USING ESDA FOR STUDYING DEMOGRAPHIC DISPARITIES IN ROMANIAN LOW URBAN POLARIZATION AREAS

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Abstract. The demographic ageing and the decrease of demographic stability are processes determining important challenges for the economies of developed countries. The description and the analysis of spatial - temporal patterns of demographic structures specific for areas of low urban polarizing becomes a priority for durable, balanced, coherent and integrated development of various categories of disfavoured territories. This article tries to describe spatial and temporal patterns of demographic structures, using an analysis of ESDA type (Exploratory Space Data Analysis) for Romania between the last two people census. Using visualizing methods in GIS and using LISA technique, we detected spatial patterns of demographic structures and we emphasized the existence of some clusters and some trends of spatial polarization. The demographic ageing and implicitly the

decrease of the rate of young people in territorial demographic structures, represents the main phenomenon being the basis of social and economic disparities, their increase in low polarized areas of urban systems, emphasizing the relations between social and demographic dynamics and regional economic changes.

Key words: territorial disparities, rural areas, cluster analysis, spatial autocorrelation, Romania.

1. Introduction

The chain of causalities between demographic and economic fields determined thorough inter-disciplinary studies during last decades. The relations between social and demographic dynamics and economic changes are very complex, involving numerous disputes and debates between economists, geographers, sociologists or demographers. The main issue of these debates was the fact if the population decrease or the increase is (in)dependent from economic increase. In specialized literature there are some critical opinions regarding the effects of population increase on economic development and modifications of social - demographic structure because of the effects of demographic transition (Bloom *et al.*, 2003).

The fast increase of population may have positive effects of economic development (Simon, 1986) and has an essential role in knowledge economy.

The theories of population increase (starting from Malthusians, optimist or neutral ones), that tried to offer a support for analysing the relations between population increase and economic development did not paid enough importance to population evolution and dynamics according to age groups, "each population age group having a different behaviour, with important economic consequences" (Bloom *et al.*, 2003: 20).

On the other hand, while some studies emphasized the relation between economic costs and high rates of demographic dependence (Coal and Hoover, 1958), the interdependence between fertility, population structure on age groups and economic dependence (Hock and Weil, 2006; Ungureanu, 2009), the others emphasized the relation between consumption depending on age groups (the young and the old groups has a consumption bugger that their production, the active age groups save money more for the education of their children) (Deaton and Paxson, 1997; Leff, 1969; Kelley and Schmidt, 1995; 1996).

The theme demographic dividend was again discussed especially regarding the problems of human capital. The relation between labour force, savings of population and human capital was explained from the perspective of demographic transition, proving "the mechanical effect of demographic transition" and the apparition of generation baby-boom (Bloom, Canning and Sevilla, 2003). The geographic disparities provoked by population distribution on age groups may be emphasized from various perspectives, according to regional innovative capacities and human capital (Gregory and Patuelli, 2013; Acs *et al.*, 2002).

Also, are known the effects of economic transition on human capital, together with the decrease of mortality and the increase of life hope at birth. The extension of life hope of a population means significant changes on the respective society, regarding its reference with education, family, health, investments, generally on the fields and the dimensions of life quality.

The demographic ageing became one of the processes determining important challenges for the economies of developed countries. This article tries to describe spatial and temporal patterns of demographic structures, using an analysis of ESDA type (Exploratory Space Data Analysis) for Romania between last two Population censuses. For the beginning, we detected spatial patterns of demographic structures and we exploited visualization methods allowing the investigation of spatial dynamics of demographic structure distribution, thus reaching a detection of some clusters and some trends of spatial polarization. In order to realize this, we used GIS analysis techniques, simultaneously exploiting and processing the data in the programs ArcGis 10.1 and GeoDa (Anselin, 2003; Anselin *et al.*, 2006; Anselin and Rey, 2014).

2. GIS analytical methods and spatial autocorrelation

GIS has contributed to the development of spatial analytical methods (Martin, 2009; Bailey and Gatrell, 1995; Goodchild, 1987; Fotheringham and Rogerson, 1993; Openshaw, 1996). Spatial analysis is requiring information about spatial objects. Location, topology, spatial arrangement, distance, and spatial interaction become the focus of attention in SDA activities (Fischer, 1999: 284).

The development of local statistics in geography is based on idea that when analysing spatial data, it might be incorrect to assume that the results obtained from the whole date set represent the situation in all parts of the study area. Interesting insights might be obtained from investigating spatial variations in the results (Fotheringham, 2000:11). The essence of spatial analysis is that "space matters", and what happens in one area is related to what happens in neighbouring areas. The issue of spatial autocorrelation is complicated, the spatial autocorrelation may potentially go to any direction. The basis for most models is an indicator of whether one region is a spatial neighbour of another; or equivalently, which regions are neighbours of a given region.

The main characteristic spatial data is that the units are correlated, according to well-known Tobler's First Law Geography (1970): "everything is related to everything else, but near things are more related than distant things". Spatial aggregation of objects produces a variety of distinct spatial patterns and can be quantified according to the degree of similarity between the objects in their attributes or quantitative values (Fortin and Dale, 2009:89). The notion of proximity is important for the analysis of spatial patterns representing the key of spatial econometrics analyses (Anselin, 2006). Spatial econometrics is a field whose analytical techniques are designed to incorporate dependence among observations (regions or points in space) that are in close geographical proximity (LeSage, 2008).

"Spatial autocorrelation is concerned with the degree to which objects or activities at some place on the earth's

surface are similar to objects or activities located nearby" (Goodchild, 1986:3).

A vector variable represents the collected observation regarding the points or the regions from a space. The observation points may include the sale price of housing, unemployment rate, criminality rate, population density etc.

The spatial autocorrelation is important because involves the presence of a spatial process. Why are near-by areas similar to each other? Why do high income people live "next door" to each other? Because it is a *geographical location*. Spatial autocorrelation indicates that samples taken from nearby areas are related to each other and are not independent. To measure the autocorrelation, we must know the "nearness" of our observations. Clustering is a classical theme in the statistical and geographical research based on different algorithms and related to the independent data. Spatial autocorrelation is a form of statistical dependence sometimes present in geographically referenced data. Geo-spatial autocorrelation arrives when spatial processes deviate as a function of geographical location (Siordia, 2013).

The spatial autocorrelation involves the evaluation of relation intensity and the proximity of places and their degree of similitude (resemblance). This spatial autocorrelation may be measured by spatial proximity and statistic indicator Moran I (low cluster, high cluster). Spatial autocorrelation is the identification of similarity in values in a similar location – counties near each other are more similar. For instance, if any of high or low values of gross birth-rate may be founded in spatial unit (for example, county) and in adjacent spatial units, so we may speak about a positive spatial autocorrelation. Spatial clustering is said to occur with positive spatial autocorrelation (Anselin *et al.*, 2000). By the help of LISA method (Local Indicators of Spatial Association) may be significantly statistically identified the concentration areas (congregation) or of spatial dispersion. Thus, may be measured spatial local distributions and some characteristics associated to this phenomenon, like the population of a certain age group (Anselin, 1995).

3. Results and discussion

Examining a simple map of distribution of young or old population in a territory, first we may observe important regional disparities at country level. These maps are important for showing territorial disparities having important effects for policymakers or researcher to visualize such distributions of the respective indicators.

However they represent important starting points, but may appear ambiguities or key questions without answers, if we may statistically confirm the spatial patterns mentioned above. The information regarding spatial patterns of the distribution of young or old population may clarify very much the *importance of location as an individual casual factor*. The purpose of this article is that of emphasizing some spatial and temporal patterns of demographic ageing and using an analysis of type Exploratory Space Data Analysis (ESDA). Following Anselin (1998), exploratory spatial data analysis (ESDA) is a collection of techniques to describe and visualize spatial distributions; identify atypical locations or spatial outliers; discover patterns of spatial association, clusters or hot-spots; and suggest spatial regimes or other forms of spatial heterogeneity.

Some areas near to towns may have lower or higher values of young or old population, depending on their geographic location. We conduct an ESDA in order to describe and visualize the distribution of spatial data. We aim to identify the patterns of spatial clusters and spatial outliers.

The essential question is that if observed patterns of young or old population are equally likely as any other spatial pattern. For measuring spatial autocorrelation, we may use the global indicator Moran's I statistic. Developed by Patrick Alfred Pierce Moran (1948), the statistic autocorrelation was extended and applied by Cliff and Ord (1981), Anselin (1996), Pinkse (2003), Griffith (2003) and others or by other studies (Gregory and Patuelli, 2013).

The Moran's *I* statistic for spatial autocorrelation is given as (ESRI, 2011):

$$I = \frac{n}{s_0} \frac{\sum_{i=1}^{n} \sum_{j=1}^{n} w_{i,j} z_i z_j}{\sum_{i=1}^{n} z_i^2} \qquad (1)$$

where:
z_i is the deviation of an attribute for feature i from its mean (x_i –),$w_{i,j}$ is the spatial weight between feature *i* and *j*, n is equal to the total number of features, and S_o is the aggregate of all the spatial weights:

$$S_0 = \sum_{i=1}^{n} \sum_{j=1}^{n} w_{i,j} \qquad (2)$$

If administrative territorial units with above-average (below-average) of youth population share is surrounded by neighbouring administrative territorial units with above-average (below-average) of youth population share, the cross product term (x_i –) (x_i –) becomes positive, making $I^s > 0$, and implies that there is positive spatial autocorrelation (respectively, it is negative when $I^s < 0$). The closer I^s gets to zero, the weaker the evidence to support spatial autocorrelation.

Since the distribution of youth population cannot be expected to be random in space, we first conduct a test for global spatial autocorrelation using the MI indicator which provides a single summary statistic describing the degree of clustering present in spatial data. In particular, it allows implications on whether, for instance, highly (lowly) "young" population areas are often surrounded by areas that are also highly (lowly) "young" population. This is interesting, since it reflects spatial dependencies that are induced, for instance, by demographic behaviours between areas. Moreover, it allows classifying regions by type of cluster.

A Moran scatter plot is centred on the mean and has the variable of interest on the x-axis and the spatial lag variable on the y-axis (Anselin, 2005; Anselin *et al.*, 2000). Each quadrant in the scatter plot corresponds to a different type of spatial autocorrelation (Anselin, 2005). High-high (upper right) and low-low (lower left) represent positive spatial autocorrelation (spatial clusters) and low-high and high-low are negative spatial autocorrelation (spatial outliers) (Anselin, 2005; Anselin *et al.*, 2000).

3.1. Local Indicators of Spatial Association (LISA) and clusters of young and elderly people

For determining specific locations and magnitude of spatial autocorrelation, we may use LISA method (Local Indicators of Spatial Association), proposed by

Anselin (1995). Anselin (1995:94) considers LISA any statistic that satisfies the following two requirements: a) the LISA for each observation gives an indication of the extent of significant spatial clustering of similar values around observation and b) the sum of LISAs for all observations is proportional to a global indicator of spatial association. Even if the Moran is positive, this shows spatial distribution of young and old population at the level of administrative territorial units and is not random, it does not locate clusters. In this case, we will consider local indicators of spatial association or LISA (Anselin, 1995).

LISA is a class of statistics that provides location-specific information (by administrative territorial units, in this case) and estimates the extent of spatial autocorrelation between the value of a given variable (in our case, young people) in a particular location and the values of those same variables in locations around it.

We will identify spatial clusters of young population "hot-spots" (high – share of young population administrative territorial units surrounded by high – share of young population administrative territorial units) and "cold –spots" (low-share of young population administrative territorial units surrounded by low–share of young population administrative territorial units). We use the Local Moran's *I* statistic or LMI (ESRI, 10.1):

$$\mathrm{I_i} = \frac{x_{i-\overline{X}}}{s_i^2} \sum_{j=1,\, j\neq 0}^{n} w_{i,j} \left(x - \overline{X} \right) \qquad (3)$$

Where x_i is an attribute for feature i, is the mean of the corresponding attribute, $w_{i,j}$ is the spatial weight between feature *i* and *j*, and:

$$S_i^2 = \frac{\sum_{j=1,\, j\neq i}^{n} \left(x_j - \overline{X} \right) 2}{n = 1} - \overline{X}^2 \qquad (4)$$

with *n* equating to the total number of features.

Positive values of *LMI* indicate positive spatial autocorrelation and negative values of *LMI* indicate spatial autocorrelation (dissimilar share of youth population). We applied the same procedure to test for the significance of the Global Moran's *I*.

Local Moran's *I* (LMI) for youth population share is 0.46, and, respectively, 0.58 for aged population, indicating a positive spatial autocorrelation.

The slope of the linear regression line that runs through the scatter plot is the Moran's I coefficient (Anselin *et al.*, 2000). MI can be interpreted as a regression coefficient resulting from the regression of the spatial lag f*Wijyi* on *yi* (Anselin 1996) (Fig. 1a, b).

Using a significance level of 0.05, we can identify 1-2 clusters of youth population shares. Clusters 1 of indicator young population share are "hot-spots" and correspond to positive and H-H (high-high) spatial autocorrelation indicating spatial clusters of administrative territorial units with above-average young population ratio. Cluster 2 is a "cold-spot" and also corresponds to a positive, but L-L (low-low) spatial autocorrelation, indicating a spatial cluster of administrative territorial units with below-average youth population share. The same exercise is available for the aged population share.

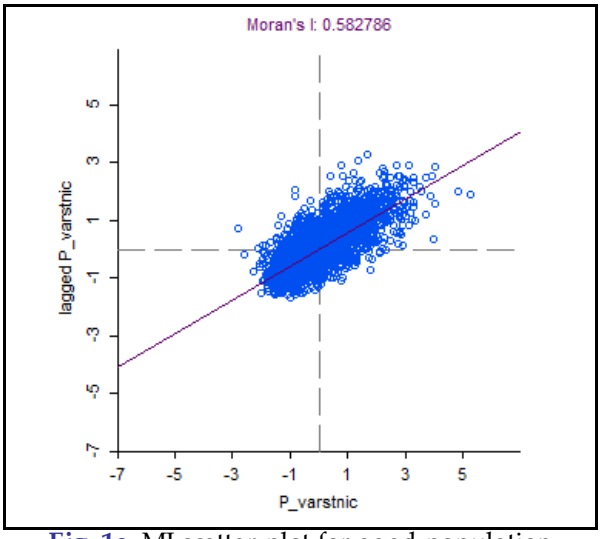

Fig. 1a. MI scatter plot for aged population

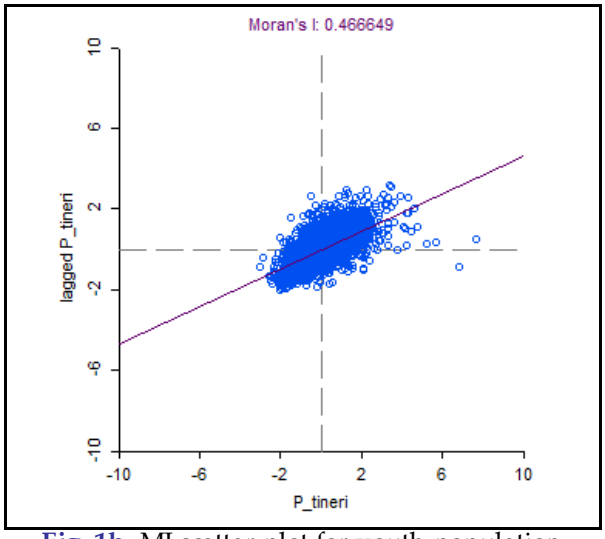

Fig. 1b. MI scatter plot for youth population

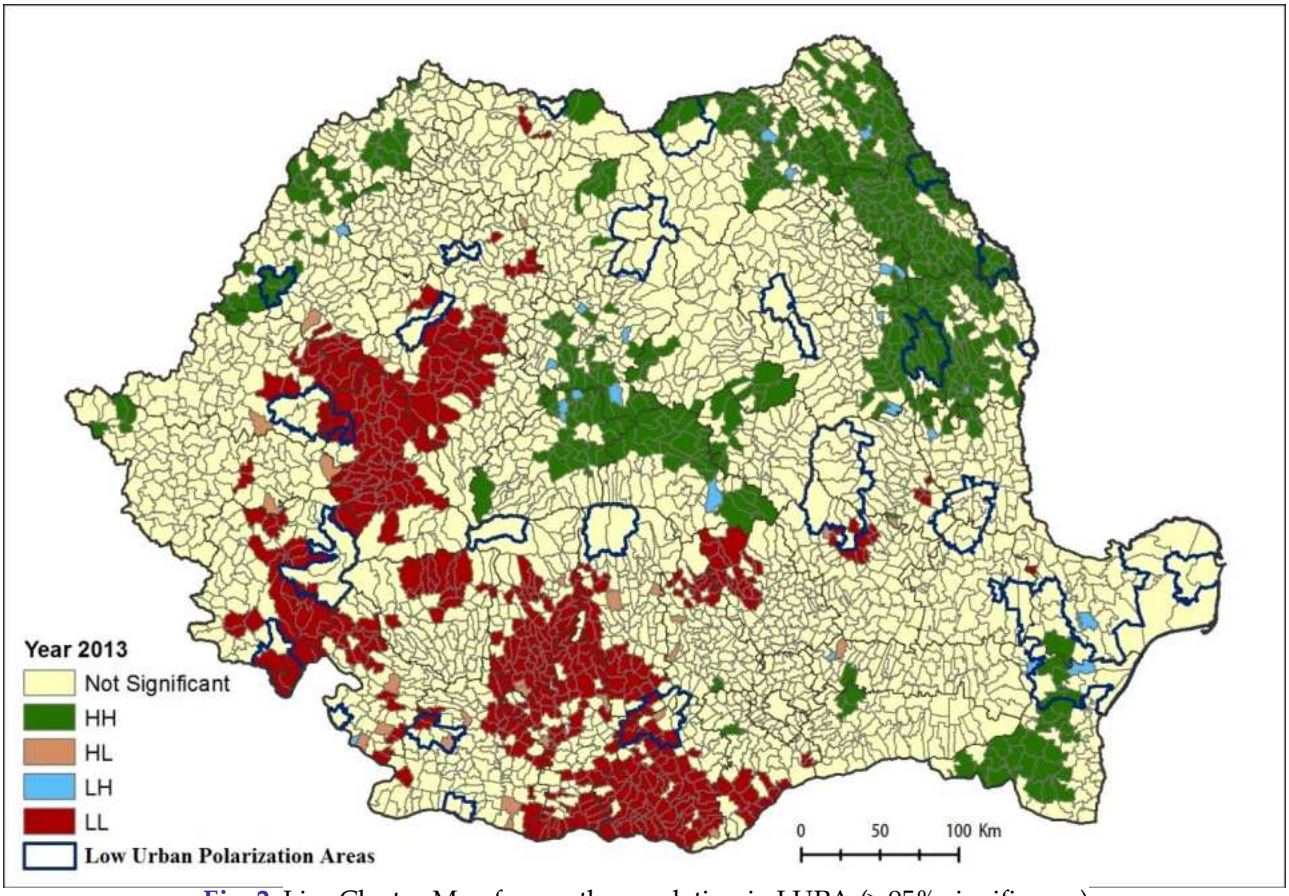

Fig. 2. Lisa Cluster Map for youth population in LUPA (> 95% significance)
Source: data processing from N.I.S., 2015

The LISA cluster map of the share of youth population reveals clusters of high youth population in NE and Centre regions.

The areas having H-H positive autocorrelation (high values) of the share of young population may be identified in North - East zones of the country (the counties Iaşi, Vaslui, Bacău, and partially, Suceava), central zone of Transilvania (The North of counties Braşov and Sibiu), isolated the West part of the country (some nucleus of the counties Bihor, Arad).

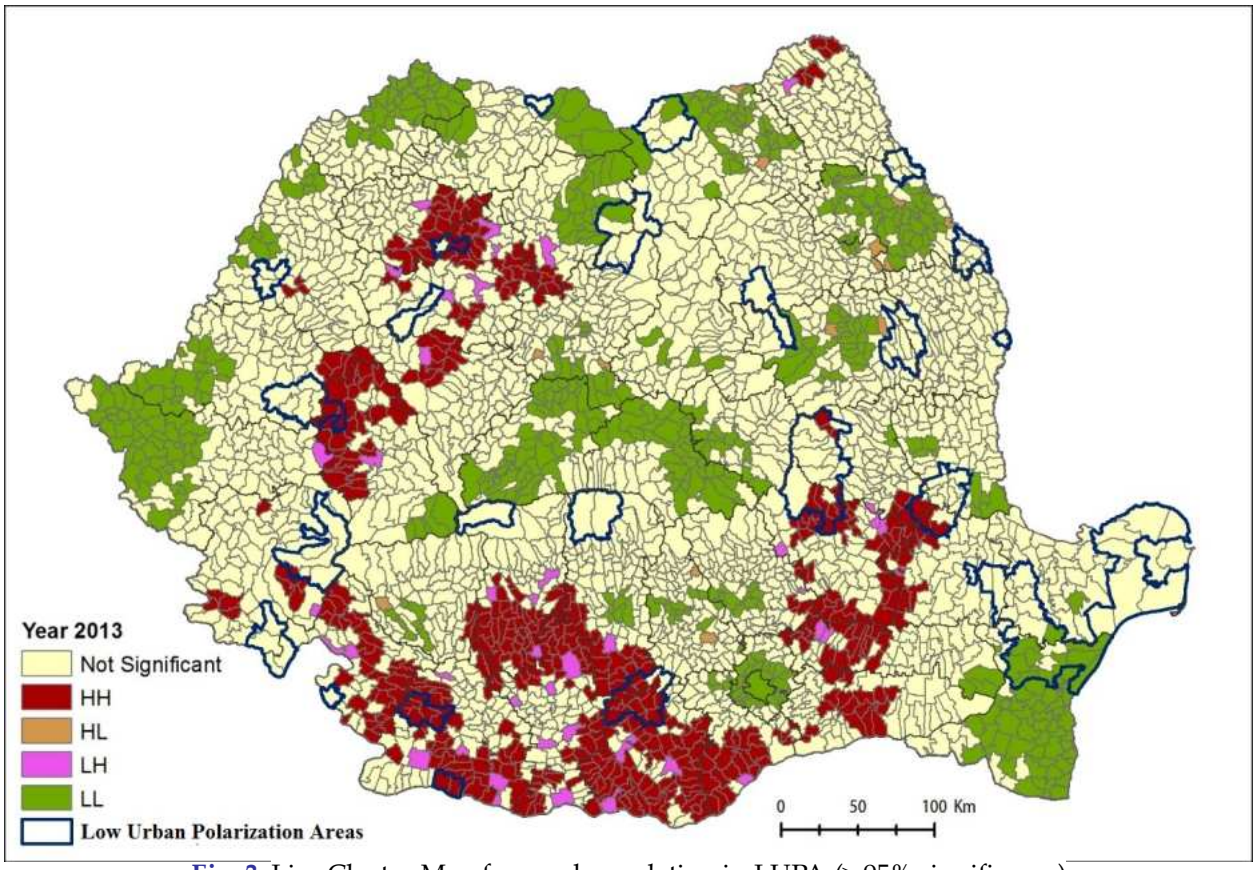

Fig. 3. Lisa Cluster Map for aged population in LUPA (> 95% significance)
Source: data processing from N.I.S., 2015

However, the map shows a large strip of areas with low youth population in south, southern and western parts. The areas having L-L negative autocorrelation (decreased values) of young population may be founded especially in the South of the country (Telorman, Olt, Vâlcea, the South of Argeş county), South-West of the country (partially the counties Mehedinți, Caraş-Severin, almost the entire Hunedoara county, the North of Alba county) (Fig. 2).

The areas having H-H positive autocorrelation of old population (with high values) are more numerous and this time may be identified in the South zones (the counties Giurgiu, Teleorman, Dolj, Mehedinți and central zones of the country (Hunedoara, Alba, Sălaj, Cluj) (Fig. 3).

The areas having L-L negative autocorrelation of old people (with decreased values) may be founded especially in the South zone of the country, in Dobrogea (almost the entire Constanța county), Bucharest –Ilfov, the polarization areas around the towns from the counties Argeş, Dâmboviţa, Prahova, Bacău, Galați the polarization areas around the towns from the North and the West zone of the country (Suceava, Maramureş, Satu Mare, Bihor, Arad, Timiş).

3.2. Identification of zones having low urban polarizing – geographic approaches and legal – administrative perspectives

The concept of urban polarization was not unitarily defined by scientific literature, being no definition

unanimously accepted. The studies performed in the field are focused on urban polarizations sense and its role on durable, balanced and integrated development of various categories of territories. The urban polarization may be examined from the angle of the influence of urban systems, nevertheless their size etc., on the rural systems, very near or from ultra-peripheral zones. The influence means the contribution that the town, through economic, social, cultural potential etc., may bring for reducing actual development discrepancies at the level of rural environment (Vâlceanu and Tămîrjan, 2011; Vâlceanu, 2013). The infrastructure rehabilitation has a very important role for the increase of territorial competitiveness and the increase of attractiveness degree of these zones for investors.

The polarization may be also studies from the angle of the two forms, respectively social and economic. The influence of urban systems on rural administrative territorial units from influence area may be reflected into their development degree. The post - socialist economic restructuration coincided with the deindustrialization process of small towns, ex mono industrial and the medium ones, and also a relocation of industrial units outside big cities. Therefore, we are present at a reconversion of urban industrial landscape and relocation in peripheral or ultra-peripheral zones, mainly rural, profitable from investment view point and most of all of cheap labour force. This must be emphasized by the decrease of development discrepancies, by the increase of territorial competitiveness.

The low urban polarization areas (LUPA) were defined as those zones characterized by stagnation processes or economic and demographic regress, that must be supported by strengthening the role and the territorial functions of rural administrative territorial units having a favourable geographic position, an economic basis and an administrative, cultural and educational infrastructure relatively developed (Soare, 2012).

The low urban polarization areas (LUPA) may be defined as the zones without towns within a radius of about 25-30 km needing public policies and intervention instruments for reducing the development disparities and increasing life quality. The localization of these administrative territorial units in zones of low access, for which the relief represents a restrictive factor in a durable, balanced and integrated development, are specific particularities of these low polarized zones by urban systems. The low urban polarization areas (LUPA) are not defined or localized by geographic accuracy in national and international specialized documentations, but they are considered and examined as disfavoured areas, at the national and especially at European level. Often, these territories are associated to notions of spatial peripheries and/or social peripheries.

According to the National Spatial Plan – Section IV: *Settlements Network*, drawn up in 2001, the zones without towns within a radius of about 25-30 km, needing priority actions for developing various administrative territorial units with a role of inter - communal services, include 17 zones situated on the territory of 28 counties. These zones include 453 administrative territorial units (about 17% from the total number of administrative territorial units), having over 2,500 villages and a population over 15% from rural population. Their localization in the country is not uniform,

these zones creating concentrations of administrative territorial units situated on the territory of various counties and a reduced frequency in Transylvania Plateau, sub-Carpathian zone, the West half of Banat and Romanian Plain.

According to legal provisions of normative document mentioned above, were delimited the zones of low urban polarization existing in 2001, in Geographic Informational System, implementing the definition "rural zones situated at least 30 km from any town", using the product ArcView 3.X and its extensions and the data basis of administrative and territorial units from Romania and going over the following stages of spatial analysis (Petrișor, 2015): the selection of towns from the data basis of all administrative and territorial units, as entities of a degree superior or equal to 2; the selection of administrative territorial units from the data basis of all administrative and territorial units, as first degree entities; the transformation of polygons corresponding to administrative territory of towns in their geometric centres, by the help of extension X-Tools (the program allows to "move" this centre nay time it is necessary in the centre of polygon); delimiting some circular zones having a diameter of 30 km and joint all superposed zones using the extension X-Tools; the selection, using the extension for spatial analysis, of administrative territorial units having centres in the zones mentioned above; inversing the selection and resulting the administrative territorial units situated at more than 30 km from any town (Fig. 4).

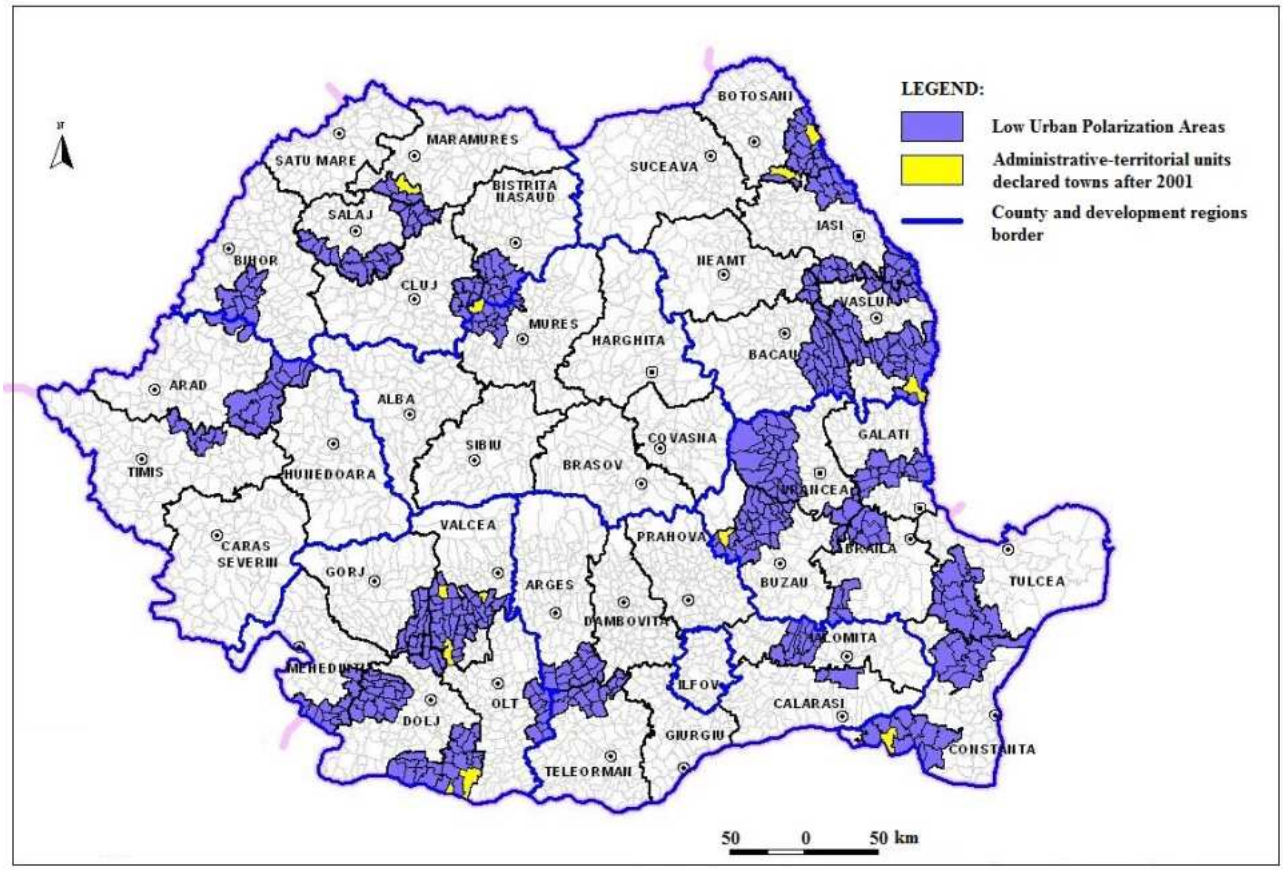

Fig. 4. The map of the zones without towns within a radius of about 25-30 km (2001)
Source: Romanian Parliament, 2001

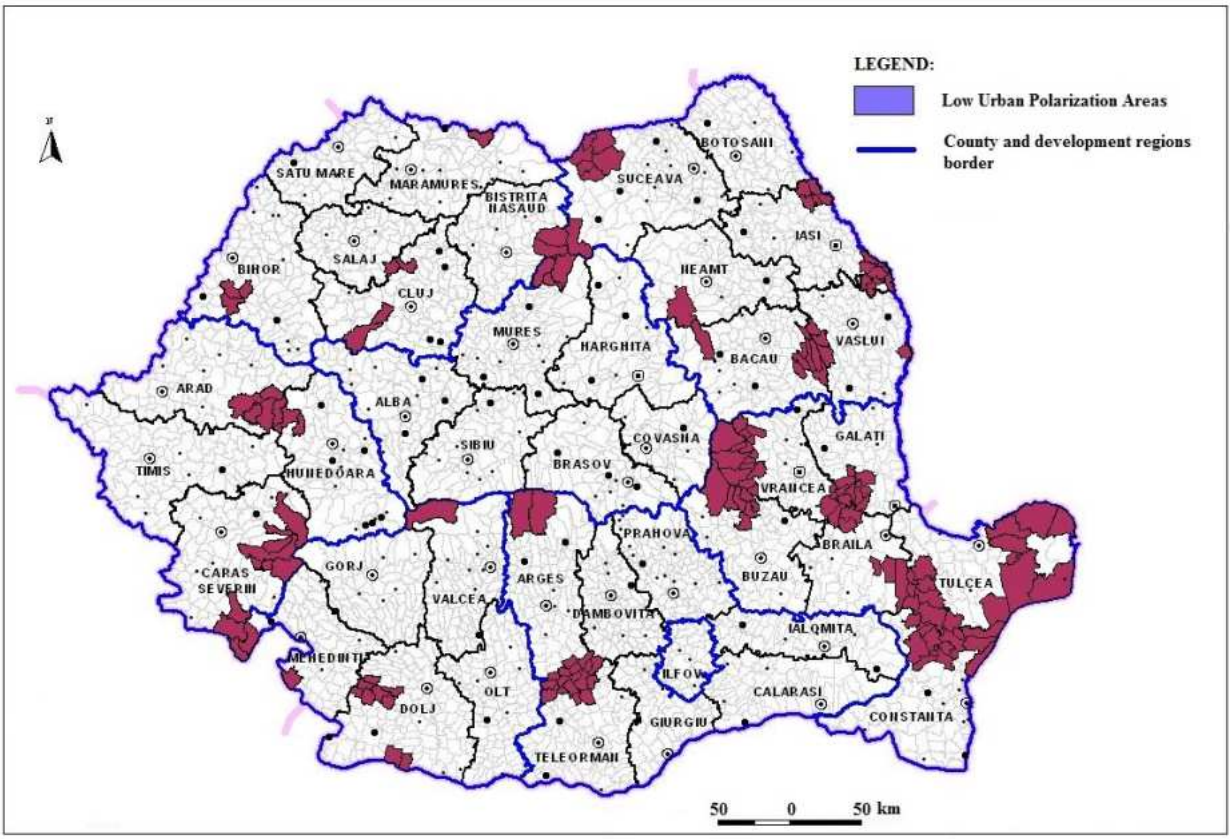

Fig. 5. The map of the zones without towns within a radius of about 25-30 km (2015)

The methodology used in this research impose an update of the Low Urban Polarization Areas because of the naming of 14 new cities after 2001. The number of LUPA increased from 17 areas (before 2001) to 23 areas (between 2001 and 2015) concomitantly with the decreasing of number of the administrative-territorial units, from 453 units until 2001 to 160 units from 2001 to present. After the year 2001, some 12 administrative territorial units from the zones without towns within a radius of about 25-30 km were declared towns, resulting 23 zones of low urban polarization, including 160 rural administrative territorial units, situated at a minimum distance of 30 km from the nearest urban system (Fig. 5).

In 2011 they have a population of 277,689 inhabitants, representing a share of 0.13% from the total population of Romania. The most numerous population is situated in the counties Vrancea (39,697 inhabitants), Tulcea (34,465 inhabitants), Bacău (28,655 inhabitants), Constanța (25,554 inhabitants) and Caraş-Severin (23,591 inhabitants), while at the opposite place, the counties having administrative territorial units of low urban polarization with the lowest values of this demographic indicator are Sălaj (1,427 inhabitants), Vâlcea (1,455 inhabitants), Neamț (3,062 inhabitants), Dâmbovița (3,943 inhabitants).

3.3. Social and economic disparities generated by demographic ageing

The very complex process of demographic ageing means economic, politic or social effects. For the countries economically developed, where the demographic ageing process is prevalent, the increase of pensioning age becomes a problem, strongly connected to evolution of migration typology. Some West European countries (Spain, Italy) and

most of East-European countries, including Romania, have a shrinking population, where the labour force decreases together with the increase of old population, provoking important economic and social consequences (Bloom *et al.*, 2002).

The demographic ageing may affect various regions at a different geographic scale and may emphasize some regional disparities and an urban and rural social polarization, depending on processes and intensity of migrations, at the level of investments or innovation capacity.

The demographic profile of these isolated administrative territorial units will be outlined according to some population characteristics, like volume, structure on ages and evolution, demographic ageing trend, during the period between Population censuses from 2002 and 2011.

The transformations appeared after 1989 in political system, in economy, in social life and also in population mentality influenced its demographic behaviour. During the first stages of the actual demographic transition process, the decrease of fertility rate was the most important, and when the process will reach the last stages, the decrease of mortality rate, especially for old ages may have a contribution to the increase of old people and implicitly, the acceleration of ageing process.

Therefore, between the census from 1992 and that of 2011, the old population belonging to the group of 65 years and over this age from Romania increased by almost 700,000 persons, because of the change of demographic behaviour of young couples the natural decrease and the negative balance of external migration provoked the decrease of the young population; the increase of general mortality. The changes of the structure and the dynamics of population in Romania represent the direct result of trends at the level of demographic phenomena (natality, mortality and migration). The demographic ageing is higher in rural environment than in urban one (mainly because of the migration of young population to the towns). In the rural environment, on July 1, 2010, 18.4% from the population exceeded the age of 65 years and more, comparing to 12.0% in urban environment. From the total of female population in the rural environment the share of old women (65 years and more) was of 21.7%.

Therefore, in rural environment was concentrated most of old population, respectively 23.9% from the total population of rural environment, comparing to urban environment, where old persons represent a share of 17.3% from the total. The population ageing in rural environment was mainly obtained from female population; the old women represent 27.7% from total women, and old men 20.2% from all men (NCAP, 2012).

The evolution of population between censuses from 2002 and 2011 is negative also at the level of administrative territorial units from the zones of low urban polarization, the medium decrease of population being about -12,6% (Fig. 6). From the administrative territorial units situated in the zones of low urban polarization, during the period between censuses, only four of them had a moderate increase of population of maximum 15%.

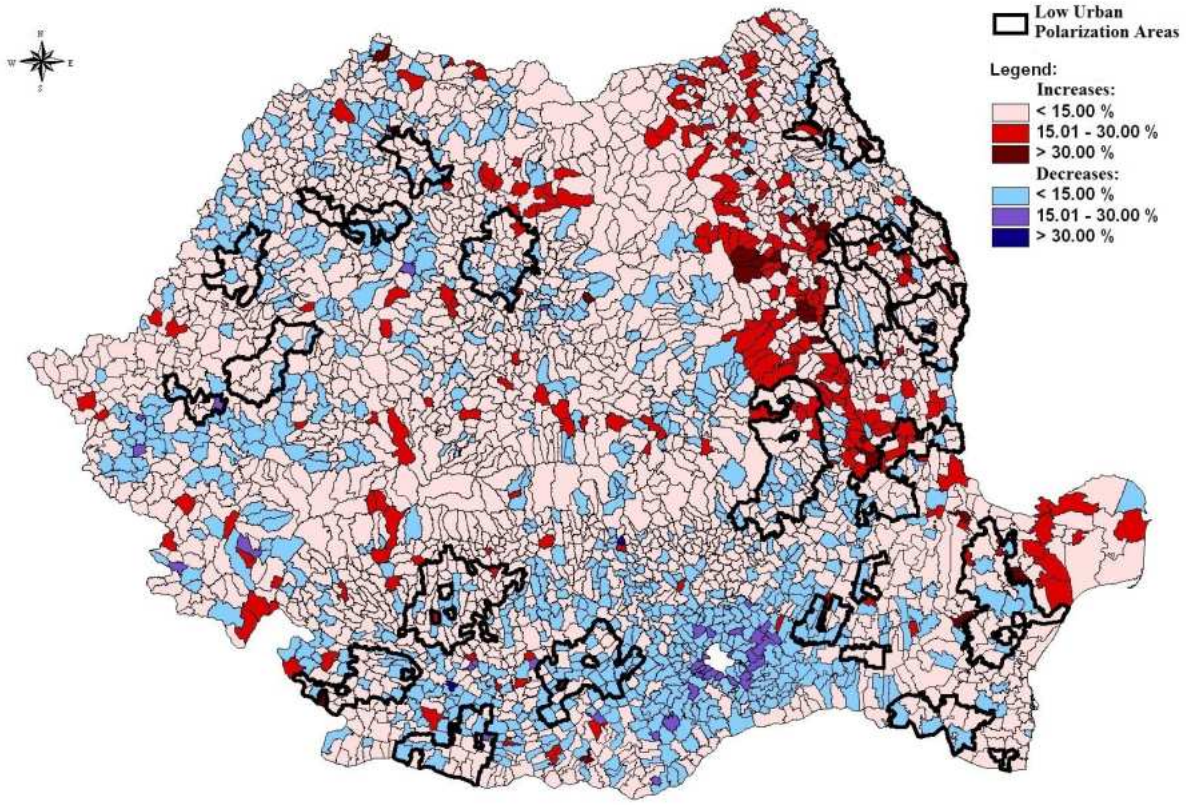

Fig. 6. The evolution of population from LUPA between the Censuses from 2002 and 2011
Source: data processing from N.I.S., 2015

Three of them are situated in the development region North - West, in the counties Bihor (Lăzăreni – 10.7% and Husasău de Tinca – 11.6%) and Sălaj (Dragu – 10.7%), and one is situated in development region of South - East, Corbu from Constanța county, having the biggest increase of population (14.7%). The last one belongs to the category of big administrative territorial units, while Dragu administrative territorial unit belongs to small ones, and the other two are administrative territorial units of medium size.

The data analysis shows a general trend of population decrease, of high and very high share in 14.4% from the administrative territorial units territorially and socially isolated, and the biggest decrease was in Bârseşti (-64%), Paltin (-50,5%) and Tulnici (-44,2%), from Vrancea county, Mahmudia (-52,4%) from Tulcea county, Popeşti (-44,2%) from Argeş county, Slobozia Conachi (-44,1%) from Galați county and Târguşor (-42,9%) from Constanța county. The analysis mentioned above emphasizes the existence of a depopulation risk if the actual trend of population decrease will continue, but different from a locality to another one, according to their demographic size. The estimated risk is higher for the small and very small administrative territorial units and lower for the big and very big administrative territorial units.

In the entire world, the old population has a fast and constant increase, the social and economic consequences of this phenomenon affecting also Romania, by high cost during transition period (Suditu *et al.*, 2014). The demographers defined "demographic ageing" as the phenomenon of relative increase of old

population from the total of a given population, being a firm and durable phenomenon, simultaneously with the decrease of specific share of young population while the share of adult people has no significant alterations (Trebici, 1979). The demographic ageing is a process that concerns groups, person communities, and not a person as a sole case, and regards the population structure, composition, according to the "age". We may observe that until 2025 the old population of this planet will increase 3.4 times, while the number of the persons over 60 years will increase 6 times and those over 80 years 10 times (NCAP, 2009).

The analytical methods used for the study of demographic ageing use various specific indices and indicators. For instance, conventionally, it was considered that a population is young if the share of old population is less than 7%, considering that demographic ageing process is in course if the share of old population is between 7 - 12%, and a share higher than 12% corresponds to a population demographically ageing.

3.4. Demographic perspectives in the Low Urban Polarization Areas

One of the indicators for characterizing demographic ageing is also the ratio between old and young people. Conventionally, some experts consider that young group is prevalent within one population, when it exceeds 1/3 comparing to the other two thirds from the total of the respective population. That population, where young group represents less than 1/3 from the total, is considered to have already installed the trend of demographic ageing. A population really young does not have a contingent of old age too high (65 years and over). It may not exceed maximum 12%. In this way we may appreciate the degree of "youth" or "old age" of a population, comparing the groups of 65 years and over, to those under 20 years, that normally must be under 0.42 when young group is prevalent, meaning over 1/3 (Vert, 2001).

The demographic profile of isolated administrative territorial units is completed in the present analysis by assessment if population vitality state, expressed by comparing young people to old people over 65 years, then completed by the share of young persons in the total of population (Vert, 2001). In order to emphasize the acceleration of demographic ageing were calculated the indicators of population vitality based on data from population census in 2002 and 2011, after which was analysed the evolution of these values between the two censuses for each territorial administrative unit. The values from 2002 were considered as a reference (100%) for those of 2011. First of all must be mentioned that the ratio between young and old people had values between 0 and 1 for 45% from the administrative territorial units examined by the census from 2002 and for 63% from the same administrative territorial units examined in 2011. The same indicator had value between 1 and 2 for 51.3% from the administrative territorial units analysed by the census from 2002 and also 35.6% from the administrative territorial units at the census from 2011. Therefore the number of young people compared to the number of old persons was higher than 1 for more than a half of the examined administrative territorial units, at the level of the year 2002, reaching the same value only for 35.6% from the administrative territorial units, in 2011. The total average in the zones of low urban polarization during this period

decreased from 1 to 0.9, meaning a decrease of 14.6% of the value of demographic vitality indicator.

The highest decrease was in the administrative territorial units Voineasa (-61.7%) from Vâlcea county, Svinița (-50.2%) and Dubova (-44,1%) from Mehedinți county, Grivița (-41,9%), Lieşti (-37,6%) and Pechea (-35,3%) from Galați county, Nistoreşti (-39,7%) and Păuleşti (-36,9%) from Vrancea county, Mirosi (-38.6%) and Arefu (-3.2%) from Argeş county, Asău (-35.9%) from Bacău county, Balaci (-35.3%) from Teleorman county and Mânzăleşti from Buzău county (-35.0%). All these administrative territorial units are situated in development areas of South - West, South-Muntenia and South-East, confirming that isolated administrative territorial units from the south area of the country are more affected by demographic ageing process that the other ones.

There are also administrative territorial units where the values of demographic vitality indicator increased over 20% during the period between the two censuses, although they are less that those having accentuated vitality decrease. They are Tinca (20%), Lăzăreni (36.7%) and Husasău de Tinca (93.2%, the highest value) from Bihor county, Sălcuța (20.6%) from Dolj county, Raca (23.5%) from Argeş county and Spulber (34.1%) from Vrancea county. The North-West region was remarked between developed regions as a zone having demographic revitalizing potential, being followed by North - east Region.

The share of young population, belonging to age category of 0-14 years, shows the demographic revival potential of a population, so over the evolution of vitality indicator we represented the young share from the extremities of value interval in each administrative-territorial unit in the year 2011. The total average of LUPA was of 18% young people from the total population of the zone. The highest young shares at the Population Census from 2011 were in Dragomireşti and Voineşti from Vaslui county, Coloneşti and Stănişeşti from Bacău county, Mihai Viteazu and Pantelimon from Constanța county, Roşcani from Iaşi county and Spulber from Vrancea county (Fig. 7). Excepting Pantelimon locality, where the vitality indicator has a negative evolution, all the other administrative territorial units mentioned above had a constant or positive evolution of the same indicator. 13% from all the administrative territorial units in examined zones had young share over 23% from the total of stable population and 26% had young share under 15% from the total of stable population after the census.

The lower values of young population were in 2011 in the administrative territorial units Balaci, Necşeşti and Zâmbreasca from Teleorman county, Gurasada from Hunedoara county, Seaca de Pădure from Dolj county, Voineasa from Vâlcea county, Svinița from Mehedinți county and Popeşti from Argeş county. If the administrative territorial units having the highest young share are concentrated in developed zones of North-East and South-East, the administrative territorial units having the lowest share are situated in developed regions of South Muntenia, South-West and West, a reason for which we may consider that in the isolated administrative territorial units from the East part of the country there is a demographic revival potential higher that in its West part.

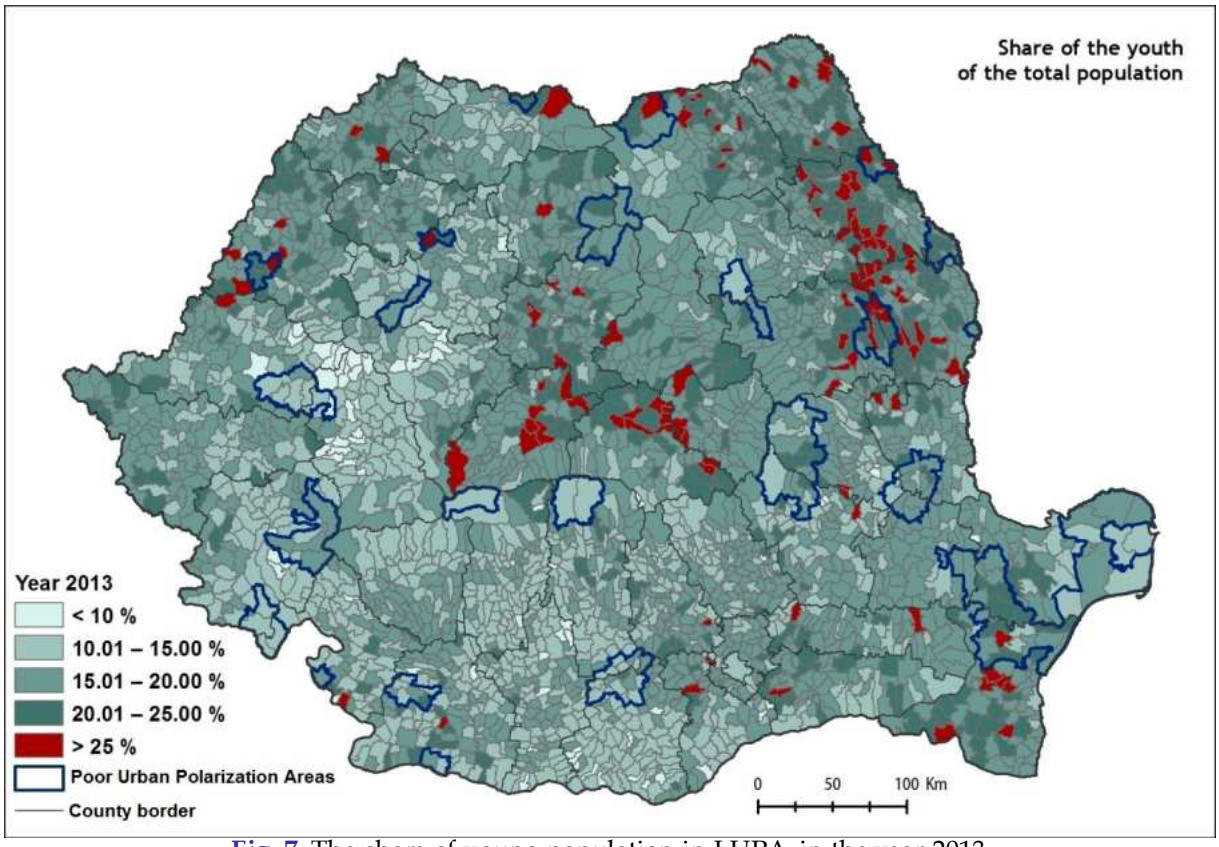

Fig. 7. The share of young population in LUPA, in the year 2013
Source: data processing from N.I.S., 2015

The effects of ageing process appeared in Romania starting from January 1, 2000, where old population exceeded numerically and as a share the young population. At that date, the population of Romania was of 22,455,485 inhabitants, and the number of persons over 60 years was of 4,196,409 persons (18.7%), exceeding by 36,842 persons that having between 0-14 years, respectively 4,159,567 persons, (18.5%).

Another indicator completing the demographic profile of the administrative territorial units from the zones without towns within a distance over 25 km is therefore the ratio of demographic dependence. The Ratio of demographic dependence represents the number of young persons (0-14 years) and old persons (65 years and over) compared as a share to the number of persons having the age between 15 - 64 years (OECD, 2005). There is the question if number more and more decreased of persons economically active may offer a "support" for a number more and more higher of persons economically dependent, especially old people. In 2011, this dependence ratio had the highest values (here the ageing phenomenon is more accentuated) in: Italy (31.5%), Germany (31.2%), Sweden (28.7%), Greece (28.0%), Portugal (27.2%), Finland (27.0%), Belgium (26.9%), Austria (26.4%), France (26.4%), Letonia (26,2%) and the lowest in **Romania** (21.5%), Malta (20.6%), Luxembourg (20.4%), Poland (19.3%), Ireland (17.8%), Slovakia (16.9%) and Cyprus (16.7%) (Eurostat, 2015).

The value of demographic dependence ratio for the entire examined zone at the Population census from 2011 was of 64 young and old persons for 100 persons of active age. 22% from LUPA

administrative territorial units had values of dependence ratio under 55. 43% from LUPA administrative territorial units had medium values of dependence ratio, and 35% had high or very high values of the same indicator (Fig. 8). From the administrative territorial units having low values of dependence ratio, under 44 young and old persons for 100 persons of active age, we mention Voineasa from Vâlcea county, Sfântu Gheorghe, Pardina and Maliuc from Tulcea county, Răstolița locality from Mureş county and Corbu locality from Constanța county.

The administrative territorial units having the highest values of dependence ratio, over 94 young and old persons for 100 persons of active age, were Panticeu from Cluj county, Balaci, Scurtu Mare and Necşeşti from Teleorman county, Seaca de Pădure from Dolj county and Dragu from Sălaj county. The regions concentrating most of administrative territorial units of low values of dependence ratio are South-East and centre, and those concentrating most of administrative territorial units having high values of dependence ratio are South-Muntenia and North-West.

For calculating the dependence ratio, the high values may come from various share of young and old persons, and so a locality having a high value of this ratio, but with high share of young people, has more chances to a demographic revival than a locality having the same value of the ratio, but with high share of old persons. In order to differentiate the administrative territorial units according to this criterion, we mentioned those having high and low share of old population from the total population at the last census. The medium share of old persons in the entire Low Urban Polarization Areas was at the Population Census from 2011 of 20.9%, a value characterizing an aged population (Fig. 9).

Most of the administrative territorial units having low share of old people are situated in South-East region. They have values under 14% of old population and there are 9 administrative territorial units: Mihai Viteazu, Corbu, Pantelimon, Vulturu and Siliştea from Constanța county; Pardinfrom Tulcea county; Răstolița from Mureş county; Nereju from Vrancea county and the Gilău from Cluj county. All these administrative territorial units have low values of demographic dependence ratio.

The administrative territorial units where old population represents 1/3 from the total population are situated in developed regions South Muntenia and South-West. They have values of dependence ratio of over 82 young and old persons for 100 persons of active age and they are the following: Scurtu Mare, Zâmbreasca, Balaci and Necşeşti from Teleorman county, Popeşti from Argeş county, Soveja from Vrancea county and Seaca de Pădure from Dolj county.

Regarding Romania, for the population of 65 years and over, it was anticipated a continuous numerical increase (NIS, 2015). Thus, according to NCAP (2012), the number of old population will increase at the national level, from 3.2 millions of persons in July 2010 to 3.7 millions in the year 2025 and to 4.1 millions in the year 2050, (constant version), its share in the total population being increased from 14.9% to 18,3% (year 2025) and to 26.5% (year 2050) (constant version). The highest share increase will be in medium version – 19.1% (year 2025) and 31.5% (year 2050) (NCAP, 2012).

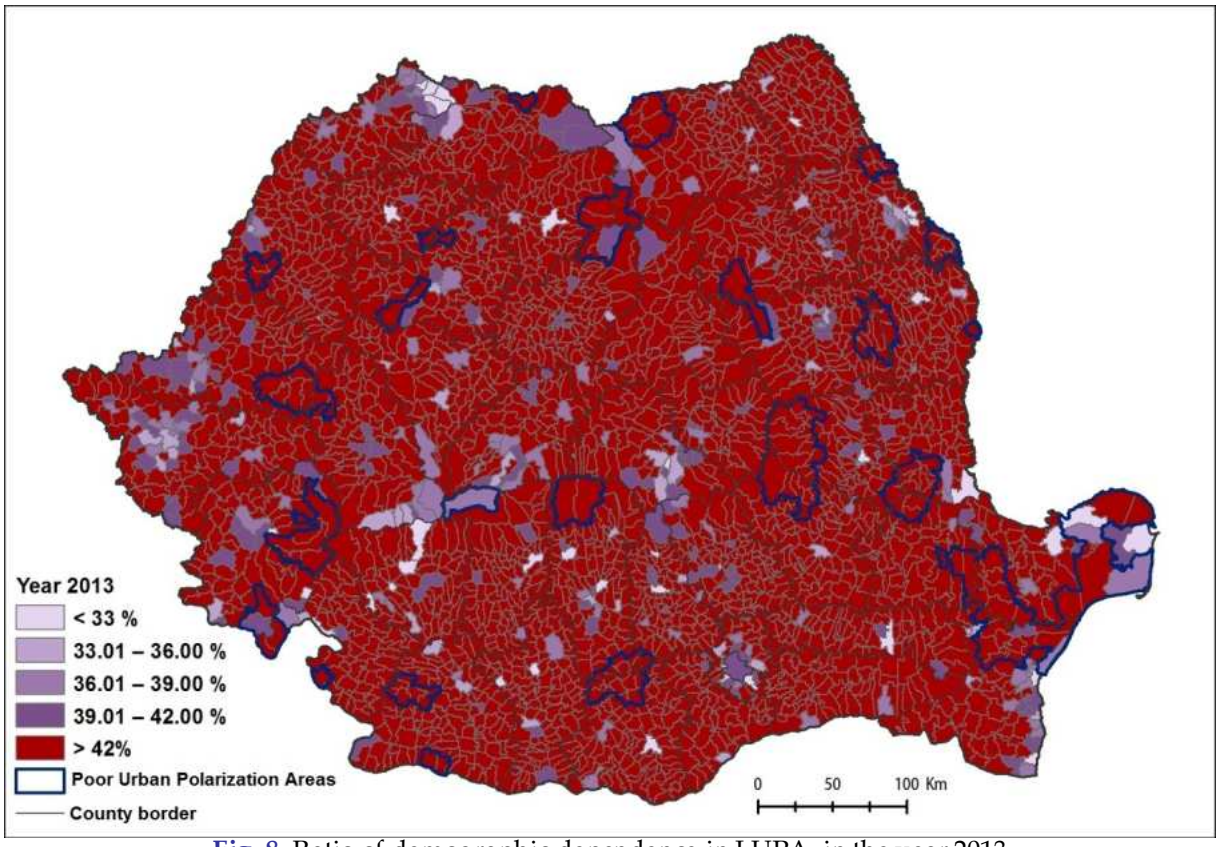

Fig. 8. Ratio of demographic dependence in LUPA, in the year 2013
Source: data processing from N.I.S., 2015

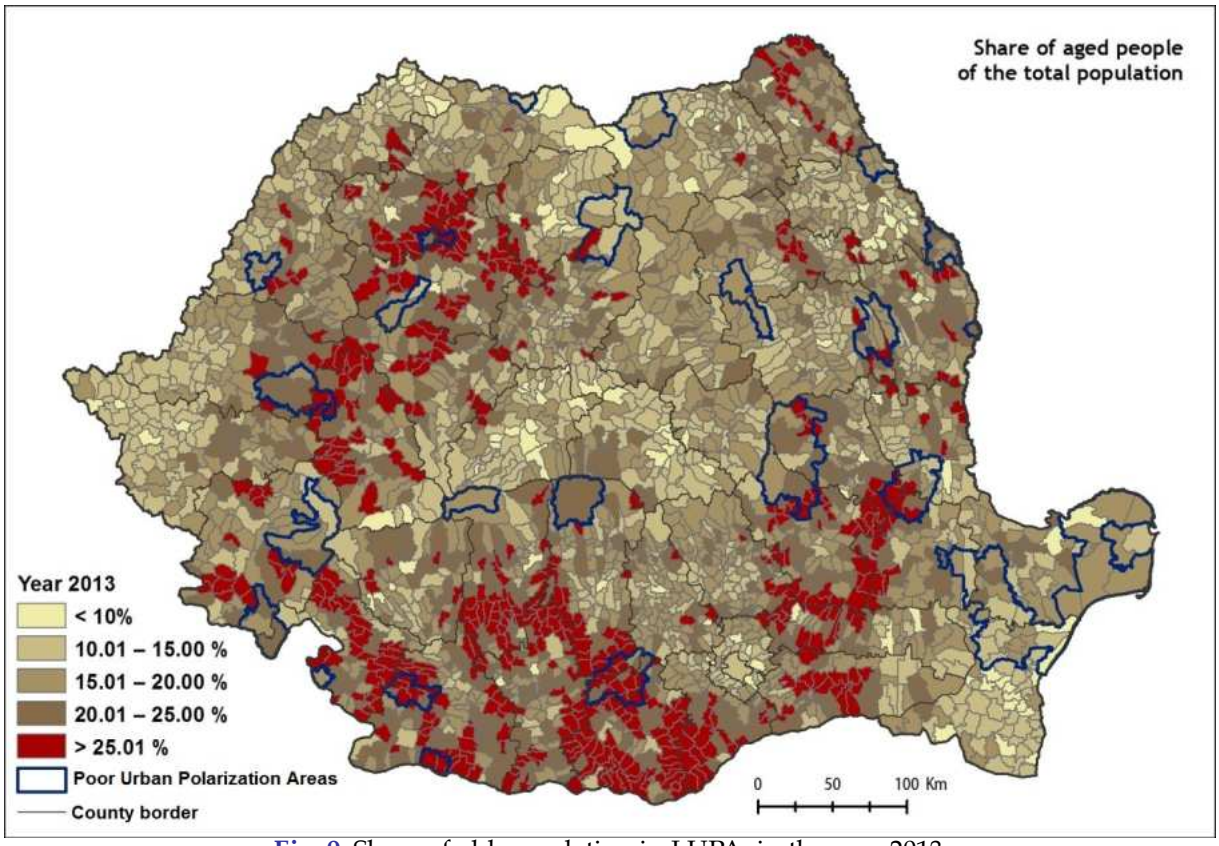

Fig. 9. Share of old population in LUPA, in the year 2013
Source: data processing from N.I.S., 2015

4. Conclusions

The main characteristic spatial data is that the units are correlated, according to well-known Tobler's First Law Geography (1970). For this reason, the space becomes the key notion for deciphering some spatial patterns of some phenomena. Location is often involved indirectly in the sense that it is used to determine whether a case falls inside or outside the study area, but the locations of cases within the study area in no way affect the outcome of this class of analyses, and can be shuffled freely (Goodchild, 1986, p. 3).
The analysis performed allows pointing out the correlation between demographic imbalances, like the decrease of the share of young people and respectively the increase of the share of old people in territorial socio-demographic structures, and the structure of urban system from Romania and of the zones of town polarization.

The demographic dynamics influence irreversible the socio-economic profile of each administrative territorial units located in the zones without towns within a radius of about 25-30 km. The labour migration from rural to urban area and the predominance of the phenomenon of an aging population are the main characteristics of Romanian Low Urban Polarization Areas, with negative consequences on their development degree.

The modification of structures on big age groups, meaning the increase of the share of 65 years old population and over, determining the decrease of the share of other age groups, tends to create social and political pressures determined by the change of the way of resource allotment into society, provoking conflicts between generations.

A decrease of potential rate of support, implicitly an increased rate of demographic dependence, shows that an increased number of beneficiaries of health public systems will be covered nu a decreased number of active tax payers. Thus, the working population will be additionally responsible from fiscal view point by paying some contributions to provide the costs of health services and fair, stable and sufficient income for retired seniors.

By using analysis method for spatial data we tried to find these spatial patterns, starting from spatial autocorrelation and to identify by the help of LMI index spatial patterns of young and old population from Romania and to offer LISA maps statistically significant. Location, topology, spatial arrangement, distance and spatial interaction have become a major focus in activities concerned with detecting patterns in spatial data, and with exploring and modelling the relationships between such patterns (Fischer, 2006, p. 79).

The GIS methods and instruments used in this research emphasize the implications of demographics phenomena on the Romanian Low Urban Polarization Areas and these can be used successfully in the development of other inter-, multi- and trans-disciplinary analysis.

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