THE TENDENCY IDENTIFICATION OF OVERALL CLUSTERING OF REGISTERED UNEMPLOYMENT AT TERRITORIAL ADMINISTRATIVE UNIT LEVEL - UAT2 IN ROMANIA[1]

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Abstract

Integrating spatial socioeconomic variables gives a new perspective of analysis. The employment growth and fight against the unemployment policies implementing practice revealed an shielded limit of comparability given by the population mean indicator. Among the core indicators of labour market is recorded the registered unemployment. Literature revealed that reporting of this indicator only at county level (NUTS 3) is not sufficient differences induced by space features are significant. Based on statistical data provided by INS - TEMPO we propose a method to identify the trend of clustering of the number of registered unemployed persons at the lowest territorial administrative level - that registered unemployment persons at territorial administrative unit level - UAT2. The method is based on Global spatial autocorrelation measured by Moran's I in GeoDa based on Anselin (1995, 1996). The tendency of overall clustering of registered unemployment during the period January 2010 - June 2014, is evidenced by analyzing time series of Moran index. The main result of this article is the development of a temporal and spatial analysis methods applied for the registered unemployment to the smallest territorial administrative level.

Keyword: spatial integration, spatial autocorrelation, clustering, unemployment
JEL Classification: R23 Regional Labor Markets , J64 Unemployment

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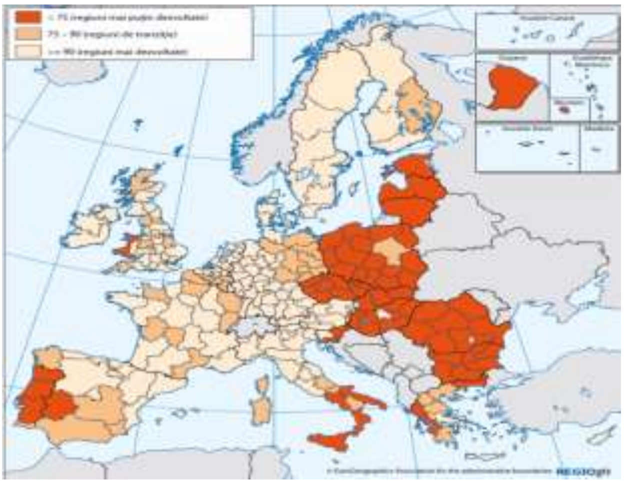
Introduction

The new cohesion policy for 2014-2020 period represents the main investment instrument of EU to support the Europe 2020 objective accomplishment. These objectives covers in a interdenpendent manner dimensions like: creating jobs and generating growth, tackling climate change and energy dependence, reducing poverty and social exclusion. The implementation of these objectives are achieved in a integrated reformed framework represented by Regulation (EU) No 1303/2013 of the European Parliament and of the Council of 17 December 2013, laying down common provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund, the European Agricultural Fund for Rural Development and the European Maritime and Fisheries Fund and laying down general provisions on the European Regional Development Fund, the European Social Fund, the Cohesion Fund and the European Maritime and Fisheries Fund and repealing Council Regulation (EC) No 1083/2006[2]. In this common regulation is used the region at NUTS2 level differentiated by tresholds of GDP/ inhabitant (se Figure 1) in view to adapt the elvel of investment to the level of development.

Figure 1

Spatial integrated perspective of analysis regarding the regional differences[3], using the Arc GIS 10.2.3. and GeoDa Softwares instruments



Less developped regions: NUTS 2 regions with GDP/ inhabitant < 75% EU 27 GDP/ inhabitant;

***Transitions regions**:* NUTS 2 regions with GDP/ inhabitant between 75% - 90% EU 27 GDP/ inhabitant;

***More developped regions**:* NUTS 2 regions with GDP/ inhabitant > 90% EU 27 GDP/ inhabitant.

Source: *** Politica de coeziune 2014-2020 Investiţii în creştere economică şi ocuparea forţei de muncă, Uniunea Europeană, Politica de coeziune, http://ec.europa.eu/inforegio

Territorial Perspective 2020 Strategy emphasizes the economic rationale of cohesion policy in the economic crisis context; the structural unemployment is a major challenge with direct effects in increasing poverty. On this background the spatial analysis instruments are requested implicitly. The spatial analysis instruments (See Spatial Analysis bibliography: Anselin, Boyle, Alvanides, Cliff, Ord, Getis, Grigffith, Haining, Harris, Longley, Scott, Janikas, Stewart, Rogerson, etc.), including maps (See in reference ESPON territorial perspective – instruments for cohesion policy), allow an increased differentiation and precision of geographical management of different problems, such as unemployment, next to other socio economic and environment dimensions. This new analysis input should give a significant contribution to better diagnosis and appropriate treatment application properly

[2] *http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2013.347.01.0320.01.ENG*

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[3] **** Politica de coeziune 2014-2020 Investiţii în creştere economică şi ocuparea forţei de muncă, Uniunea Europeană, Politica de coeziune, http://ec.europa.eu/inforegio*

selected policy/measures/ actions in increased efficiency and effectiveness conditions, to deliver a sustainable that excludes the regional disparities.

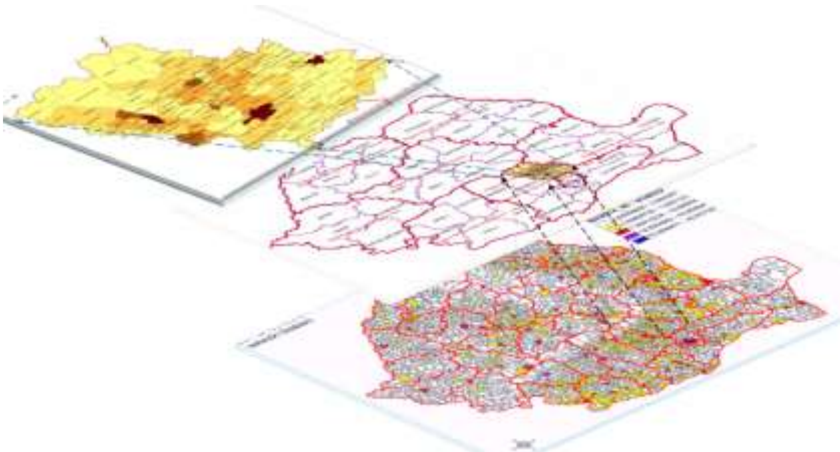
I. Research Question

Applied spatial analysis on labour market analysis with focus on unemployment spatial perspective represents a research topic developed in the last decade. Niebuhr (2003) analised the Spatial Interaction and *Regional Unemployment in Europe, Patuelli (2007) analised the Regional Labour Markets in Germany: Statistical Analysis of Spatio-Temporal Disparities and Network Structures. Weber and Pacheco (2009) made an spatial perspective across Auckland and Zachary and Smith (2010) presented Spatial analysis of changes in the unemployment rate: a county-level analysis of the New England states.*

Our general scientific objective is the analysis of spatial and temporal variation for the the number of registered unemployed (Figure 2).

Figure 2

Spatial integrated perspective of analysis regarding the regional differences on labour market, using the Arc GIS 10.2.3. and GeoDa Softwares



Source: Graphic made by authors Arc GIS 10.2.3. and GeoDa, number of registered unemployed persons data from INS TEMPO, Shape file UAT2 ESRI Romania, 2013

II. Models, Variables and data

The Information System of Administrative-Territorial Units Register - SIRUTA, is a basic tool in automatic data processing in territorial both statistical system and the economic system – general financial in Romania[4].

Table 1

The equivalence of Territorial Administrative Units between NUTS's European Standardisation and SIRUTA 's Romanian systems by level of detaliation

NUTS level	NUTS	SIRUTA	SIRUTA level
1	Country / Area	Country - Romania	0
2	Region	Development Region	-

[4] It work based on legal framework: Law no. 2/1968, Decree-Law no. 38/1990 as a legal trustees territorial organization of Romania, HG no. 575 bis / 1992, CNS President Order 817/1994.

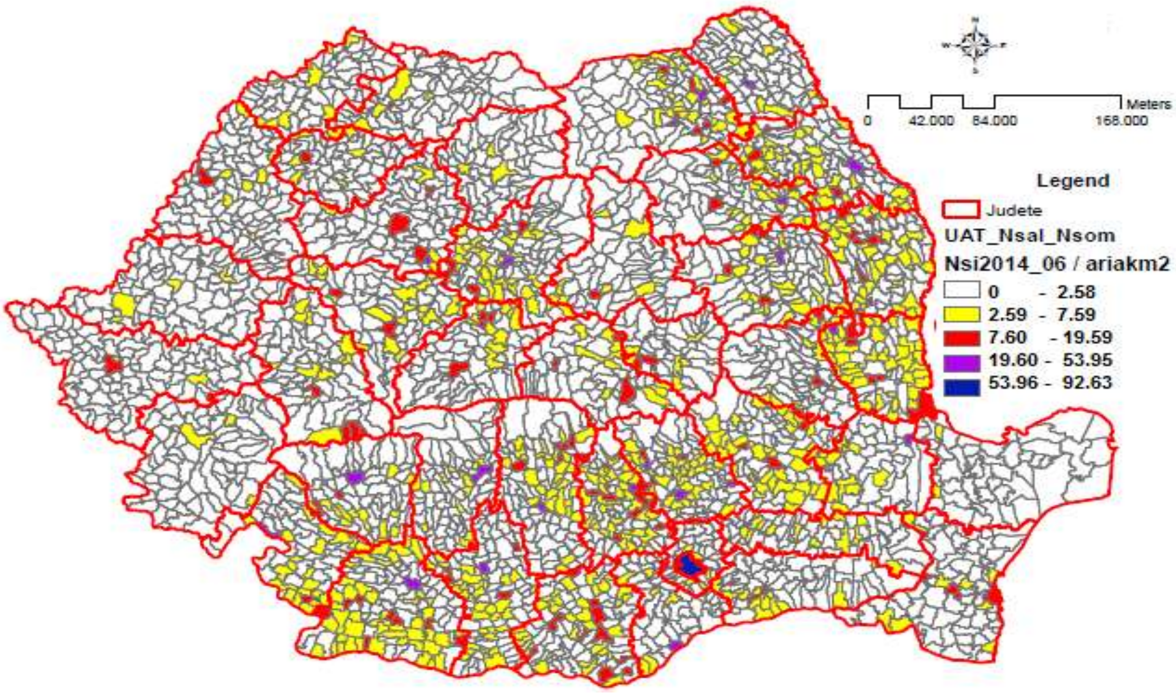
NUTS level	NUTS	SIRUTA	SIRUTA level
3	Department	Județ	1
4	Local Administrative Units's Association	-	-
5	Local Administrative Unis	Unități administrative teritoriale - municipiu, oraș, comună (Local Administrative Units – municipiu, towns, communes)	2
6	- (don't exists)	Localities and their components	3

*Where: **NUTS** - Nomenclature of Territorial Units for Statistics (Nomenclatorul unităţilor teritoriale pentru statistici la nivelul Uniunii Europone - Autoritatea de origină : Oficiul de Statistică al Uniunii Europene EUROSTAT)*
***SIRUTA** - Sistemul Informatic al Registrului Unităţilor Teritorial - Administrative*
Source: Romania's National Institute of Statistic (INS) – The National Interest Nomenclature Server – SENIN, Methodology SIRUTA – General Presentation/ www.insse.ro/cms/files/siruta/Metodologie.doc
http://colectaredate.insse.ro/senin/classifications.htm?selectedClassification=SIRUTA_AN_2014&action=download

Data. The number of registered unemployed persons is provided by TEMPO INS / SOM101E and is spatially vectorised using the polygons areas for LAU2 described by ESRI Romania using Arc GIS Software. In Figure 4 we present the Registered unemployed persons density in spatial perspective in a Cloropleth Map Jenks - natural breaks optimisation for 06.2014.

Figure 4

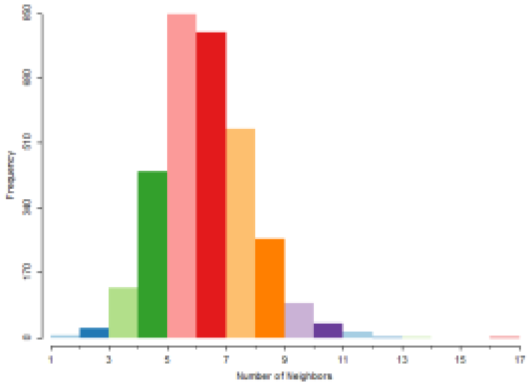
Registered unemployed persons density: Number of registered unemployed persons at the end of June 2014 per km2 at LAU2 /NUTS5 level
Cloropleth Map Jenks - natural breaks optimisation



Source: Graphic made by authors with number of registered unemployed persons data from INS TEMPO in monthly variation, Shape file UAT2 ESRI Romania, calculated in Arc Gis 10.2.3.

Figure 3

Neigborhood Histogram (rook, 1st order)



Source: Graphic made by authors in GeoDa

Spatial relation conceptualisation - spatial LAG modeling is presented in Figure 3 based on rook contiguity, first order type.

*We use as the main instrument the **global spatial autocorrelation** measurement considering:*

a. The spatial autocorrelation term refers to the correlation of a variable with itself. The term of spatial dependence was defined as the absence of independence in reference to data from locations that are close / neighboring. [Haining (2003) cited by Lloyd (2011)]

b. Therefore the degree that there is spatial dependence may suggest the presence of spatial dependence or independence. [Cliff and Ord (1973) and Griffith (1987) cited by Lloyd (2011), pp80]

C. The main tool for measuring global spatial autocorrelation is Morans's I (method which we apply in this study) and Geary's C (more relevant for local spatial correlation).

Moran's I Global[5] :

$$I = \frac{N}{\sum_i \sum_j w_{ij}} \frac{\sum_i \sum_j w_{ij} (X_i - \bar{X})(X_j - \bar{X})}{\sum_i (X_i - \bar{X})^2} \quad (1)$$

N is the number of spatial units indexed by i and j;

X is the variable of interes;

$\bar{X}$ is the mean of X;

w_{ij} is an element of a matrix of spatial weights

The expected value of Moran's I under the null hypothesis of no spatial autocorrelation is

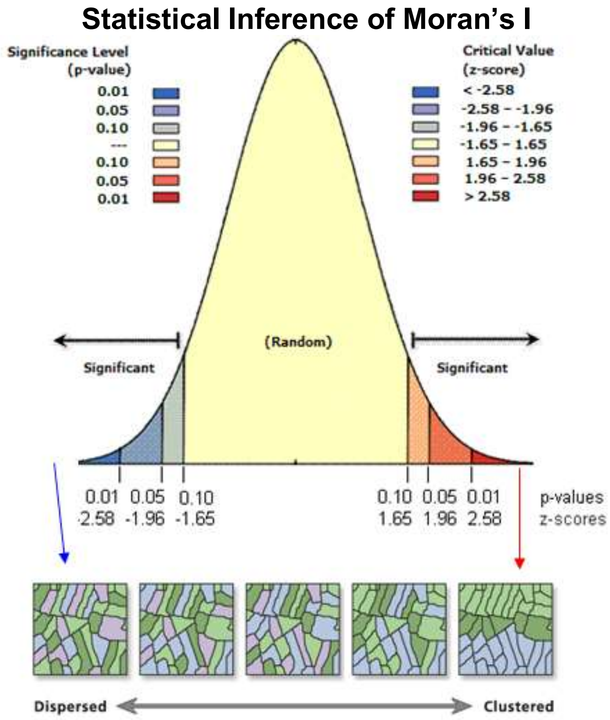
$$E(I) = \frac{-1}{N-1} \quad (2)$$

Statistical inference[6] of Moran's I index is described in report with null hypothesis, and is completed with value p and z-score compared with critical thresholds to identify / establish confidence intervals (Figure 5)

[5] *http://en.wikipedia.org/wiki/Moran's_I*

[6] *http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//005p0000000t000000*

Figure 5



Source: http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//005p0000000t000000

In conclusion, "The Spatial Autocorrelation (Global Moran's I) tool measures spatial autocorrelation based on both feature locations and feature values simultaneously, creating a *deviation from the mean".*[7]

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[7] *http://help.arcgis.com/en/arcgisdesktop/10.0/help/index.html#//005p0000000t000000*

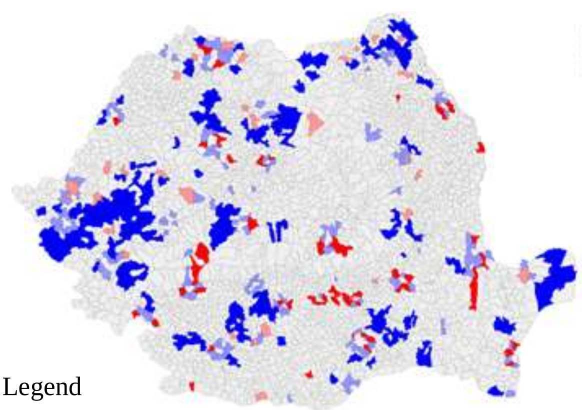
Results and discussions

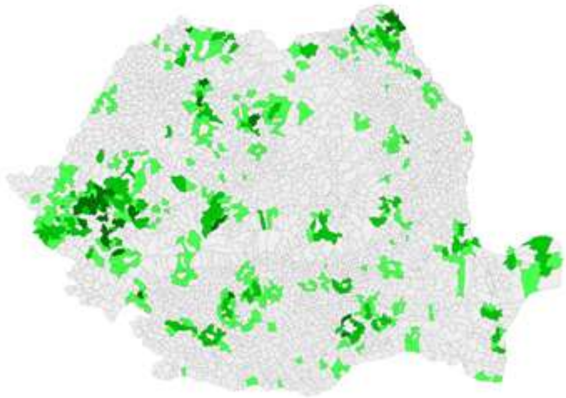
In a simple combined image of space and time is visible the local spatial autocorrelation maps for registered unemployed persons at LAU2 for the years 2010 and 2013, indicates that the HH clusters increases from 56 to 77 LAU2 and the LL clusters increases more from 283 to 320 LAU2 (see Figure 6). This two time snapshot indicates the presence of increasing the heterogenity of unemploymnet in space, a polarisation accentuation and practically an regional disparity increasing.

Figure 6

Local spatial autocorrelation maps for registered unemployed persons at LAU2/NUTS5 level, 999 permutations

Map 1. LISA clusters in 2010 **Map 2. LISA significance Map in 2010**

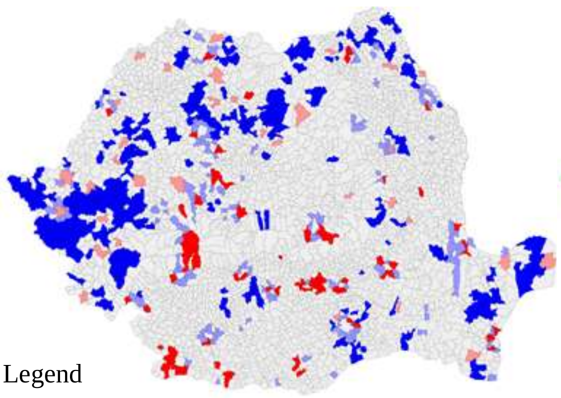


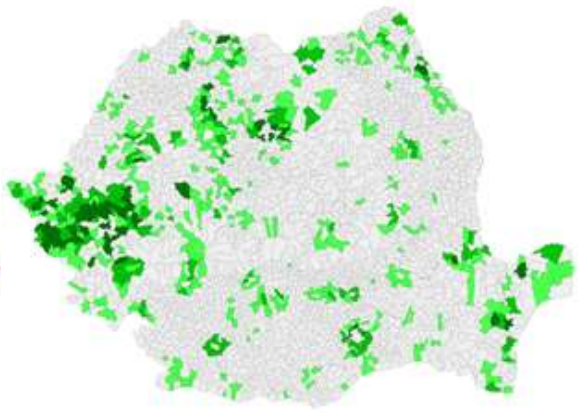


Legend

Not Sig.	High-High	Low-Low	Low-High	High-Low	Not Sig.	p=0,05	p=0,01	p=0,001	p=0,0001
2643	*56*	*283*	*178*	*29*	*2643*	*364*	*147*	*35*	*0*

Map 3. LISA clusters in 2013 **Map 4. LISA significance Map in 2013**





Legend

Not Sig.	High-High	Low-Low	Low-High	High-Low	Not Sig.	p=0,05	p=0,01	p=0,001	p=0,0001
2591	*77*	*320*	*168*	*33*	*2591*	*387*	*151*	*60*	*0*

Source: Graphic made by authors Arc GIS 10.2.3. and GeoDa, number of registered unemployed persons data from INS TEMPO, Shape file UAT2 ESRI Romania, 2013

In Figure 7. Scatter point graph is represented Moran's I index for the number of registered unemployed is made with the OX axis representation of standardized values (corresponding to unit standard deviation) of the indicator and on the axis OY recalled its values weighted space (lag).

Figure 7.

Scatter point of Moran's I for the registered number of unemployment persons at LAU2 level in 2013

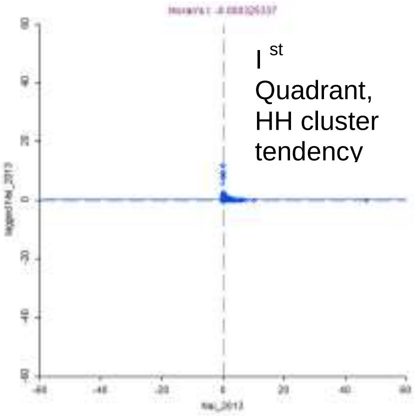
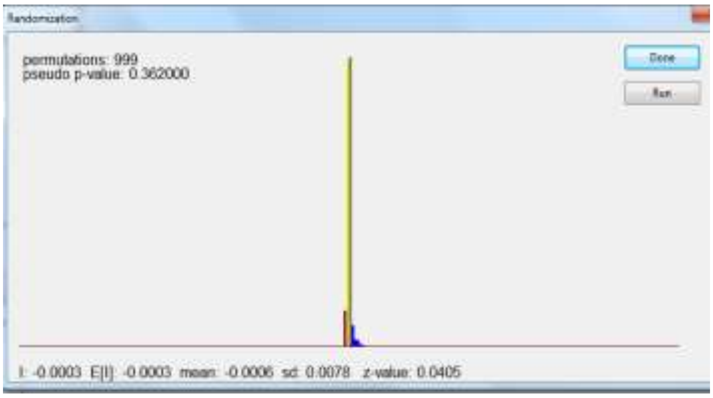


Figure 8.

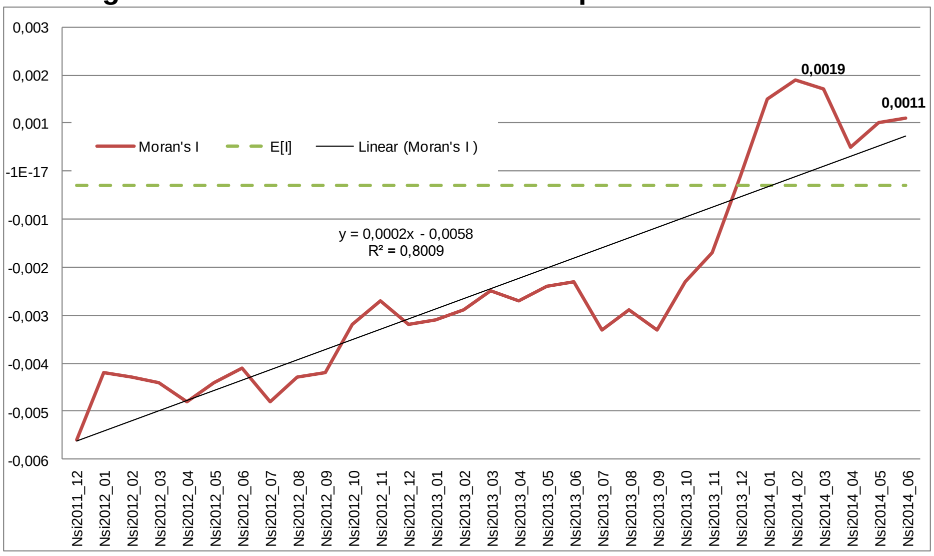
The empiric distribution of 999 permutations for Moran's I inference determination of the registed number of unemployment persons at LAU2 level in 2013



The value of Moran I index (Anselin 1995, 1996) indicates the presence of spatial autocorrelation when values for neighboring features are either both larger than the mean or both smaller than the mean there is identified the clustering tendency, there are similarities of the evaluated indicator. The cross-product could be positive in the case High – High locations with high values surrownded by locations with high values or the case Low-Low locations with low values susrrounded by locations with low values for the indicator analysed. (See also Figure 4, and also I Quadrant in Figure 5)

Figure 9

The Moran's I global spatial autocorrelation index) and its theoretical value E[I], calculated at LAU2 level for registered unemployed persons in monthly variation during 01.2010- 06.2011 – Detail for the period 12.2011- 06.2014



Source: Graphic made by authors with number of registered unemployed persons data from INS TEMPO in monthly variation, Shape file UAT2 ESRI Romania, calculated in GeoDa

The number of registered unemployed persons presents two different tendencies defined by the spatial variation pattern in monthly variation during January 2010 and June 2014 period, located at the lowest territorial administrative level UAT2, based on the diagnostic of the existence of Global spatial autocorrelation measured by Moran's I, calculated in GeoDa (Figure 9 based on data presented in Annex 1):

- An slight dispersion tendency for the period January 2010-December 2013, while the Moran I Global index<0 (see the case of year 2013 illustrated in Figure 8);
- An slight clustering tendency January 2014-June 2014 while Global Moran I index > 0. In this cases, Global Moran's I values are higher than its theoretical value E[I]- indicates a significant correlation, corresponding to a total of 9999 permutations, with a pseudo-significance level of p є [0.27; 0.316] <0.32 (low confidence level of 68%, Figure 4 scheme of interpretation), Z score of Moran's **I** є [0.1467; 0.3081] Sd <1.65 Sd, we accept the null hypothesis and we conclude that the identified pattern is a result of chance.

III. Conclusions

Spatial concentration of unemployment tendency identification, as an spatio temporal analyse, allow the policy makers to identify eficient solutions and implement appropriate additional social protection measures in the precise locations, where this risk exists.

Aknowledgments

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Annex 1

Table 1

Results – Global Moran's I in monthly and annual variation for the registered number of unemployed persons during 01.2010-06.2014 at 999 permutations

Indicators	*Symbol*	***2010***	***2010_01***	***2010_02***	***2010_03***	***2010_04***	***2010_05***	***2010_06***
pseudo p value	p	0,426	0,461	0,432	0,46	0,45	0,475	0,475
Global Moran's I	I	-0,0033	-0,0025	-0,0033	-0,0026	-0,0025	-0,0027	-0,0028
Theoretical value Moran's I	E[I]	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003
Mean (I)	M	-0,0004	-0,001	-0,0003	-0,0005	0,0003	-0,0003	-0,0006
Standard deviation of I	Sd	0,0088	0,009	0,0091	0,0088	0,0103	0,009	0,0086
Sd of normal distribution of I	z	-0,3277	-0,1708	-0,3261	-0,2424	-0,2708	-0,2698	-0,2641
Indicators	*Symbol*		***2010_07***	***2010_08***	***2010_09***	***2010_10***	***2010_11***	***2010_12***
pseudo p value	p		0,365	0,37	0,307	0,293	0,363	0,404
Global Moran's I	I		-0,0037	-0,0038	-0,0044	-0,0046	-0,004	-0,0033
Theoretical value Moran's I	E[I]		-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003
Mean (I)	M		-0,0001	0	-0,0008	-0,0002	-0,0008	-0,0003
Standard deviation of I	Sd		0,0085	0,0092	0,0073	0,0092	0,0075	0,0086
Sd of normal distribution of I	z		-0,4223	-0,4141	-0,4961	-0,4843	-0,4254	-0,3548
Indicators	*Symbol*	***2011***	***2011_01***	***2011_02***	***2011_03***	***2011_04***	***2011_05***	***2011_06***
pseudo p value	p	0,173	0,332	0,373	0,27	**0,189**	0,372	0,41
Global Moran's I	I	-0,0056	-0,0043	-0,004	-0,0048	**0,0042**	-0,001	-0,0026
Theoretical value Moran's I	E[I]	-0,0003	-0,0003	-0,0003	-0,0003	**-0,0003**	-0,0003	-0,0003
Mean (I)	M	-0,0003	-0,0001	-0,0004	-0,0001	**0,0001**	-0,0003	-0,0003
Standard deviation of I	Sd	0,0072	0,0086	0,0087	0,0083	**0,0081**	0,0071	0,0068
Sd of normal distribution of I	z	-0,7332	-0,492	-0,4096	-0,569	**0,5017**	0,0302	-0,3333
Indicators	*Symbol*		***2011_07***	***2011_08***	***2011_09***	***2011_10***	***2011_11***	***2011_12***
pseudo p value	p		0,337	0,23	0,17	0,198	0,228	0,187
Global Moran's I	I		-0,0037	-0,0049	-0,0057	-0,0053	-0,005	-0,0056
Theoretical value Moran's I	E[I]		-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003
Mean (I)	M		-0,0005	-0,001	-0,0001	-0,0006	-0,0003	-0,0005
Standard deviation of I	Sd		0,0066	0,0078	0,0075	0,0065	0,0075	0,0069
Sd of normal distribution of I	z		-0,4796	-0,6169	-0,731	-0,716	-0,6263	-0,7372

Indicators	*Symbol*	***2012***	***2012_01***	***2012_02***	***2012_03***	***2012_04***	***2012_05***	***2012_06***
pseudo p value	p	0,377	0,313	0,267	0,262	0,215	0,246	0,277
Global Moran's I	I	-0,0032	-0,0042	-0,0043	-0,0044	-0,0048	-0,0044	-0,0041
Theoretical value Moran's I	E[I]	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003
Mean (I)	M	-0,0004	-0,005	0	-0,0001	-0,0002	-0,0002	-0,0002
Standard deviation of I	Sd	0,0074	0,0073	0,0079	0,0078	0,0066	0,0068	0,007
Sd of normal distribution of I	z	-0,3832	-0,5125	-0,5513	-0,549	-0,6893	-0,6243	-0,5586
Indicators	*Symbol*		***2012_07***	***2012_08***	***2012_09***	***2012_10***	***2012_11***	***2012_12***
pseudo p value	p		0,21	0,277	0,283	0,374	0,454	0,396
Global Moran's I	I		-0,0048	-0,0043	-0,0042	-0,0032	-0,0027	-0,0032
Theoretical value Moran's I	E[I]		-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003
Mean (I)	M		-0,0005	-0,0003	-0,0004	-0,0004	-0,0006	-0,0003
Standard deviation of I	Sd		0,0068	0,0072	0,0066	0,0074	0,0073	0,0076
Sd of normal distribution of I	z		-0,6449	-0,5534	-0,5738	-0,3864	-0,2838	-0,3778

Indicators	*Symbol*	***2013***	***2013_01***	***2013_02***	***2013_03***	***2013_04***	***2013_05***	***2013_06***
pseudo p value	p	0,394	0,375	0,416	0,45	0,421	0,438	0,451
Global Moran's I	I	-0,0001	-0,0031	-0,0029	-0,0025	-0,0027	-0,0024	-0,0023
Theoretical value Moran's I	E[I]	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003
Mean (I)	M	-0,0001	0,0001	-0,0003	-0,0008	0	-0,0002	-0,0003
Standard deviation of I	Sd	0,0076	0,0075	0,0076	0,0066	0,0075	0,0065	0,0068
Sd of normal distribution of I	z	-0,0061	-0,4254	-0,336	-0,2682	-0,3592	-0,3294	-0,2847
Indicators	*Symbol*		***2013_07***	***2013_08***	***2013_09***	***2013_10***	***2013_11***	***2013_12***
pseudo p value	p		0,367	0,38	0,341	0,476	0,47	0,369
Global Moran's I	I		-0,0033	-0,0029	-0,0033	-0,0023	-0,0017	-0,0001
Theoretical value Moran's I	E[I]		-0,0003	-0,0003	-0,0003	-0,0003	-0,0003	-0,0003
Mean (I)	M		-0,0002	-0,0001	0,0002	-0,0005	-0,0004	-0,0005
Standard deviation of I	Sd		0,0073	0,0067	0,0076	0,0071	0,0078	0,0069
Sd of normal distribution of I	z		-0,4213	-0,4112	-0,4595	-0,2601	-0,1679	0,0597

Indicators	*Symbol*	2014	***2014_01***	***2014_02***	***2014_03***	***2014_04***	***2014_05***	***2014_06***
pseudo p value	p		0,27	**0,271**	0,287	0,316	0,295	0,273
Global Moran's I	I		0,0015	**0,0019**	0,0017	0,0005	0,001	0,0011
Theoretical value Moran's I	E[I]		-0,0003	**-0,0003**	-0,0003	-0,0003	-0,0003	-0,0003
Mean (I)	M		-0,0005	**-0,0001**	-0,0001	-0,004	-0,0003	-0,0006
Standard deviation of I	Sd		0,0074	**0,0077**	0,0069	0,0067	0,0065	0,0057
Sd of normal distribution of I	z		0,2644	**0,266**	0,2691	0,1467	0,2019	0,3081