Analyzing Migration Phenomena with Spatial Autocorrelation Techniques

Beniamino Murgante[1] and Giuseppe Borruso[2]

[1] University of Basilicata, 10, Viale dell'Ateneo Lucano, 85100 Potenza, Italy
[2] University of Trieste, P. le Europa 1, 34127 Trieste, Italy
beniamino.murgante@unibas.it,giuseppe.borruso@econ.units.it

Abstract. In recent times a complete lack of attention to migration phenomena, in national and global policies, led to a huge concentration of foreigners in major cities of Europe and USA. This trend has been faced without effective policies and programs. Consequently, a great opportunity has been transformed in a great threat and the word immigration is generally associated with the term social security. In less than one century, Italy has been transformed from a country originating great migration flows to a country which is the destination of migration flows. The aim of this paper is to examine foreign immigration in Italy distinguishing according to nationality of foreigners. In order to analyze this phenomenon Shannon and Simpson Diversity Indices to measure the level of entropy in a distribution and the variation in categorical data have been used. The spatial dimension of migration flows has been analyzed in this paper using Spatial Autocorrelation techniques and more particularly Local Indicators of Spatial Association in order to analyze the highest values of a foreigner group considering the relationship with the surrounding municipalities.

Keywords: Migration Phenomena, Foreign Immigration analysis, Shannon Index, Simpson Index, Spatial Autocorrelation, Local Indicators of Spatial Association.

1 Introduction

During each political pre-electoral debate in Europe and in USA, one of the most discussed topics is migration phenomena and related policies. This situation arises due to a total lack of attention to such phenomena by national policies of these countries. Consequently, these phenomena have been completely unplanned and uncontrolled producing a huge social impact in major cities of these countries.

Foreigners' presence coupled with a careful integration of people with different demographic and social characteristics, cultural backgrounds, experiences and expectations may represent a great opportunity for destination areas of migration.

In order to avoid that such opportunities become threats, a continuous observation of the phenomenon is fundamental for programming measures and interventions suitable for an effective integration of immigrants and their families.

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Migration has always been a natural process which produces other significant transformations in the environment as well as in everyday life, in economic systems, cultures, religions etc. The presence of foreigners is not easily detectable, because it is a particularly complex and rapidly evolving phenomenon.

Modern migrations are mainly characterized by two components, comparable in terms of absolute value: internal migration where part of the population moves within the country; external migration where part of the population reaches the country coming from another state. This work is completely concentrated on external component of migration towards Italy, distinguishing according nationalities of foreigners. An analysis of migration phenomenon in Italy which considers both the internal and the external components, without distinguishing between them, has been developed by Scardaccione et al. [6].

Several Indices have been used in this paper to analyze migration flows. Shannon and Simpson Diversity Indices, originally adopted in ecology to quantify habitat biodiversity, have been frequently used in several other fields and also in analyzing various demographic groups. These indices produce interesting results but they do not compute spatial dimension. Spatial autocorrelation techniques consider the intensity of a phenomenon inside a municipality, measuring at the same time the degree of influence over its surrounding municipalities. More particularly, for each foreigner nationality, Local Indicator of Spatial Association has been adopted in order to discover the highest values of the phenomenon coupled with the highest level of similarity with its neighbouring municipalities.

2 Methods

2.1 Shannon and Simpson Diversity Indices

Other than analyzing characteristics of single ethnic groups and comparing them, an element of interest lays in the analysis of the overall distribution and variability of foreign population in an area or in a single country, therefore considering both quantitative and categorical data concerning the presence of migrants. Indices of diversity can be useful when the focus is also on the different number and type of nationalities in an area, other than their figures.

Diversity indices originate from ecology and biology and are mainly aimed at measuring biodiversity of an ecosystem. They can be applied to measure diversity of a population in which each member belongs to a unique species. They have been used in studies concerning landscape [15] and social sciences [16], substituting the notion of ‘species’ with, for instance, land cover types rather than ethnic groups, and considering individual residents of an ethnic group instead of ‘individuals belonging to species’ [18], [19].

A commonly used index is Diversity Index or Index of Variability, frequently used to measure a variation in categorical data. It is known in the version of Shannon index [11] [12] that measures the level of entropy in a distribution, converting species in symbols and their population sizes in a measure of probability. Both number and evenness of species are considered and the values increase either by adding unique

species or by means of a higher evenness of species. Shannon Diversity Index (SHDI) can be expressed by the following formula:

$$SHDI = -\sum_{i=1}^{N} p_i * \ln p_i \quad (1)$$

where p is the proportion of individuals or objects in a category - the relative abundance of each type or the proportion of individuals of a given type to the total number of individuals in the category - and N is the number of categories. The index ranges from 0 to infinity, with 0 representing the case in which the analysed area is perfectly homogeneous in terms of population, while higher values represent a higher heterogeneity as the figures increase [10].

Simpson Diversity Index D (SIDI) is another index of Diversity - different from the Duncan and Duncan one [13] – and it is used for measuring the variation in categorical data.

$$SIDI = 1 - \sum_{i=1}^{N} p_i^2 \quad (2)$$

p is the proportion of individuals or objects in a category and N is the number of categories. A perfectly homogeneous population would have a diversity index score of 0, while a perfectly heterogeneous population would have a diversity index score of 1 - assuming infinite categories with equal representation in each category.

As the number of categories increases, the maximum value of the diversity index score also increases.

The two indices are focused on different aspects concerning diversity. Shannon index particularly aims at highlighting the richness component, while Simpson index is more concerned with evenness and the analysis of dominant types [10]. According to some authors [14] Shannon diversity index is more sensitive to changes occurring in the importance of rarest elements, while Simpson index seems to respond to changes in the proportional abundance of most common community [10].

The indices are adapted in this study to the different ethnic groups and their weights in terms of resident individual, focusing the attention on different spatial levels.

2.2 Spatial Autocorrelation Techniques

Geographical objects are generally described by means of two different information categories: spatial location and related properties. In data analysis there is a huge literature concerning methods which separately compute attributes from spatial components.

The most interesting property of spatial autocorrelation is the capability to analyze at the same time locational and attribute information [3]. Consequently, spatial autocorrelation can be considered as a very effective technique in analyzing spatial distribution of objects assessing at the same time the degree of influence of neighbour objects. This concept is well synthesized in the first law of geography defined by

Waldo Tobler "All Things Are Related, But Nearby Things Are More Related Than Distant Things" [4]. Adopting Goodchild [3] approach, Lee and Wong [5] defined spatial autocorrelation as follows:

$$SAC = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} c_{ij} w_{ij}}{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}} \tag{3}$$

Where:

1. n is the number of objects;
2. i and j are two objects;
3. x_i is the value of object i attribute;
4. c_{ij} is a degree of similarity of attributes i and j;
5. w_{ij} is a degree of similarity of location i and j;

if $c_{ij}=(x_i-x_j)^2$ *Geary C Ratio* [7] can be defined as follows:

$$c = \frac{(N-1)(\Sigma_i \Sigma_j w_{ij}(x_i - x_j)^2)}{2(\Sigma_i \Sigma_j w_{ij})\Sigma_i (x_i - \bar{x})^2} \tag{4}$$

if $c_{ij} = (x_i - \bar{x})(x_j - \bar{x})$ *Moran Index I* [8] can be defined as follows:

$$I = \frac{N\Sigma_i \Sigma_j w_{ij}(x_i - \bar{x})(x_j - \bar{x})}{(\Sigma_i \Sigma_j w_{ij})\Sigma_i (x_i - \bar{x})^2} \tag{5}$$

These two indices are very similar, mainly differing in the cross-product term in the numerator, which in Moran is calculated using deviations from the mean, while in Geary is directly computed.

These two indices are global indicators of spatial autocorrelation. They provide an indication about the presence of autocorrelation. The precise location of elevated values of autocorrelation is provided by Local Indicators of Spatial Association. One of the most adopted indices of local autocorrelation is LISA-Local Indicator of Spatial Association [1] [2] considered as a local Moran index. The sum of all local indices is proportional to the value of Moran one:

$\sum_i I_i = \gamma * I$. The index is calculated as follows:

$$I_i = \frac{(X_i - \bar{X})}{S_X^{\,2}} \sum_{j=1}^{N} \left(w_{ij}\left(X_j - \bar{X}\right)\right) \tag{6}$$

It allows, for each location, to assess the similarity of each observation with its surrounding elements. Five scenarios emerge:

- locations with high values of the phenomenon and high level of similarity with its surroundings (high-high), defined as *hot spots*;
- locations with low values of the phenomenon and high level of similarity with its surroundings (low-low), defined as *cold spots*;
- locations with high values of the phenomenon and low level of similarity with its surroundings (high-low), defined as potentially *spatial outliers*;
- locations with low values of the phenomenon and low level of similarity with its surroundings (low-high), defined as potentially *spatial outliers*;
- locations completely lacking of significant autocorrelations.

LISA (Local Indicator of Spatial Association) provides an effective measure of the degree of relative spatial association between each territorial unit and its surrounding elements, allowing highlighting type of spatial concentration for the detection of spatial clusters.

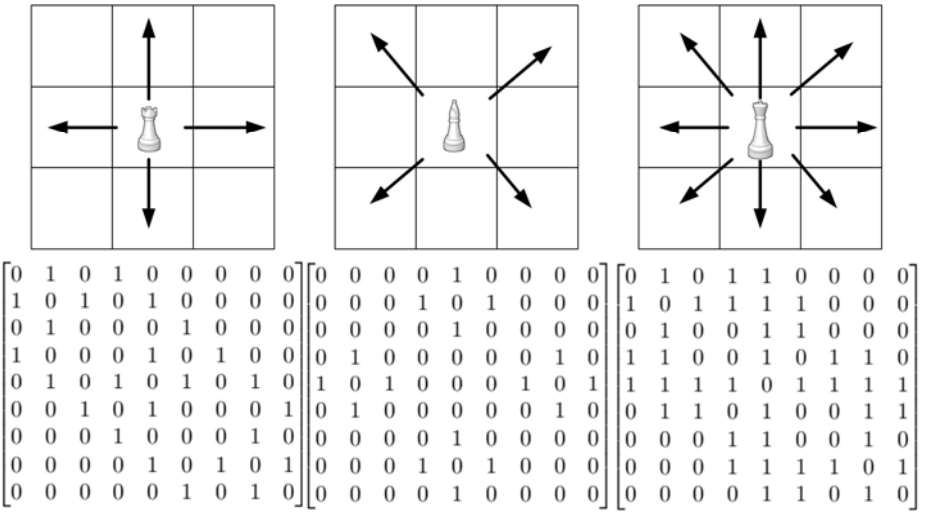

Fig. 1. Spatial weights matrix and the metaphor chess game

In equations 3, 4, 5, 6 the only term not well formalized is w_{ij} related to neighbourhood property. The most adopted approach in formalizing this property is spatial weights matrix, w_{ij} are elements of a matrix considered as spatial weights, equal to 1 if *i* and *j* are neighbours equal to 0 in the case of self-neighbour or if *i* and *j* are not neighbours.

This approach is based on the concept of contiguity, where elements share a common border of non-zero length. It is important to give a more detailed definition of contiguity and more particularly what does a border of non-zero length exactly mean.

Adopting chess game metaphor [9], contiguity can be considered as allowed by paths of *rook*, *bishop* and *queen* (figure 1). It is possible to adopt also the second or

higher order of contiguity considering the crown of elements contiguous to first order neighbours. It is also possible to consider higher order of contiguity including the lowest order.

3 Italian Spatial Distribution of Foreign Immigration

In recent years Italy has tested a strong intensification of immigration. The biggest cities and metropolitan areas are major attraction centres for immigrants and even if less than in the past this phenomenon is mainly concentrated in Northern part of Italy. Despite today immigration phenomenon is seen as a crucial problem for the large number of immigrants who daily arrive on the Southern coast of the country, the dimension of the phenomenon is rather concerning movements from Italian regions where the economic crisis is more evident to those where there is more job offer.

In the past, migratory phenomenon in Italy was mainly characterized by abandonment of the nation to reach North and South America. Subsequently, migration originated in Southern Italy and it was mainly directed to Switzerland and Germany. Considering internal migration, an exodus directed to big industrial centres of Northern Italy occurred after the Second World War, when a lot of people left Southern Italy countryside to reach the big industrial cities of the North in search of a job.

Population growth observed recently in Italy is strongly determined by the foreign component. For this reason this paper is completely concentrated on this aspect. Data concerning foreign residents at municipality scale have been analyzed for years 2003 and 2009 using official data of Italian Institute of Statistics (ISTAT).

We considered 2003 because on 30 July 2002 Italian parliament approved a new law concerning immigration discipline and rules on conditions of foreigners. Consequently, a strong increase of residence permits has been registered in 2002 due to the regularization of foreign people having working permits. In fact, in 2003, working permits increased of about 355 thousand units for men and approximately 295 thousand units for women. While in subsequent years, the increase of residence permits was almost exclusively due to family reunification. We took into account 2009 because it is the last year of available data on foreign origin at municipality scale.

The analysis over data concerning foreign migration in Italy provided interesting results in terms of the pattern drawn by their spatial distribution in Italian municipalities. As a general note, we can recall that Italy experimented a dramatic increase in percentage of foreign population living in its territory, since the value more than doubled in less than a decade, from 3.5% at the beginning of the century to the current 7% of foreign population over the total. This value of course represents the average and local variations can be noticed in all administrative unit levels, these being regions, provinces and municipalities, as those analyzed here.

If we observe general data and compare the two years considered - 2003 and 2009 - we can notice that foreign residents more than doubled, from fairly 2 million people in 2003 to 4.2 million people in 2009. Such an increase of more than 2.2 million people was led by few national groups, since ten nationalities count for 73% of total immigrants in Italy in 2009 and a total of 20 nationalities explain the most of immigration process covering 88% of foreign residents.

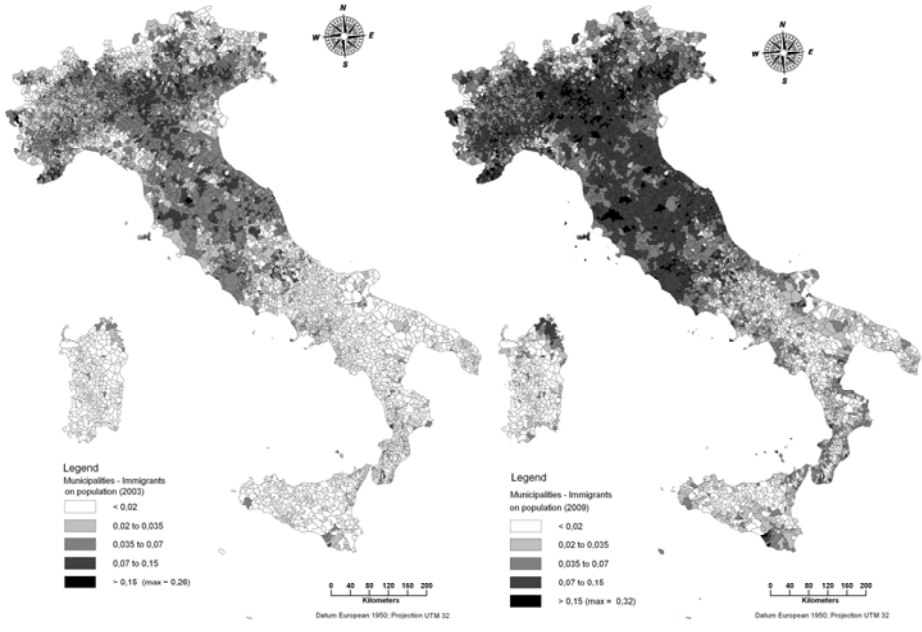

Fig. 2. Foreign residents in Italy. Percentage of foreign residents over population in Italy in 2003 and 2009. Source: our elaboration from Italian Institute of Statistics - Istat

In the top ten positions, in terms of absolute numbers – as well as absolute increase – we can find countries like Romania, Albania, Morocco, People's Republic of China, Ukraine, Philippine Islands, India, Poland, Moldova and Tunisia. In particular Romania, Albania, Morocco and China lead the way. Especially Romanians represent the first most numerous group which has experienced the most dramatic increase. A partial reason of such an increase can be possibly found in Romania accessing EU in 2004, which allowed an easier movement of people between the two States and therefore people to relocate to Italy.

Data show also that 'historical' groups as Albanians continue to choose Italy as a destination for migration, as well as other groups coming from North African countries, like Morocco, Tunisia, Egypt and Senegal. A most recent phenomenon is related to the immigration from South East Asia, particularly from China, India and Bangladesh, not to forget Philippine Islands, already 'settled' as a foreign group in Italy.

Italy represents a destination also for nationals from industrialized countries, as the rest of EU and USA. The number of people from these latter countries involved is not as high as those related to the countries already mentioned, but in any case they are interesting to understand some spatial patterns, as it will be more evident when observing local cases.

Table 1. Foreign residents in Italy. 2003 - 2009 comparison and absolute increases of single groups (absolute and percentage values). Source: our elaboration from Italian Institute of Statistics - Istat

Countries	Population 2003	Population 2009	Percentage increase	Absolute increase
Romania	177812	887763	399,27%	709951
Albania	270383	466684	72,60%	196301
Morocco	253362	431529	70,32%	178167
China	86738	188352	117,15%	101614
Ukraine	57971	174129	200,37%	116158
Philippine	72372	123584	70,76%	51212
India	0	105863		105863
Poland	40314	105608	161,96%	65294
Moldova	24645	105600	328,48%	80955
Tunisia	68630	103678	51,07%	35048
Macedonia	51208	92847	81,31%	41639
Peru	43009	87747	104,02%	44738
Ecuador	33506	85940	156,49%	52434
Egypt	40583	82064	102,21%	41481
Sri Lanka	39231	75343	92,05%	36112
Bangladesh	0	73965		73965
Senegal	46478	72618	56,24%	26140
Former-Yugoslavia	51708	57877	11,93%	6169
Nigeria	26383	48674	84,49%	22291
Total foreigners	1990159	4235059	112,80%	2244900
Total population	56890331	60320749	6,03%	3430418

3.1 Results and Comments with Shannon Diversity Index

Shannon and Simpson diversity indices have been calculated and applied to foreign immigration in Italian municipalities. In particular, they were tested for the presence of different nationalities and their figures.

The indices were computed over a subset of available data. In particular, SHDI and SIDI were calculated for years 2003 and 2009. Also, the indices considered both the whole dataset of foreign and Italian nationals in the territory and just the one of foreign nationals. It was thought that in the first case the indices could be useful to observe the presence of municipalities of high foreign immigration pressure on Italian nationals, while in the second case, if homogeneity occurred, it could be the subject for further investigations and it could highlight possible ghettoes and single-ethnic groups presence.

However the analysis and comments here are mainly focused on Shannon Diversity Index, as Sinpson's one seem a promising one but still providing results of difficult interpretation, a part from the fact that very high value occur, therefore showing a quite general and widespread co-presence of different nationals in same municipalities.

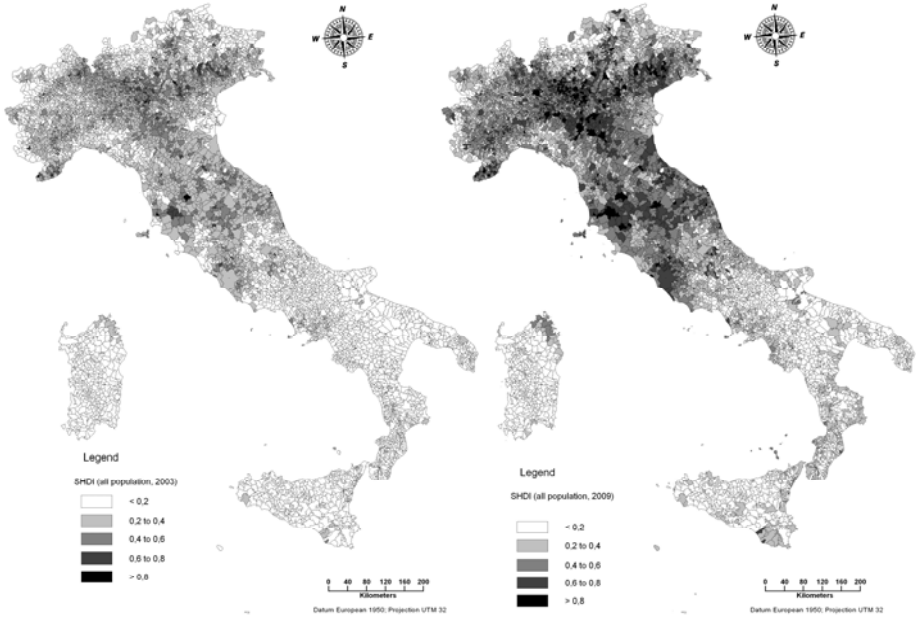

Fig. 3. Shannon Diversity Index considering the whole population 2003 (left) and 2009 (right)

The analysis of SHDI for the two years (2003 and 2009) and for the two dataset (considering for each year all national groups in one case and only foreign groups in the other one) is visible in figures 3 and 4.

We can notice a certain degree of matching with the picture drawn by spatial distribution of percentage of immigrants on overall population (figure 2). Maps could be easily overlapped and arising patterns appear quite similar.

A general note is that heterogeneity (i.e., higher values of SHDI) can be noticed in areas presenting higher percentage values of immigrants. Also, heterogeneity tends to increase as the weight of immigrations increases: comparing 2003 and 2009 figures and indices' values, we can notice higher values of heterogeneity in the same municipalities presenting higher percentage of immigrants over the entire population, and therefore highlighting also local variations in cases where immigration phenomenon is not so evident – as in Islands and Southern regions' locations.

SHDI applied to foreign residents alone offers a picture not 'affected' by the percentage values of immigrations over the entire population and therefore it allows observing the internal variation of foreign nationals. SHDI applied to 2003 data on foreign people alone confirms the 'image' of a concentration of people in urban areas in all regions, as well as in Italian industrial and agricultural districts. This is true for Northern regions, as well as for central and southern ones. Milan, Turin, Verona, Venice can easily be noticed, as well as central Italian cities as Florence and Rome, not to forget the 'linear' set of Emilia Romagna cities (Parma, Modena, Reggio Emilia, Bologna, etc.).

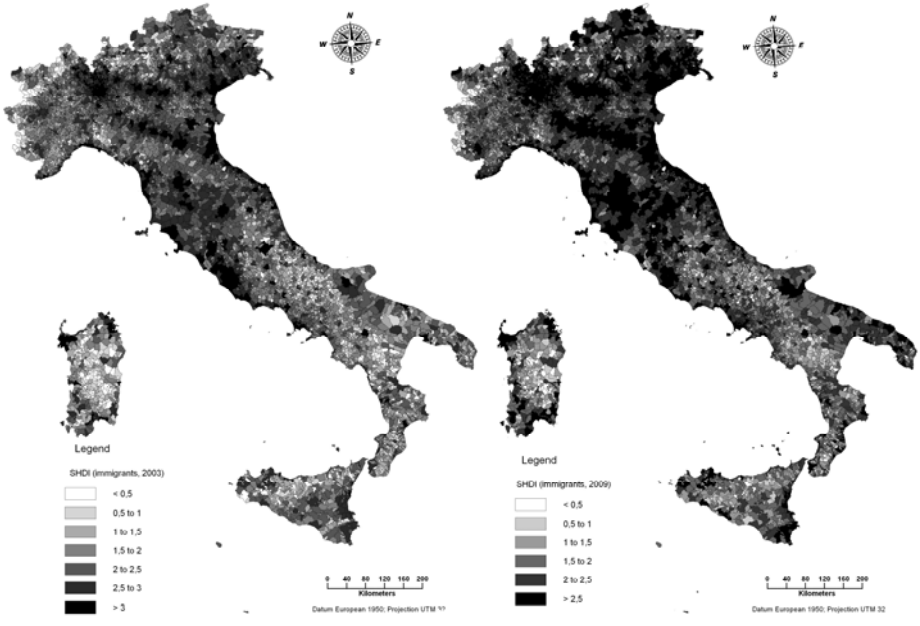

Fig. 4. Shannon Diversity Index considering only foreigners at 2003 (left) and 2009 (right)

Southern Italian cities also seem showing a high level of heterogeneity and therefore a high level of nationalities represented. This is true for cities like Bari, Foggia and Taranto in Puglia, Naples and Salerno in Campania, Sassari and Cagliari in Sardinia, just to mention a few of them. 2009 data analysis confirms what said for 2003, with a higher level of heterogeneity also in neighbouring municipalities with respect to those observed in 2003. This could imply a level of 'suburbanization' of immigrations, with an increase of the presence of immigrants in municipalities once less affected by the phenomenon, as well as an increase in the diversity of nationalities located there.

3.2 Results and comments with Local Indicators of Spatial Association Index

The application of LISA allows detecting clusters in a spatial distribution at local level; in this case the analysis was computed considering foreign population in Italian municipalities. The analysis was applied on some of the national groups.

Considering data at 2003, the Chinese group shows clusters particularly in some major metropolitan urban areas, as Milan and Rome and their hinterlands. Also, the phenomenon is interesting in its presence in Tuscany, between the provinces of Florence and Prato, as well as in the area crossing the three regions of Veneto, Lombardy and Emilia Romagna. In this latter region, there is a cluster of municipalities connecting urban areas of Parma, Reggio Emilia and Modena. In Veneto a cluster can be noticed around the city of Venice in the municipalities located in the mainland.

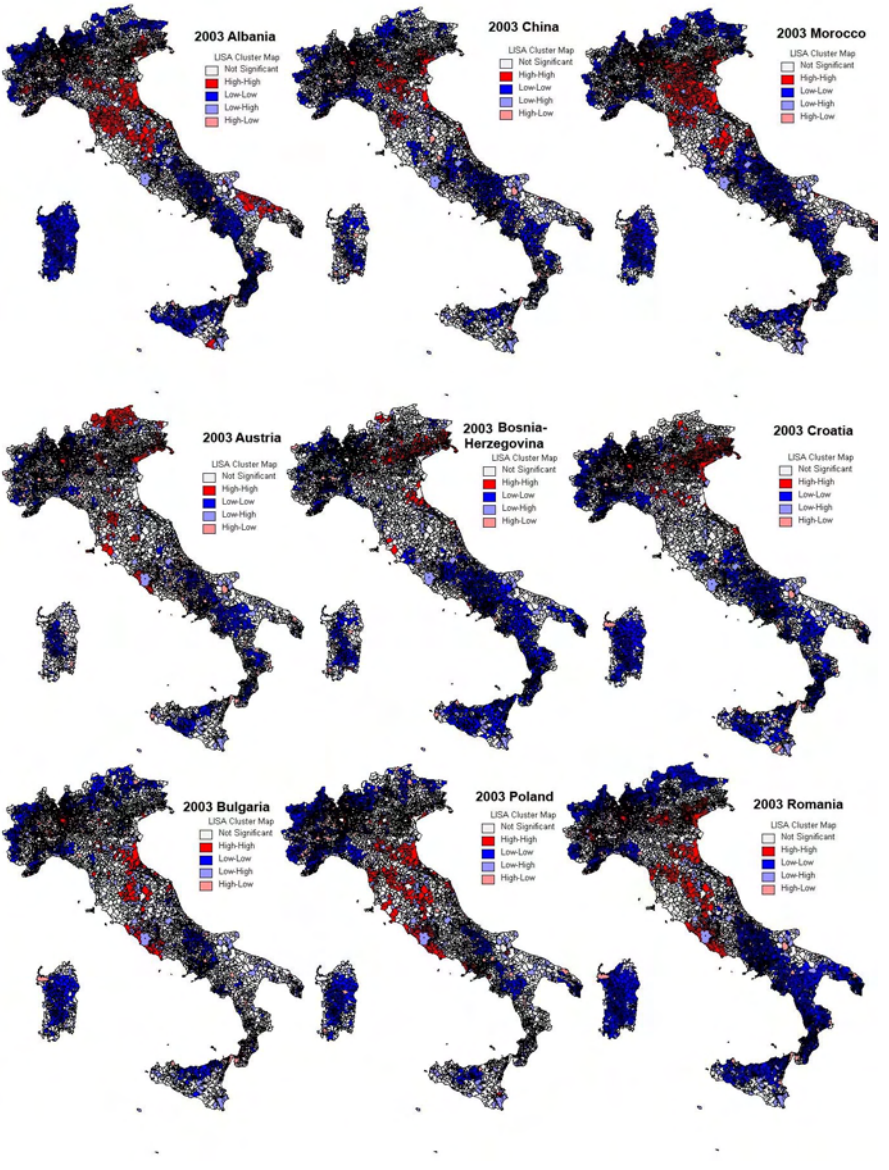

Fig. 5. LISA cluster map 2003. (our elaboration with GeoDa on ISTAT data)

A preference for location clustered in Northern – Central Italian regions seems to be noticed also in case of people from Morocco. We can fairly notice a single cluster of municipalities whose vertices can be observed in the areas around the cities of Venice and Milan and covering the area including Veneto, Lombardy and most of Emilia Romagna regions. Clusters can be also observed in northern Tuscany and in Umbria regions, as well as on the Adriatic Coast in Marche region.

'New' migrants from Poland and Bulgaria seem to prefer central Italian locations, being mainly clustered in Emilia Romagna, Tuscany and Lazio regions, here also preferring some urban and periurban locations (i.e., Rome and its hinterland). Former Yugoslavian states, as Yugoslavia (in 2003 grouping Serbia and Kosovo), Bosnia-Herzegovina and Croatia are present with groups mainly clustered in North-eastern Italy, starting from the North-eastern border between Italy and Slovenia and spreading westwards to Verona area and also (Croatians) clustering in the city of Milan.

Tunisian people are mainly concentrated in Emilia Romagna region, as well as in Milan area and in some Southern Italian locations, such as Naples area, Puglia region and Sicily (this latter possibly motivated by its geographical proximity to Tunisia and the integration of migrants in activities concentrated on fishery and agriculture).

With reference to the groups from industrialized countries, the algorithm used seems to be useful in highlighting some hot spots that can be quite easily explained.

Neighbouring Austrian people cluster in Alto Adige province in Northern Italy, located at the State Border with Austria, and presenting a strong Austrian-speaking community. Also, their presence is noticed in part of Friuli Venezia Giulia Region, here also close to the State Border, as well as in municipalities along the coastline. Such areas are renowned as tourist locations for Austrian people and, in some cases, once belonged to Austro-Hungarian Empire. Their presence can also be noticed in municipalities neighbouring important urban areas, as Venice, Verona, Milan, Florence and Rome.

Switzerland, UK and USA show also interesting settling pattern in Italian municipalities. For Swiss people some similar comments as for Austrian can be drawn, as the fact that clusters can be found in Lombardy and Alto Adige areas close to the State Border. Apart for that characteristic, all these groups tend to prefer also urban areas as Milan, Venice, Rome and Florence and particularly Tuscany as a region (among all, the "Chiantishire"), this latter therefore not to be considered just as a tourist destination, but also as a relocation site for these nationals. Some interesting patterns can be also noticed concerning USA people, as some clusters can be noticed close to important military installations, as Aviano and Sigonella Air Force Bases, respectively located in Friuli Venezia Giulia Region, close to Pordenone and in Sicily, in Catania province.

Some general conclusions can be drawn considering the different nationals. Foreign immigration appears as a phenomenon mainly characterizing Northern and Central Italy, in quantitative terms and with reference of its spatial distribution. Southern Italy and Islands appear less characterized by immigration, although, of course, important figures can be observed here (one for all, the presence of Tunisians in Sicily and Albanian people both in Sicily and Puglia).

Large urban areas tend to attract immigrants. This is visible both considering cities (i.e., Milan) and municipalities neighbouring urban areas (i.e., municipalities surrounding cities like Rome, Naples, Florence, Venice, Verona, etc.). Industrialized areas attract also immigrants, both in terms of 'traditionally' industrialized areas and also in the small-medium enterprises districts. This is visible particularly in North-eastern, North-west (Milan area) and Northern-Central Italy (Emilia Romagna and Tuscany Regions).

3.2.1 LISA 2009

The analysis of 2009 data can provide us with some information concerning the variation occurred in the years and new patterns of settlements.

We highlight here some major changes in some of the groups examined.

As a general remark, all groups analysed seem to maintain their spatial organization in the years, although clusters generally enlarge and new locations appear.

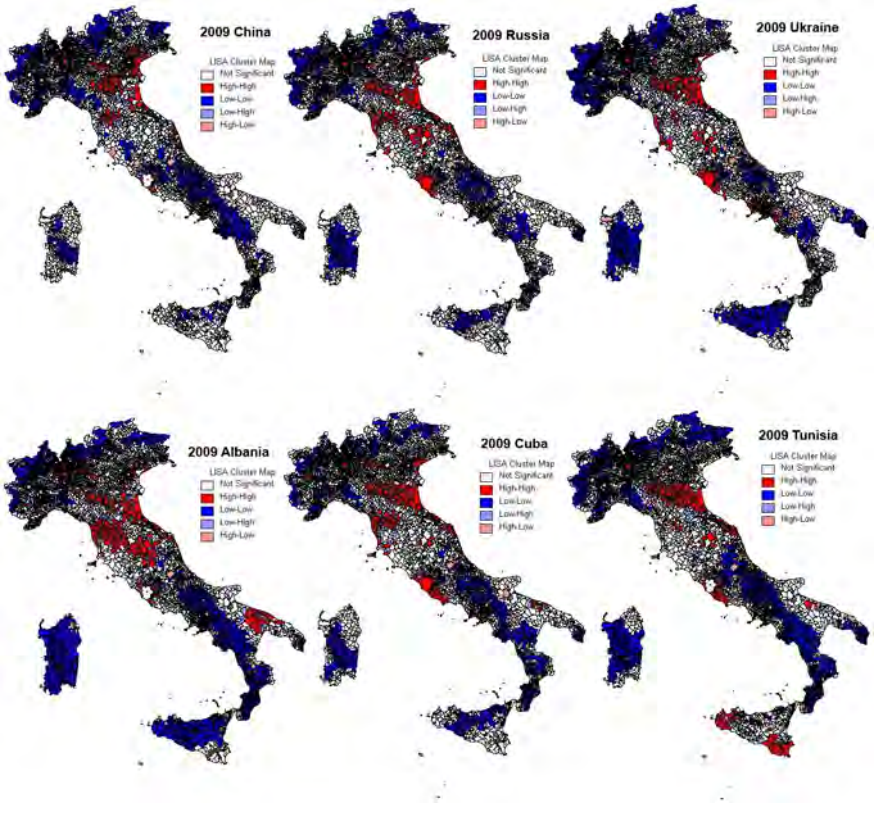

Fig. 6. LISA cluster map 2009. (our elaboration with GeoDa on ISTAT data)

In particular Bulgarian people reinforce their presence around the Italian Capital Rome, while a new cluster appears in Puglia region, centred in the city of Foggia and in its neighbouring municipalities. This seems to be due to activities of Bulgarian people in agricultural activities. Also news report of irregular immigration from Bulgaria being increasing in the area. Polish people confirm the same immigration pattern of 2003, although enlarging their clusters, reinforcing their presence in Lazio (especially Rome), and 'heading south', locating in Puglia region in Foggia area, as well as Bulgarian people, and also in Southern Sicily.

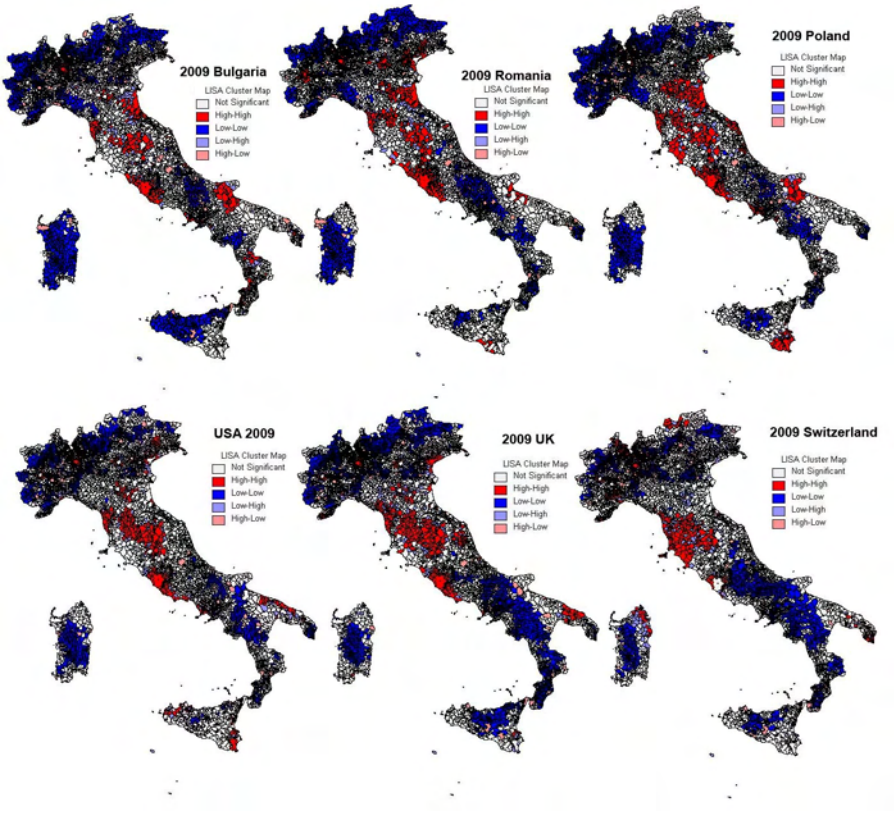

Fig. 7. LISA cluster map 2009. (our elaboration with GeoDa on ISTAT data)

Industrialized countries, UK and US confirm their spatial distribution, with new locations in Puglia and Lazio regions, particularly in the municipalities of Rome and neighbouring ones, and British people, in particular, tend also to move eastwards from the traditional location in Tuscany ("Chiantishire") to locate also in Umbria and Marche Regions. Similar patterns as those noticed can be detected for Switzerland. Here also people tend to settle in Tuscany and in neighbouring regions (Umbria and Marche) but also to experiment a 'spatial diffusion' towards the North-eastern coast of Sardinia.

Here also some general conclusions can be drawn. In general terms the considerations done with reference to 2003 can be confirmed, particularly in terms of North-South differences and polarization of migrants in (big) urban and industrialized areas. However, some interesting patterns seem to arise, as we can spot a trend of 'internal movements' of migrants, since clusters seem to grow in their dimensions and also to appear, with reference to some groups, in areas once not experimenting the phenomenon, in particular some other groups, part from Albanian and Tunisian people, settling in Southern Italy (i.e., Bulgarian and Polish people in Puglia, Campania and Calabria Regions).

4 Conclusions

The research carried out in this paper relied on the application of some spatial statistical techniques to immigration phenomena, focusing on the Italian case.

In particular, we tested some well known spatial analytical techniques for the immigration phenomena, thus trying to couple some quantitative methods with qualitative analysis and interpretation of the observed phenomena. We applied LISA algorithms and Entropy based indices to foreign residents in Italy, related to municipalities and diversified in terms of their nationality of origin.

As we run LISA methods on some of the major groups currently living in Italy, we were able to detect clusters in their spatial distribution, not limiting us to examin immigration in terms of their percentage weight, but also, and more importantly, in terms of spatial aggregation of foreign groups over the territory.

Entropy-based, diversity indices suggested the characters of heterogeneity versus homogeneity of the phenomenon. We could therefore observe some interesting clusters and trends, valid for immigration in wide terms and also in terms of national differences. In particular, we discovered some of the major characters of immigration in the two years, 2003 and 2009: in general terms it is a phenomenon especially characterizing Northern regions, cities – metropolitan areas and industrial districts and areas. Different nationals show differences in migration and settlement patterns. These can be explained by means of migration chains, geographical proximity and economic specialization in the country of origin that is proposed as expertise in the country/site of destination. Changes occurred in less than a decade, demonstrating a trend in internal movements inside Italy, visible in terms of enlargement of single nation clusters and creation of new ones, different from the original ones. It meant also suburbanization, since presence of foreign people in suburban municipalities around major cities and metropolitan areas increased. Also, Southern and insular Italy became areas of settlement for some migrant groups, if not with very large numbers, with interesting composition. In terms of heterogeneity, we noticed that the 'weight' – in percentage terms – of foreign population is in most of the cases characterized by an increase in number of nations in single municipalities, as well as of people. This means that in general, at least with reference to single municipalities, we do not observe ghettoization processes with dominance of single foreign groups – here we cannot say nothing related to dynamics *within* a municipality.

These same conclusions, of course, are compatible with other levels of data analysis and knowledge of the phenomenon. However, we must stress that the methods applied here were quite precise in highlighting some of the characters of immigration phenomenon that could be just imagined or hypothesized by means of other more traditional methods. It must be also stressed that this method can be interesting coupled with more qualitative local analysis. Indeed, it proved to be interesting in highlighting clusters and therefore local cases of some interest, therefore helping scholars to more precisely aim and deepen their research.

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