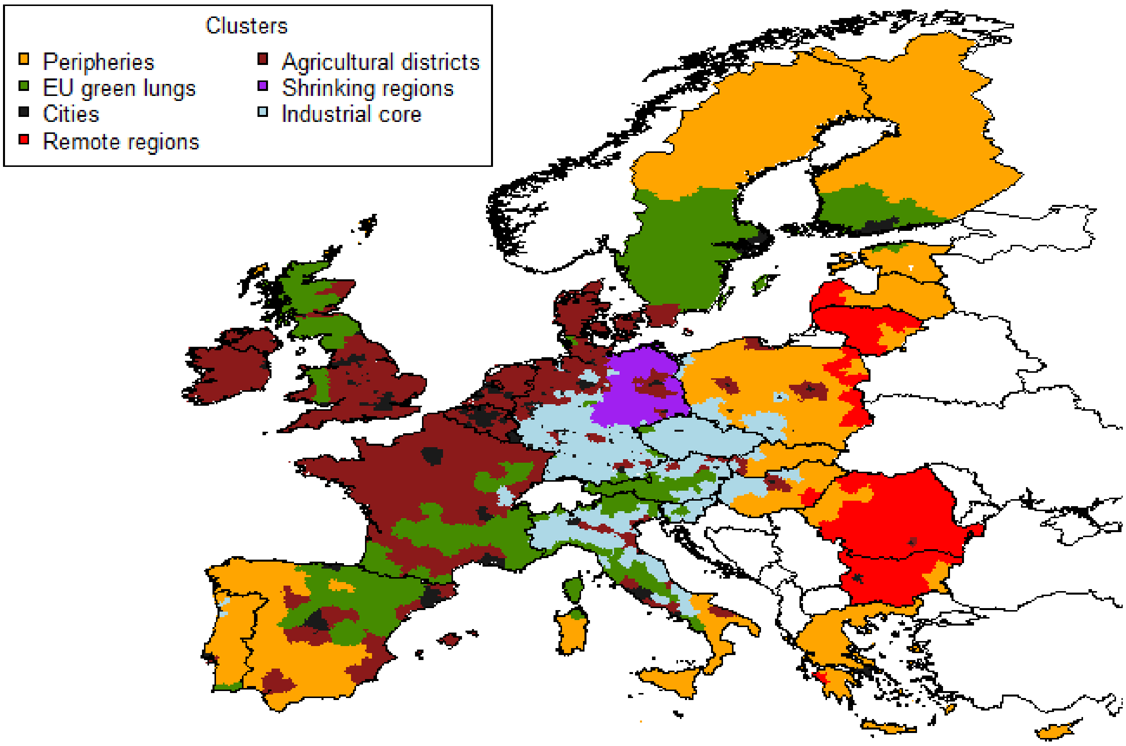
	PC1 – Economic and geographical centrality	**PC2 – Demographic shrinking / ageing**	**PC3 – Manufacturing in rural areas**	**PC4 Land Use:**	**PC5 – Urban dispersion**
Peripheries	**-3.25**	-0.65	-0.68	0.08	-0.43
EU green lungs	-0.10	-0.07	-0.41	**1.43**	**-1.40**
Cities	**3.42**	**-1.47**	-1.29	-0.15	0.97
Remote regions	**-6.33**	-0.89	0.00	-0.77	**1.89**
Agricultural districts	**1.10**	-0.01	0.85	**-1.06**	-0.72
Shrinking regions	0.38	**4.09**	**-1.70**	**-1.10**	0.46
Industrial core	0.54	0.42	**1.16**	**1.10**	0.53

Source: own elaboration

According to these results, some preliminary considerations can be reported. According to PC1, the cluster of cities shows a score well above the average, whereas regions belonging to cluster 1 (peripheries) and cluster 4 (remote areas) are below the EU average. Demographic shrinking (PC2) mainly affects the cluster of the shrinking regions, whereas other clusters show on average values. The presence of both manufacturing activities and a well performing labour market (PC3) are particularly strong within the industrial core. According to PC4 (land use), forests are widespread across the green lungs but also (more surprisingly) in the EU industrial core. Remote regions, agricultural districts and shrinking regions, on the opposite side, are more agricultural cluster. The phenomenon of urban dispersion (PC5) mainly affects remote regions and cities. It is less noticeable within the EU green lungs.

Before moving to an in-depth analysis of the seven clusters, some additional information about the clustering output can be provided. A broad picture of the distribution of the seven clusters across Europe is provided in Figure 2: this can be considered a well-balanced classification according to the number of NUTS 3 regions, resident population and geographical area (Table 5).

Figure 2 - Territorial distribution of the seven clusters



Source: own elaboration (software R, EuroGeographics for administrative boundaries)

Table 5 - Relevance of clusters: number of regions, population, geographical area

	No. NUTS 3 regions	Population (000)	Area	% NUTS 3 regions	% of Population	% of Area
Peripheries	204	74,965	1,516,377	15.84	15.08	35.22
EU green lungs	140	42,546	774,287	10.87	8.56	17.98
Cities	185	133,075	118,173	14.36	26.77	2.74
Remote regions	77	27,065	411,722	5.98	5.44	9.56
Agricultural districts	315	132,382	927,612	24.46	26.63	21.54
Shrinking regions	91	10,774	93,351	7.07	2.17	2.17
Industrial core	276	76,370	463,983	21.43	15.36	10.78
Total	1288	497,177	4,305,504	100.00	100.00	100.00

Source: own elaboration

Moving from the clustering output, a more detailed description about the seven selected clusters can be shown

Cluster 1 – Peripheries: the clusters accounts for about 15% on the total EU population, even though it covers more than 35% of the EU total area, mainly in Northern Scandinavia, new Central Eastern Europe MSs (e.g. Baltic States, Poland, Slovakia and Hungary) and Mediterranean Countries (Greece, Southern Italy, Spain and Portugal). According to this territorial distribution, the cluster has been labelled as the EU peripheries. It shows negative values for the PC1 (economic and geographical centrality), as well as poor economic figures, low levels of demographic density and low accessibility.

Cluster 2 – EU Green lungs: the cluster achieves positive values for PC4, meaning the widespread diffusion of forests. The geographical analysis of the cluster confirms these findings: the cluster includes the Alps and the Pyrenean region, as well as large parts of Scotland, Southern Sweden and Finland. In spite of this territorial pattern, the cluster is not affected by deep remoteness (PC1 is

close to the EU average) and economic figures are close to the EU average. These low densely-populated regions are thus characterised by a positive performance according to both demography and economic issues (having taken advantage from the natural landscape as well as from diversification of economic activity, e.g., throughout touristic services).

Cluster 3 – Cities: the cluster is characterised by very large values for PC1 (economic / geographical centrality). Actually, these regions share the highest level of potential accessibility as well as of economic wealth. On the opposite side, these areas are not affected by demographic shrinking. According to these figures, the cluster refers to urban areas: all the EU capital cities as well as large metropolitan areas are included in it. As expected, the manufacturing sector is scarcely represented (the share of employment in service is on average close to 80%).

Cluster 4 – Remote regions: regions located along EU easternmost border (Romania, Bulgaria, Lithuania, Poland) belong to this cluster. They share the lowest scores according to PC1. On average, multimodal accessibility index is quite poor; whereas average distance to the closest category 1 MEGA is larger than 750km. Geographical remoteness is coupled with poor economic figures: actually, economy is mainly driven by the agricultural sector. Even though these areas are not demographically shrinking (according to PC2), they are affected by urban dispersion (PC 5 is positive).

Cluster 5 – Agricultural districts: the cluster is mainly located in the plain areas across the North-Western part of the EU-15. Two PCs define it: PC1 is slightly positive; PC4 is negative (thus evoking the large relevance of an agricultural landscape). Actually, the cluster includes the main EU agricultural regions, where agricultural areas account for about 70% of the total surface. Then, the cluster is located in quite central regions within the EU context. Economic figures are close to the EU average, manufacturing activities are not particularly relevant.

Cluster 6 – Shrinking regions: the cluster is located in the Länder belonging to the former Eastern Germany. Both demographic shrinking and population ageing affect it. In particular, strong out-migration flows are observed and the share of old people on the total population has largely increased[9]. These regions are also affected by poor economic figures and by the lack of manufacturing activities. On the opposite side, the cluster is characterised by the large dimensions of the agricultural holdings (the average farm size and the average SGM are well above the overall EU average).

Cluster 7 – Industrial core: it is characterised by positive values for PC3 (the share of employment in manufacturing activities is greater than 27%, on the total). Thus, the cluster represents the industrial core of the EU, covering most part of Northern and Central Italy[10], Southern Germany and Czech Republic. The cluster also covers regions in Austria, Slovenia and Western Hungary. Moreover, these regions show well-performing labour markets, with low levels of unemployment rate. From a demographic perspective, however, these regions seem to be affected by an ongoing ageing of the population.

According to these results, the existence of different typologies of rural areas within Europe fairly emerges. These typologies differ according to both their main socio-economic features and their territorial distribution. Actually, rural areas are getting more and more heterogeneous within the EU,

---

[9] The shrinkage of Eastern German Länder has already been widely analysed in literature (Bontje, 2005; Lötscher *et al.,* 2004; Müller and Siedentop, 2004; Peter, 2004).

[10] This area is generally referred to as 'Third Italy', according to the definitions from Bagnasco (1977, 1988). These regions are actually characterised by systems of small and medium enterprises, distributed in industrial districts (Brusco, 1999; 2007; Becattini, 1989).

especially in terms of a different mix of rural-peripheral features. Thus, the PR Index according to the seven clusters has been analysed. In Table 6, PR Index average values are shown for the 7 clusters, as well as standard deviations: on average, it ranges from 11.32 (‘cities’) to 18.50 (‘remote regions’).

In particular, some clusters share very similar distribution for the PR Index. Therefore, ANOVA (analysis of variance) has been performed: it highlights no statistical differences in the value of the PR Index between ‘Agricultural districts’ and ‘Industrial core’, as well as between ‘Industrial core’ and ‘EU Green Lungs’. However, from this distribution a clearer picture about peripherurality across Europe emerges. All clusters located along EU borders share both rural and peripheral features: thus, according to this picture at the EU scale, new geographies within the single national contexts emerge, too. These findings are relevant in order to better understand the the territorial distribution of the EU main regional policies and of the CAP. Actually, throughout this index is possible to understand how green EU RDP is, looking at the territorial distribution of expenditures.

Table 6 - PR Index and clusters: average values

	PR INDEX	
	Mean	**Standard deviation**
Peripheries	16.74	0.78
EU green lungs	15.46	0.74
Cities	11.32	2.03
Remote regions	18.50	0.91
Agricultural districts	14.99	0.85
Shrinking regions	16.28	1.06
Industrial core	15.18	0.76

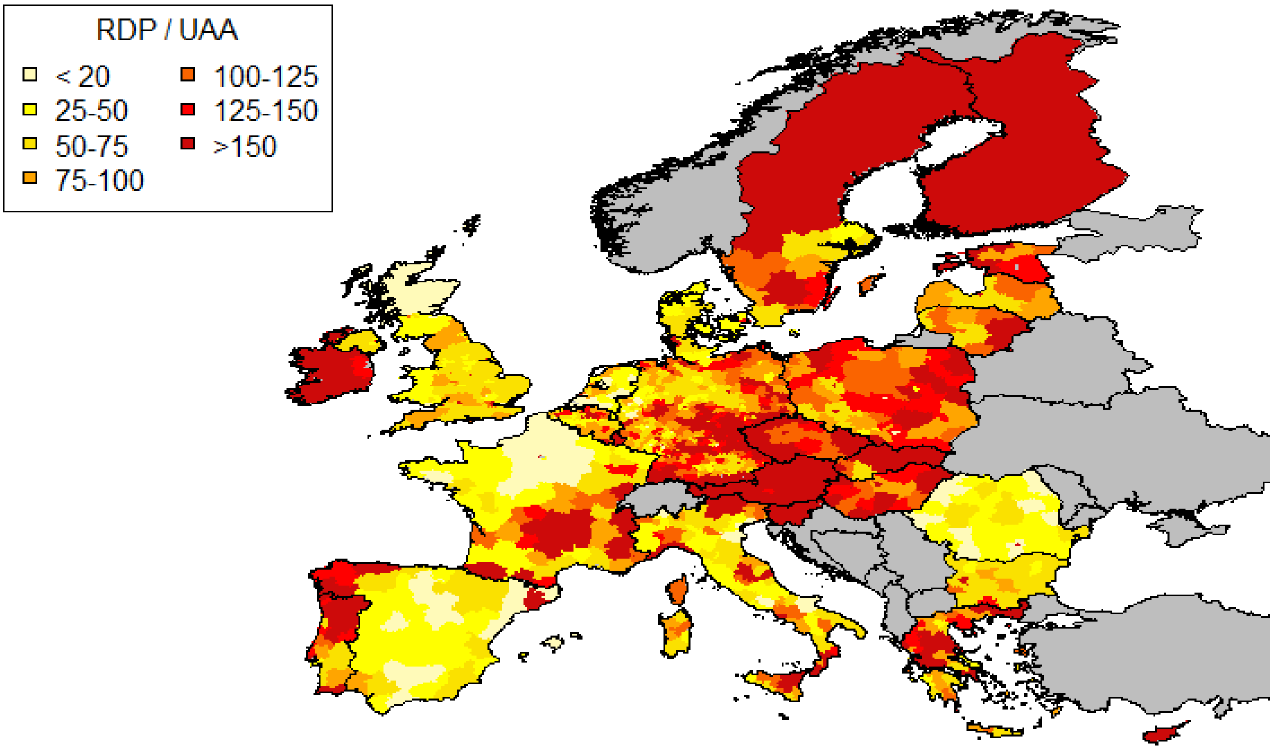
Source: own elaboration

4.3. *Describing the spatial allocation of the EU funds*

According to the territorial distribution of peripherurality, the allocation of the overall EAFRD expenditures for years 2007 to 2009 is then considered. At the NUTS 3 level, both raw EAFRD expenditures and the intensity of the RDP support are considered. Intensity can be expressed in terms of three different agriculture-related variables: intensity per unit of utilized agricultural areas (UAA); ii) intensity per unit of agricultural labour work (expressed in annual work unit, AWU); intensity per thousand Euros of agricultural gross value added (GVA).

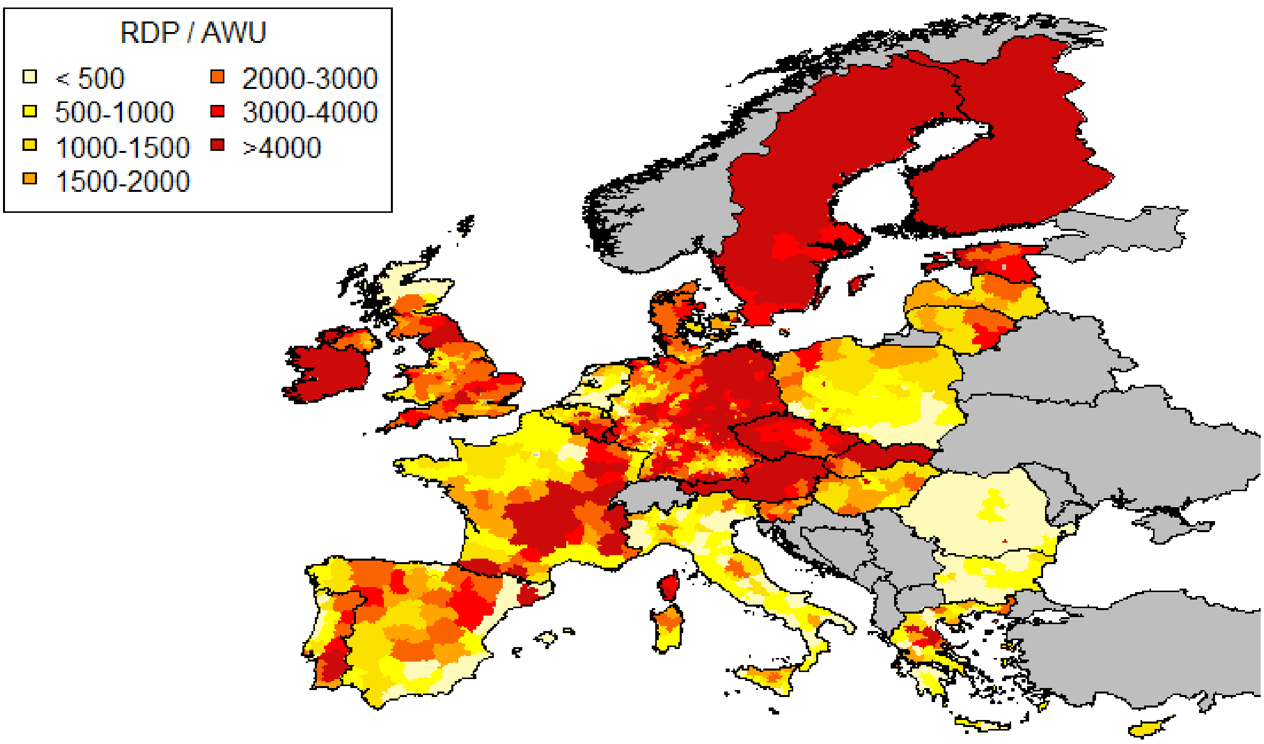
In Figure 3, Figure 4, Figure 5, the intensity of RDP expenditure at the NUTS 3 level is shown. Values show great heterogeneity, due to major differences in the main features of EU regions’ agricultural sectors. For example, the intensity or RDP expenditures per unit of UAA is particularly low in Northern France or in Spain, due to the larger presence of agricultural areas in those regions. Conversely, when considering RDP expenditures per agricultural GVA, this ratio is higher in Eastern Europe regions than in Western Countries, due to lower values of GVA.

Figure 3 - RDP expenditures per unit of utilized agricultural area (UAA)



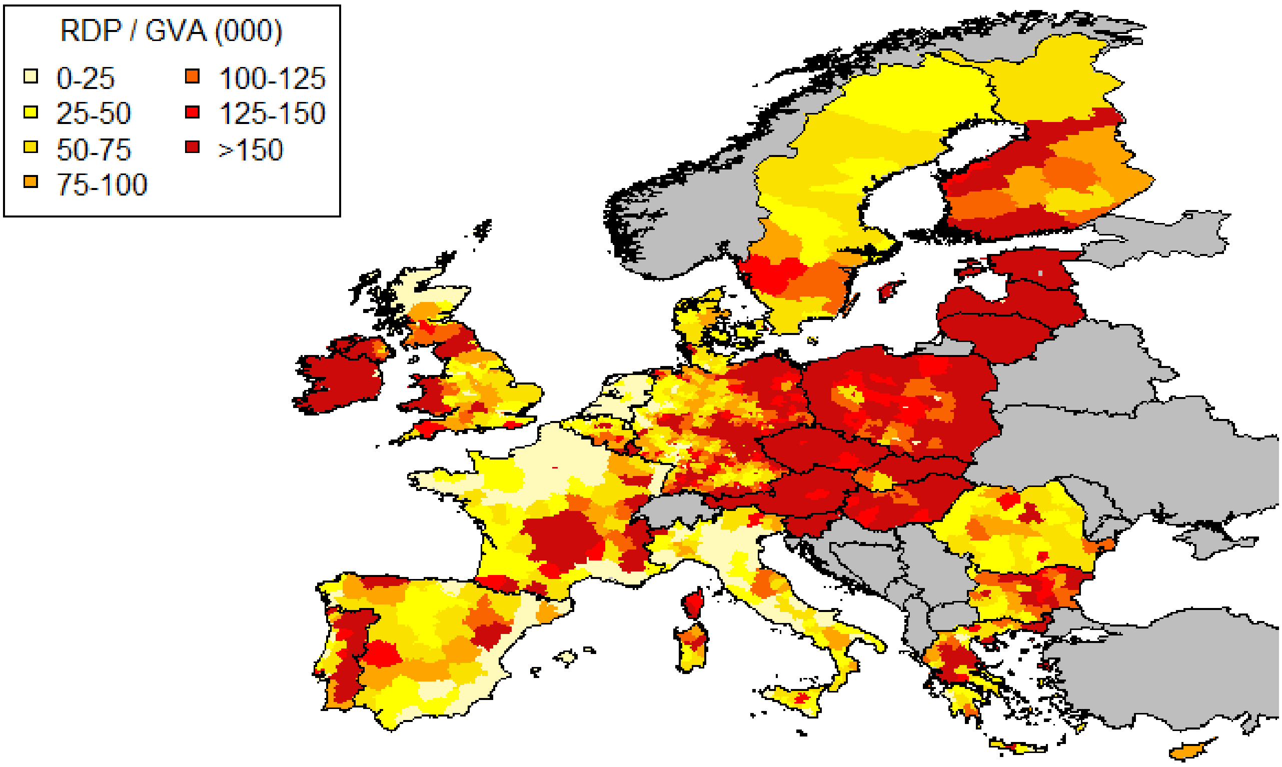
Source: own elaboration on European Commission data (software R, EuroGeographics for administrative boundaries)

Figure 4- RDP expenditures per unit of agricultural labour work (in annual work unit, AWU)



Source: own elaboration on European Commission data (software R, EuroGeographics for administrative boundaries)

Figure 5 - RDP expenditures per agricultural GVA (thousand)



Source: own elaboration on European Commission data (software R, EuroGeographics for administrative boundaries)

Moving from the analysis of the intensity of the support from RDP at the NUTS 3 level, some outliers can be easily detected: they mainly refer to urban areas (e.g., Paris and London), where both utilized agricultural areas and agricultural workforces are very low (thus implying higher levels of the expenditures' intensity). Before moving to the observation of expenditures spatial allocation across clusters, these outliers have been dropped out from the analysis.

According to the remaining observations, Table 7 shows the average expenditures per typology of urban-rural region (Eurostat, 2010) and per cluster. When considering the typologies from Eurostat (2010), a very simple picture can be highlighted: PR regions show greater expenditures than PU regions, considering both the total values and their intensity. Thus, RDP seems properly targeted to more rural areas within the EU.

However, when considering the distribution of expenditures across the seven clusters, a more complex pattern starts emerging. Actually, values are not so homogeneous across EU clusters. First, when considering intensity per unit of utilized agricultural areas, the shrinking regions, the EU green lungs, the industrial core and the peripheries receive more funds then all other clusters. On the opposite side, both remote regions as well as agricultural districts receive very few funds from EARFD. When considering the expenditures per agricultural annual work unit, they are mainly located within shrinking regions and EU green lungs. Again, remote regions receive very few funds compared to their agricultural labour force. Those data are partially compensated by the analysis of the expenditures per agricultural GVA: in this case, remote regions seem receiving higher intensity of funds (due to the lower value of agricultural GVA which is observed).

Table 7 - Average RDP expenditures per cluster

	EAFRD Expenditures			
	Total expenditures (000 €)	Expenditures per UAA	Expenditures per AWU	Expenditures per Agri GVA (in .000 €)
Predominantly Rural (PR) regions	19,103	130.76	3,048.21	154.72
Intermediate (IR) regions	10,611	111.33	2,997.10	117.72
Predominantly Urban (PU) regions	5,786	101.07	2,625.86	89.82
Peripheries	23,393	135.55	1,801.96	137.13
EU green lungs	19,059	147.76	4,720.54	180.06
Cities	4,304	120.35	3,273.43	96.04
Remote regions	14,389	60.44	533.27	124.88
Agricultural districts	11,933	69.89	2,067.80	76.20
Shrinking regions	6,934	152.09	7,797.13	242.67
Industrial core	9,851	141.76	2,714.20	127.04

Source: own elaboration on European Commission data

Moreover, the correlation coefficients between the RDP expenditures and some indicators of remoteness / centrality have been computed (Table 8). In particular, density, PC1 (which is a measure of economic and geographical centrality) and the PR index are taken into account. According to these analyses, some contrasting findings emerge. First, when considering the intensity in terms of agricultural areas (UAA), no significant correlations are found. Then, when considering the expenditures per agricultural workforce, the intensity of support is greater in more central regions: actually, the indicator shows a positive and significant correlation with density and PC1, whereas it shows a negative and significant correlation with the PR Index. On the opposite side, when moving to the analysis of the intensity of the RDP expenditures expressed in terms of agricultural GVA, opposite results emerge. The intensity of the support is negatively related to density and PC1; it is positively related to the PR Index.

Table 8- Pearson correlation coefficients: RDP expenditures and different measures of centrality/remoteness

	Density	PC1 - Economic and geographical centrality	PR Index
Total expenditures	-0.051 (0.066)	-0.274 (<2.2e-16)	-0.094 (0.001)
Expenditures per UAA	0.033 (0.245)	-0.028 (0.325)	-0.023 (0.416)
Expenditures per AWU	0.091 (0.001)	0.133 (1.85e-06)	-0.073 (0.009)
Expenditures per Agri GVA	-0.009 (0.760)	-0.117 (2.5e-05)	0.090 (0.001)

Source: own elaboration on European Commission data

5. CONCLUSIONS

This study sheds new light on rural and peripheral areas across Europe. Actually literature stresses the wide heterogeneity affecting these regions. Thus, it is important to go beyond the definition of urban-rural typologies proposed by OECD (1994; 1996; 2006) and Eurostat (2010). Indeed, a multidimensional approach is crucial in order to catch all the different features affecting trends and development of rural areas. Moreover, the dichotomous approach to rurality is now largely outdated, due to the observed heterogeneity within those regions. This research has actually

highlighted the main dimensions affecting EU rural areas. Throughout a PCA, some considerations on the main drivers of EU territorial development have been assessed. In particular, it is observed that economic performance and wealth are still strictly linked with accessibility and centrality. Remote and rural areas are still among the poorest ones within the EU. Focusing on rural and peripheral areas, other considerations emerge. First, a possible form of diversification of rural economy is represented by the manufacturing activity. An industrial core can be highlighted within the EU: moreover, such a core is also characterised by a better performing labour market than other EU rural regions. Looking at major issues, the PCA suggested that demographic shrinking and population ageing, although representing relevant issues for rural areas, actually affect just specific regions and not the whole set of rural and peripheral regions. Especially in Southern peripheries, rural areas are not demographically shrinking at all.

Then, throughout cluster analysis, specific typologies of EU rural areas can be identified. The classification follows a clear territorial pattern: more central and more accessible clusters of regions are quite different from those clusters which are composed by peripheral and lagging behind regions. Thus, from this analysis the relevance of the geographical features clearly emerges. Geography still deeply affects both the regional economic performance and their main socio-demographic trends (both in urban and rural areas).

By computing a comprehensive Peripherurality (PR) Index, findings from both PCA and cluster analysis have been linked together. The analysis of the distribution of the PR Index across Europe suggests the existence of a more complex geography at the EU scale. Indeed, national approaches to rural and peripheral areas should be coupled with broader approaches which are able to encompass all the different territorial level of the analysis (e.g., the sub-national, the national and the EU level of analysis).

The provided taxonomy is also helpful in analysing the spatial allocation of the CAP Pillar 2 expenditures. According to data referring to years 2007 to 2009, EAFRD expenditures tend to be spatially clustered. Although expenditures intensity is greater in predominantly rural regions (according to the Eurostat methodology), some clusters are characterised by high values of RDP expenditures: EU green lungs, shrinking regions and even cities seem to be characterised by a greater intensity of these expenditures. These findings are partially confirmed from the analysis of the correlation between them and some more quantitative measure of remoteness: actually, RDP expenditures are negatively related with the PR index. Actually, the RDP seems to be less ‘green’ that expected: major urban areas as well as more central regions still have a greater capacity to use EU funds than more peripheral and lagging behind regions. However, findings are influenced by the nature of the indicators which are used to calculate the intensity of the expenditures. Even if RDP expenditures mainly focus on agricultural areas, deeper analyses should be assessed by considering RDP’s different axes.

However, by focusing on the spatial allocation of the RDP expenditures at the EU level, this work has just provided a very general picture about it. However, this analysis does not directly provide any further explanations about the main economic drivers beyond this allocation. Moreover, from the analysis of the correlation coefficients, some contrasting results emerge. In next works, causal relations defining the spatial allocation of funds will also be investigated. In particular, the main drivers affecting the spatial allocation within urban and rural regions will be modeled.

AKNOWLEDGMENTS

The research is part of the FP7/2007-2013 “WWWforEurope” Project, funded by the European Community's Seventh Framework Programme FP7/2007-2013 under grant agreement n° 290647.

REFERENCES

Anania, G., Tenuta, A. (2008), “Ruralità, urbanità e ricchezza nei comuni italiani”. *La questione Agraria* 1: 71-103.

Auber, F., Lepicier, D., Schaffer, Y. (2006). The construction Diagnostic des espaces ruraux français : proposition de méthode sur données communales et résultats à l’échelle du territoire national. *Notes et Etudes Economiques* 26.

Bagnasco, A. (1977). *Tre Italie: la problematica territoriale dello sviluppo economico italiano*. Bologna: Il Mulino.

Bagnasco, A. (1988). *La costruzione sociale del mercato*. Bologna: Il Mulino.

Ballas, D., Kalogeresis, T., Labrianidis, L. (2003), A Comparative Study of Typologies for Rural Areas in Europe, paper presented at the 43rd “European Congress of Regional Science Association”, Jyvaskyla, 27-30 August.

Barjak, F. (2001). Regional Disparities in Transition Economies, a Typology for East Germany and Poland. *Post Communist Economies* 13 (3): 289-311.

Beccatini, G. (1989), *Modelli locali di sviluppo*. Bologna: Il Mulino.

Becattini, G., Rullani, E. (1993). Sistema locale e mercato globale. *Economia e Politica Industriale* 80: 25-48.

Bertolini, P., Montanari, M., Peragine, V. (2008). *Poverty and Social Exclusion in Rural Areas*, Bruxelles: European Commission

Bertolini, P., Montanari, M. (2009). Un approccio territoriale al tema della povertà in Europa: dimensione rurale e urbana. *Economia & Lavoro* 1: 25-52.

Bogdanov N., Meredith D., Efstratoglou, S. (2007). A typology of rural areas in Serbia. In: Tomić D. and Sevarlić M. (eds) *Development of Agriculture and Rural Areas in Central and Eastern Europe*. Proceedings from 100th Seminar of EAAE, Novi Sad, 553-562.

Bollman, R., Terluin, I., Godeschalk, F., Post J. (2005). Comparative Analysis of Leading and Lagging Rural Regions in OECD Countries in the 1980s and 1990s, paper presented at the European Congress of the European Regional Science Association (ERSA). Amsterdam: Vrije Universiteit, 23-27 August

Bontje, M (2005). Facing the challenge of shrinking cities in East Germany: the case of Leipzig, *Geojournal* 61 (1): 13-21.

Brusco S. (1999). The Rules of the Game in Industrial Districts. In Grandori A. (ed.), *Interfirm Networks: Organization and Industrial Competitiveness*. London-New York: Routledge, 17-40.

Brusco S. (2007). *Distretti industriali e sviluppo locale: una raccolta di saggi (1990-2002)*, edited by Natali, A., Russo, M., Solinas, G. Bologna: Il Mulino.

Buesa, M., Heijs, J., Pelliero, M.M., Baumert, T. (2006). Regional Systems of Innovation and the Knowledge Production Function: The Spanish Case. *Technovation* 26: 463-472

Copus, A.K. (1996). A Rural Development Typology of European NUTS 3 Regions. Working paper 14 (AIR3-CT94-1545), The Impact of Public Institutions on Lagging Rural and Coastal Regions

Copus, A.K., Psaltopoulos, D., Skuras, D., Terluin, I., Weingarten, P. (2008), *Approaches to Rural Typology in the European Union*. Luxembourg: Office for Official Publications of the European Communities

Dimara, E. and Skuras, D. (1996), Microtypology of rural desertification in Greece. Working Paper 20, (AIR3-CT94-1545)

Esposti R. (2011), "Reforming the CAP: an agenda for regional growth?" in: Sorrentino, S., Henke, R., Severini, S. (eds.), *The Common Agricultural Policy after the Fischler Reform. National Implementations, Impact Assessment and the Agenda for Future Reforms*, Farnham: Ashgate, pag. 29-52.

ESPON 1.1.1 (2005), *Potentials for polycentric development in Europe*. Final Report. Stockholm: Nordregio

European Commission (2006). *Rural Development in the European Union. Statistical and Economic Information*. Report 2006. Bruxelles: DG AGRI.

Eurostat (2010). A revised urban-rural typology. In Eurostat, *Eurostat regional yearbook 2010*. Luxembourg: Publications Office of the European Union

Everitt B.S., Hothorn T. (2010). *A Handbook of Statistical Analysis using R*. Boca Raton (FL): Taylor & Francis Group.

FAO-OECD (2007). *OECD-FAO Agricultural Outlook 2007-2016.* Report, Rome, July 7th.

Hoggart, K., Buller, H., and Black, R. (1995). *Rural Europe; Identity and Change*. London: Edward Arnold

Hotelling, H. (1933). Analysis of a complex of statistical variables into principal components. *Journal of Educational Psychology* 24:. 417-441.

Johnson, S.C. (1967). Hierarchical clustering Schemes. *Psychometrika* 32(3): 241-254.

Kaiser, H.F. (1974). An index of factorial simplicity. *Psychometrika* 39: 31-36.

Kaufman, L. and Rousseeuw, P. (1990). *Finding Groups in Data: An Introduction to Cluster Analysis*. Hoboken (N.J.): Wiley Series in Probability and Mathematical Statistics.

Kawka, R. (2007). Typisierung von ländlichen Räumen in Deutschland, unpublished OECD Rural Policy Reviews: Germany, PARIS.

Lötscher, L., Howest, F., Basten, L. (2004). Eisenhüttenstadt: Monitoring a shrinking German city, *Dela* 21: 361-370

Lowe, P., Ward, N. (2009). "Rural Futures: A socio-geographical approach to scenarios analysis", *Regional Studies* 43(10): 1319-1332

MacQueen, B. (1967). Some Methods for classification and Analysis of Multivariate Observations. *Proceedings of 5th Berkeley Symposium on Mathematical Statistics and Probability*, vol. 1: 281-297. Berkeley (CA): University of California Press

Merlo, V., Zaccherini, R. (1992). *Comuni urbani e comuni rurali*. Milano: Franco Angeli.

Monasterolo, I. and Coppola, N. (2010). More targeted rural areas for better policies. In: *Proceedings of the 118th EAAE Seminar 'Rural development: governance, policy design and delivery'*, Ljubljana, Slovenia, 25-27 August 2010.

Montresor, E. (2002). Sviluppo rurale e sistemi locali: riflessioni metodologiche. *La Questione Agraria* 4: 115-146.

Müller, B. and Siedentop, S. (2004). Growth and Shrinkage in Germany - Trends, Perspectives and Challenges for Spatial Planning and Development. *German Journal of Urban Studies* 44 (1).

Nordregio, UMS RIATE , RRG Spatial Planning and Geoinformation, Eurofutures Finland, LIG (2007). *Regional disparities and Cohesion: What strategies for the future*. Report commissioned by European Parliament Committee on Regional Development, IP/B/REGI/IC/2006_201. http://www.europarl.europa.eu/meetdocs/2004_2009/documents/dv/200/200705/20070530 intraregionaldisparitiesen.pdf

NUI Maynooth, Centre for Local and Regional Studies, National Spatial Strategy (2000). *Irish Rural Structure and Gealtacht Areas* http://www.irishspatialstrategy.ie/docs/report10.pdf

Ocana-Riola R. and Sánchez-Cantalejo C. (2005). Rurality Index for Small Areas in Spain. *Social Indicators Research* 73: 247-266

OECD (1994). *Creating Rural Indicators for Shaping Territorial Policy*. Paris: OECD

OECD (1996). *Territorial Indicators of Employment. Focusing on Rural Development*. Paris: OECD

OECD (2006), *The New Rural Paradigm. Policies and Governance*, Paris: OECD

Paci, M. (1978). *Capitalismo e classi sociali in Italia*. Bologna: Il Mulino.

Pearson, K. (1901). On lines and planes of closest fit to systems of points in space. *Philosophical Magazine* 2: 559-572.

Peter, F. (2004). Shrinking Cities - Shrinking Economy? The Case of East Germany. *German Journal of Urban Studies* 44 (1).

Psaltopoulos, D., Balamou, E., Thomson, K.J. (2006). Rural/Urban impacts of CAP measures in Greece: an interregional SAM approach". *Journal of Agricultural Economics* 57: 441-458.

Sotte F. (2009), *La Politica di Sviluppo Rurale 2007-2013. Un primo bilancio per l'Italia*, Gruppo 2013-Coldiretti, Quaderni, Rome: Edizioni Tellus.

Sotte, F., Esposti, R., Giachini, D. (2012). The evolution of rurality in the experience of the "Third Italy". paper presented at the workshop "European governance and the problems of peripheral countries" (WWWforEurope Project), Vienna: WIFO, July 12-13

Terluin, I., Godeschalk, F.E., Von Meyer, H., Post, J. A., Strijker, D. (1995). Agricultural incomes in Less Favoured Areas of the EC: A regional approach. *Journal of Rural Studies* 2(2): 217-228.

The Wye Group (2007). *Handbook Rural Households' Livelihood and Well-Being Statistics on Rural Development and Agriculture Households Income*. New York (NY) and Geneva: United Nations, http://www.fao.org/statistics/rural/.

Tobler, W.R. (1970). A computer movie simulating urban growth in the Detroit region. *Economic Geography* 46: 234–240.

Tryon, R. C. (1939). *Cluster analysis*. New York: McGraw-Hill.

Vidal, C., Eiden, G., Hay, K. (2005). *Agriculture as a Key Issue for Rural Development in the European Union*. UN Economic Commission for Europe. Working Paper No. 3.

Ward, J.H. (1963). Hierarchical Grouping to Optimize an Objective Function. *Journal of American Statistical Association* 58: 236-244.