Süleyman Demirel Üniversitesi
İktisadi ve İdari Bilimler
Fakültesi Dergisi
Y.2011, C.16, S.2, s.219-234.

Suleyman Demirel University
The Journal of Faculty of Economics
and Administrative Sciences
Y.2011, Vol.16, No.2, pp.219-234.

SPATIAL ANALYSIS OF RELATIONS AMONG DEMOCRACY, ECONOMIC FREEDOM AND ECONOMIC GROWTH: A RESEARCH ON THE EUROPEAN COUNTRIES

DEMOKRASİ, EKONOMİK ÖZGÜRLÜK VE EKONOMİK BÜYÜME ARASINDAKİ İLİŞKİLERİN MEKÂNSAL ANALİZİ: AVRUPA ÜLKELERİ ÜZERİNE BİR İNCELEME

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ABSTRACT

The aim of this paper is to examine relations among democracy, economic freedom and economic growth by using spatial data and techniques for European countries. For this purpose we use quartile maps, Moran's Scotterplots and LISA (Local Indicators of Spatial Association) statistics. In this study we investigate spatial distribution of per capita GDP in the period of 1995-2009 periods, democracy index in 2006-2008 and economic freedom index over 1995-2009. Our findings display that there are positive relations among per capita GDP, democracy and economic freedom. We determine that nucleus countries of Europe are primarily Germany and France and additionally Belgium, Denmark and Netherlands. It observed that these countries (especially Germany and France) are driving force of main countries of Europe in terms of economic development level, economic size and population.

ÖZET

Bu çalışmanın amacı, mekansal veri ve teknikleri kullanarak Avrupa ülkeleri için demokrasi, ekonomik özgürlük ve ekonomik büyüme arasındaki ilişkileri incelemektir. Bu amaçla, Quartile haritalar, Moran's Scatterplots ve LISA istatistiği kullanılmaktadır. Çalışmada 1995-2009 yılları arasındaki kişi başına gayri safi yurtiçi hâsıla, 2006-2008 yılları için demokrasi indeksi ve 1995-2009 yılları için ekonomik özgürlük indeksinin mekansal dağılımı incelenmektedir. Elde edilen bulgular, kişi başına gayri safi yurtiçi hasıla, demokrasi ve ekonomik özgürlükler arasında pozitif bir ilişki olduğunu

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göstermektedir. Avrupa'nın çekirdeğini oluşturan ülkelerin başta Almanya ve Fransa olmak üzere Belçika, Danimarka ve Hollanda olduğu belirlenmiştir. Bu ülkelerin (özellikle Almanya ve Fransa) hem ekonomik kalkınma düzeyi hem de ekonomik büyüklük ve nüfus olarak Avrupa'nın geri kalanı için itici güç oldukları görülmüştür.

Spatial Statistics, LISA (Local Indicators of Spatial Association) Techniques, Europe, Democracy, Economic Freedom
Mekansal istatistik, LISA Tekniği, Avrupa, Demokrasi, Ekonomik Özgürlük

1. INTRODUCTION

Economic growth is primarily the result of gains from trade, capital investment, and the discovery of improved products, lower-cost production methods, and better ways of doing things. Numerous studies have shown that countries with more economic freedom grow more rapidly and achieve higher levels of per-capita income than those that are less free. Similarly, there is a positive relationship among changes in economic freedom, democracy and the growth of per-capita income. Given the sources of growth and prosperity, it is not surprising that increases in economic freedom and improvements in quality of life have gone hand in hand during the past quarter of a century (EFW, 2009:3)

Economic freedom is defined by The Heritage Foundation as "the fundamental right of every human to control his or her own labor and property". Individuals are free to work, produce, consume, and invest with that freedom protected and unconstrained by the democratic state in an economically free society. In these countries, governments allow labor, capital and goods to move freely, and refrain from coercion or constraint of liberty beyond the extent necessary to protect and maintain liberty itself (HF, 2010).

It is accepted by many economists that democracy and economic freedom has an affect on economic growth and development. Every developed country has high level democracy and economic freedom. We cannot see any country in the world that its democracy and economic freedom level are low but its economic growth and democracy level is high. For this reason we want to investigate relations between democracy, economic freedom and economic growth level in both Eastern and Western European countries because after 1990s, Eastern European countries gained independency from Soviet Russia and these countries want to improve economic growth and development levels. But their democracy level and economic freedom indicators were not high enough since the beginning of the 21st century.

2. LITERATURE

In recent years, many economists have studied about reasons of economic growth. These studies show that economic growth is not only related to economic indicators but also social and legal system (democracy, freedoms) and human capital capacity (education, experience etc). In this scope, one of the pioneer studies belongs to Scully and Slottje (1991). They prepared an index that has 15 elements for 144 countries. In this study, they find positive relations between real GDP growth rate and economic freedom.

De Vanssay and Spindler (1994) detect that effect of economic freedom on economic growth is significant and substantial for a hundred countries (separately OECD and non-OECD). Abrams and Lewis (1995) bring out that cultural, political and economic arrangements and personal freedoms are statistically significant determinants of growth for ninety countries in the period of 1968-1987.

In Dawson (1998)'s study, empirical results indicate that economic freedom has significantly positive impact on growth in a large sample of countries over the years 1975-1990. His study's evidence suggests that the effect of economic freedom on growth works through both a direct effect on total factor productivity and an indirect effect on investment.

Wu and Dawis (1999) suggest that a democracy without a high degree of economic freedom cannot achieve high economic growth in their analysis for 100 countries in the period of 1975-1992. For a developing country, the key to economic development is to establish and sustain free market institutions and economic freedom.

Barro (1999) finds that improvements in the standard of living predict increases in democracy his analysis for 100 countries from 1960 to 1995. Rodrik (1999) find that positive relations among labor productivity, income levels, the level of manufacturing wages and democracy. Haan and Sturm (2000) investigate connection between economic freedom and economic growth. Their paper compares various indicators for economic freedom. Their conclusion is that greater economic freedom fosters economic growth. Przeworski et al. (2000) indicates positive relations between democracy and development, as former studies.

Strum and Haan (2001) provide a formal analysis of the importance of outlying observations in the relationship between economic freedom and economic growth. Their studies show that the change in economic freedom is strongly related to economic growth. However, the level of economic freedom is not related to growth. Hayo (2001) analyzes whether attitudes towards the progress in democratization in Eastern Europe is influenced by economic factors. Heo and Tan (2001) perform causal analysis about relations between democracy and economic growth.

Another empirical research has shown that both more economic freedom and a higher stability of policy variables are supportive for economic growth. Thus, the path of economic and policy liberalization may

have a considerable influence on a nation's growth performance (Pitlik, 2002). Öniş and Türem (2002) look into relations among entrepreneurs, democracy, and citizenship in Turkey. Ali (2003) reveal that countries with high levels of economic growth are characterized by high levels of economic freedom and judicial efficiency, low levels of corruption, effective bureaucracy, and protected private property. Rabinson (2006) has shown affirmatively effects of economic development on democracy.

Contrary to positive correlations between economic freedom, democracy and growth, some researches get negative results. For example, Santhirasegaram (2007) finds different results from existing literatures and policy prescriptions on that positive role of democratic and economic freedom for economic growth. According to this paper, economic freedom is negatively related with economic growth especially in developing countries.

In the next section, we will give information about data and methodology, especially spatial techniques.

3. DATA, METHODOLOGY AND FINDINGS

The data of Economic Freedom Index[3] is composed by The Heritage Foundation by using some components for 40 European countries in the period of 1995-2009. We use the average 2006 and 2008 values of The Economist Intelligence Unit's index of democracy[4]. Due to data limitations about Democracy Index, we had to use only 2006 and 2008 figures. Per Capita Gross Domestic Product (PPP- purchasing power parity – constant prices) comes from The World Bank WDI[5] (World Development Indicators) Online databases for average values of 1995-2009 period.

To analyze spatial economic relations between Europe countries, we use GeoDa (Geographic Data Analysis) software package which conducts Spatial Data Analysis, geovisualization, spatial autocorrelation and spatial modeling.[6]

3.1. Quartile Maps

Our analysis start with the quartile maps of the distribution of our variables for each country. Darker colors explain higher values and lighter colors show lower values in quartile map in for all variables.

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[3] The Heritage Foundation composes Economic Freedom Index by using some components: Business Freedom, Trade Freedom, Fiscal Freedom, Government Size, Monetary Freedom, Investment Freedom, Financial Freedom, Property Rights, Freedom from Corruption, Labor Freedom. (www.heritage.org)

[4] Democracy Index consists of Electoral Process and Pluralism, Functioning of Government, Political Participation, Political Culture and Civil Liberties. This index starts from 2006 and the latest values are in 2008. (www.economist.com)

[5] Look at http://data.worldbank.org/data-catalog/world-development-indicators

[6] Here are some of the studies in this regard: Rey and Montouri (1999), Ying (2000), Manfred et al. (2001), Le Gallo and Ertur (2003), Van Oort and Artezema (2004), Dall'erba (2005), Voss et al. (2006), Ezcurra et al. (2007), Ezcurra et al. (2008), Battisti and Di Vaio (2008), Celebioglu and Dall'erba (2010).

Figure. 1: Per Capita GDP (Averagely 1995-2009) in Europe (40 Countries)

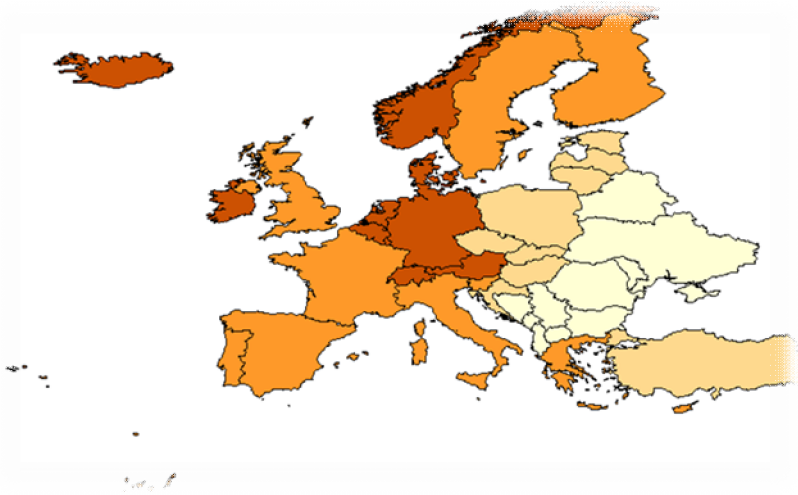


Figure 1 shows that per capita GDP is especially high values in West Europe Countries. Iceland, Denmark, Ireland, Germany, Austria, Switzerland, Netherlands, Belgium and Norway have the highest values that compare with other European countries. On the contrary, Belarus, Ukraine, Moldova, Serbia, Romania, Bosnia & Herzegovina, Bulgaria, Montenegro, Macedonia and Albania have the lowest values in this analysis.

Figure. 2: Democracy Index Values (average of 2006-2008) in Europe (40 Countries)

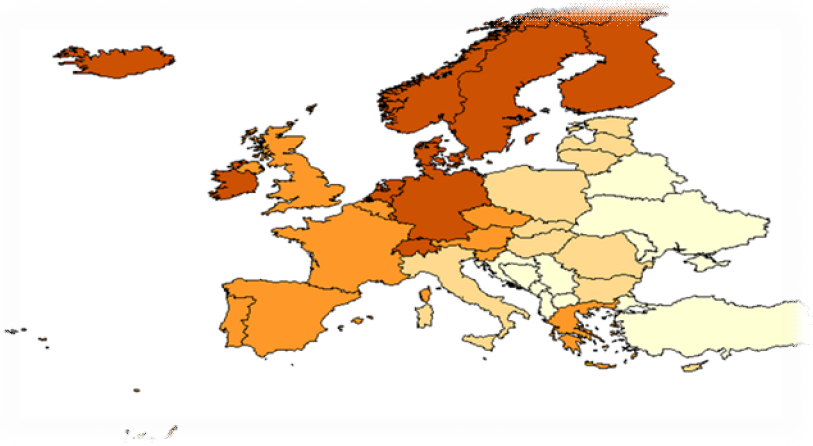
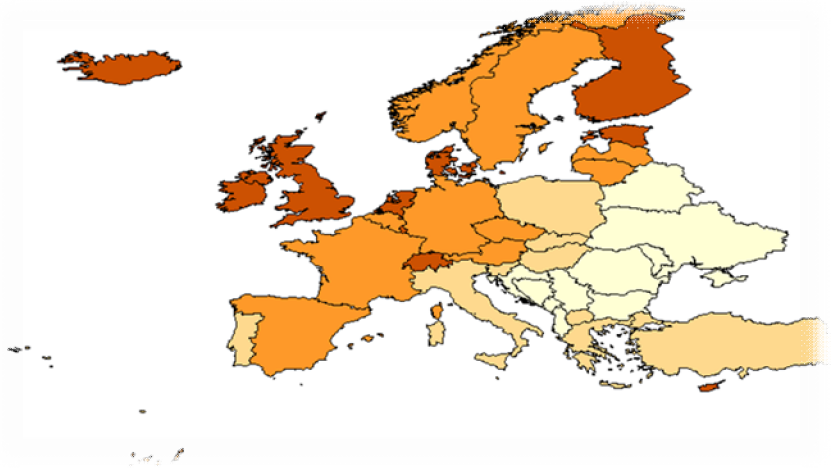


Figure 2 displays distribution of democracy values of each country. According to figure 2, especially Middle and North Europe countries (Iceland, Finland, Denmark, Ireland, Luxemburg, Germany, Switzerland,

Netherland, Norway and Sweden) have the highest democracy index values. East Europe countries have the lowest democracy figures.

Figure 3 presents economic freedom index values for 40 Europe countries. In this figure, we can see mostly West Europe countries that have higher values and East Europe countries that have lower values in scope of this index. Countries that have the highest values are Iceland, Finland, Estonia, United Kingdom, Denmark, Ireland, Luxemburg, Switzerland, Cyprus and Netherland.

Figure. 3: Economic Freedom Index Values (average of 1995-2009) in Europe (40 Countries)



3.2. Spatial Weight Matrix

A spatial weight matrix is the necessary tool to impose a neighborhood structure on a spatial dataset. As usual in the spatial statistics literature, neighbors are defined by a binary relationship (0 for non-neighbors, 1 for neighbors). Weight matrix calculation is performed under GeoDa. It can be used two basic approaches for defining neighborhood: contiguity (shared borders) and distance. Contiguity-based weights matrices include rook and queen. Areas are neighbors under the rook criterion if they share a common border, not vertices. Distance-based weights matrices include distance bands and k nearest neighbors. Based on these two concepts, we decided to create weight matrices to investigate the distribution of our variables of interest: k_4 nearest neighbor matrix. Due to space constraints, we present the k_4 nearest neighbor matrix only below:

$$\begin{cases} w_{ij}(k) = 0 \; if \; i = j \\ w_{ij}(k) = 1 \; if \; d_{ij} \le D_i(k) \; and \; \overset{*}{w}_{ij}(k) = w_{ij}(k) / \sum_j w_{ij}(k) \; for \; k = 4 \\ w_{ij}(k) = 0 \; if \; d_{ij} > D_i(k) \end{cases} \quad (1)$$

where $d_{i,j}$ is great circle distance between centroids of region i and j and $D_i(k)$ is the 4th order smallest distance between regions i and j such that each region i has exactly 4 neighbors. Now that the weight matrix has been defined, we estimate a couple of spatial statistics that will shed some light on the spatial distribution of our variables. The most common of them is Moran's I which is a measure of global spatial autocorrelation (Anselin, 1988).

3.3. Calculation of Moran's I for Global Spatial Autocorrelation

Spatial autocorrelation refers to the correlation of a variable with itself in space. It can be positive (when high values correlate with high neighboring values or when low values correlate with low neighboring values) or negative (spatial outliers for high-low or low-high values). Note that positive spatial autocorrelation can be associated with a small negative value (e.g., -0.01) since the mean in finite samples is not centered on 1. Spatial autocorrelation analysis includes tests and visualization of both global (test for clustering) and local (test for clusters) Moran's I statistic (Anselin et al. 2006).

Global spatial autocorrelation is a measure of overall clustering and it is measured here by Moran's I. It captures the extent of overall clustering that exists in a dataset. It is assessed by means of a test of a null hypothesis of random location. Rejection of this null hypothesis suggests a spatial pattern or spatial structure, which provides more insights about a data distribution that what a quartile map. For each variable, it measures the degree of linear association between its value at one location and the spatially weighted average of neighboring values (Anselin et al. 2007; Anselin 1995) and is formulized as follows:

$$I_t = \frac{\sum_{i=1}^{n}\sum_{j=1}^{n} w_{ij}^{*}(k)\,x_{it}x_{jt}}{\sum_{i=1}^{n}\sum_{j=1}^{n} x_{it}x_{jt}} \qquad (2)$$

Where w_{ij}^{*} is the (row-standardized) degree of connection between the spatial units i and j and $x_{i,j}$ is the variable of interest in region i at year t (measured as a deviation from the mean value for that year). Values of I larger (smaller) than the expected value E(I) = -1/(n-1) indicate positive (negative) spatial autocorrelation. In our study, this value is (-0.0256). There are different ways to draw inference here. The approach we use is a permutation approach with 999 permutations. It means that 999 re-sampled datasets were automatically created for which the I statistics are computed. The value obtained for the actual dataset has then been compared to the empirical distribution obtained from these re-sampled datasets.

The results of Moran's I are presented in table 1 below. All the results indicate a positive spatial autocorrelation, i.e. the value of a variable in one location depends positively on the value of the same variable in neighboring locations. For instance, when the per capita income in one province increases by 1%, the one of its neighbors increases by slightly more than 69%. All of our three variables of interest are significant (at 1%) with the k_4 nearest neighbor matrix. For this reason, this is the weight matrix we will use in the rest of our study.

Table 1: The results of Moran's I for the nearest four neighbors

Variables	K_4
Per capita GDP (average values of 1995-2009)	0.6952 (0.001)
Democracy Index Values (average of 2006-2008)	0.5281 (0.001)
Economic Freedom Index (average values of 1995-2009)	0.6285 (0.001)

Note: p-values are into brackets

3.4. Moran's Scatterplots

The Moran scatter plot complements Moran's I because it provides to categorize the nature of spatial autocorrelation into four types: low-low (LL), low-high (LH), high-low (HL) and high-high (HH). The x-axis captures the value of a variable compared to the average value of the sample. For example, all the points on the right hand side of the figure mean (the vertical axis in the middle) that in the corresponding provinces, the value of the variable under study was above the sample's average. On the other hand, the y-axis captures the average value of the same variable in the neighboring locations (with the neighbors being defined by the weight matrix). For instance, all the points below the mean (the horizontal axis in the middle of the figure) represent provinces of which neighbors display, on average, a lower value than the sample's mean.

The result of this approach is a figure with four windows which reflect the correlation between the relative (to the mean) value of a variable in one location and the relative value of the same variable in neighboring locations. For instance, the quadrant HH means a high value in the studied area and a high value in the neighboring areas. Regions located in quadrants I and III refer to positive spatial autocorrelation, i.e. the spatial clustering of similar values, whereas quadrants II and IV represent negative spatial autocorrelation, i.e. the spatial clustering of dissimilar values. Note also that the link between a scatter plot and Moran's I is reflected by a line of which slope is the value of Moran's I statistic.

Figure. 4: Moran's Scatterplot for per capita GDP in the period of 1995-2009

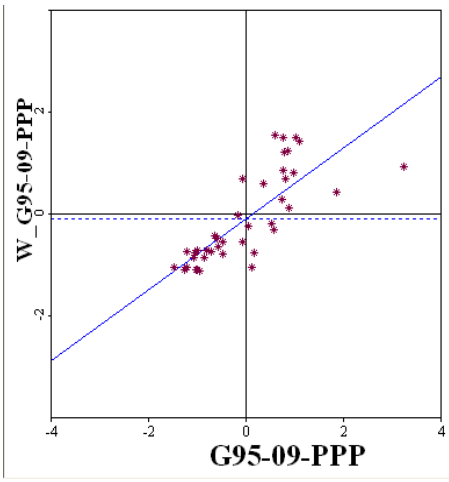


Figure. 5: Moran's Scatterplot for Democracy Index in 2006 and 2008

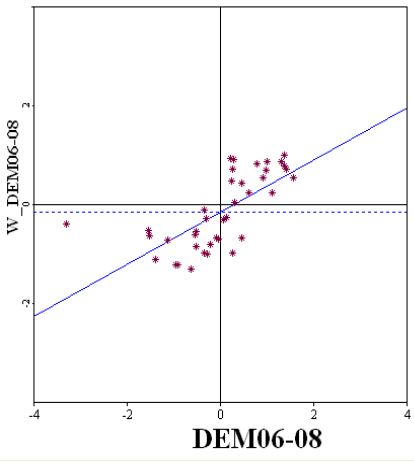
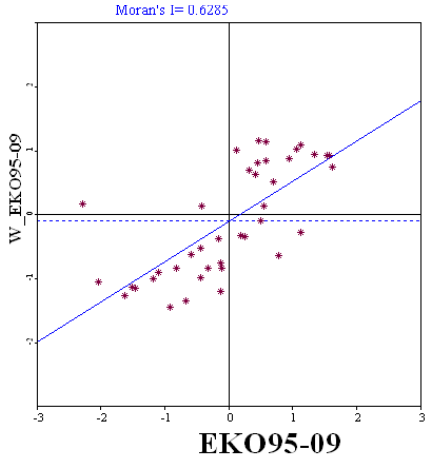


Figure. 6: Moran's Scatterplot for Economic Freedom Index in the period of 1995-2009



Figures 4 to 6 above show the Moran scatter plots of our variables of interest. All of the per capita GDP, Democracy Index and Economic Freedom Index have positive spatial autocorrelation that is reflected by the value of Moran's I and the fact that most of the provinces are located in quadrants HH and LL with HH displaying a cluster of West Europe countries while LL shows a cluster of East Europe countries. Once again, Moran's Scatter Plots reflects the dualistic structure of Europe's countries.

Table 2: Distribution of Spatial Autocorrelation

Variables	HH	LL	LH	HL
Per capita GDP (average values of 1995-2009)	Iceland, United Kingdom, Denmark, Ireland, Luxemburg, Germany, Austria, Switzerland, France, Netherland, Belgium, Spain, Norway, Sweden	Estonia, Latvia, Lithuania, Belarus, Poland, Ukraine, Slovakia, Moldova, Hungary, Serbia, Romania, Bosnia&Herzegovina, Croatia, Bulgaria, Montenegro, Macedonia, Albania, Malta, Turkey	Portugal, Czech Republic	Finland, Slovenia, Cyrus, Greece, Italy
Democracy Index Values (average of 2006-2008)	Iceland, Finland, United Kingdom, Denmark, Ireland, Luxemburg, Czech Republic, Germany, Austria, Switzerland, France, Netherland, Belgium, Portugal, Spain, Norway, Sweden	Estonia, Latvia, Lithuania, Belarus, Ukraine, Slovakia, Moldova, Hungary, Serbia, Romania, Bosnia&Herzegovina, Croatia, Bulgaria, Montenegro, Macedonia, Albania, Cyrus, Turkey	Poland	Slovenia, Malta, Greece, Italy
Economic Freedom Index (average values of 1995-2009)	Iceland, Finland, United Kingdom, Denmark, Ireland, Luxemburg, Germany, Austria, Switzerland, France, Netherland, Belgium, Portugal, Spain, Norway, Sweden	Ukraine, Slovakia, Moldova, Hungary, Slovenia, Serbia, Romania, Bosnia&Herzegovina, Croatia, Bulgaria, Montenegro, Macedonia, Albania, Malta, Greece, Turkey, Italy	Belarus, Poland	Czech Republic, Cyrus, Estonia, Latvia, Lithuania,

Table 2 shows the name of the regions according to their distribution in the Moran scatterplot quadrants. Positive spatial autocorrelation is reflected by the fact that most countries are in the high-high and low-low quadrants. More definitely, for all variables, the West Europe countries are mostly High-High areas while the East ones are Low-Low. Obviously, the Low-High and High-Low quadrants contain fewer countries.

3.5. LISA Statistics for Local Spatial Autocorrelation

LISA statistics (Local Indicators of Spatial Association) measure, by definition, the presence of spatial autocorrelation for each of the location of our sample. It captures the presence or absence of significant spatial clusters or outliers for each location. Combined with the classification into four types defined in the Moran scatter plot above, LISA statistics indicates significant local clusters (high–high or low–low) or local spatial outliers (high–low or

low–high). The average of the Local Moran statistics is proportional to the Global Moran's I value (Anselin 1995; Anselin et al. 2007).

Anselin (1995) formulated the local Moran's statistics for each region (I) and year (t) as follows:

$$I_i = \left(\frac{x_i}{m_0}\right)\sum_j w_{ij}x_j \quad with \;\; m_0 = \sum_i x_i^2 / n \tag{3}$$

where w_{ij} is the elements of the row-standardized weights matrix W and $x_i(x_j)$ is the observation in region *i(j)*. The significant results (at 1%) of the LISA statistics are presented in table 3. Their significance level is based on a randomization approach with 999 permutations of the neighboring provinces for each observation.

Table 3: LISA analysis results (at 1% significant)

Countries	Per capita GDP	Democracy Index	Economic Freedom Index	Countries	Per capita GDP	Democracy Index	Economic Freedom Index
Albania	LL	LL	LL	Lithuania	LL	LL	
Austria				Luxembourg			
Belarus	LL			Macedonia	LL		LL
Belgium	HH	HH	HH	Malta			
Bos. and Her.			LL	Moldova	LL	LL	LL
Bulgaria			LL	Montenegro	LL	LL	LL
Croatia			LL	Netherlands	HH	HH	HH
Cyprus	HL			Norway		HH	HH
Czech R.				Poland			
Denmark	HH	HH	HH	Portugal			HH
Estonia				Romania	LL		LL
Finland				Serbia	LL	LL	LL
France	HH	HH	HH	Slovak R.			
Germany	HH	HH	HH	Slovenia			
Greece	HL	HL	LL	Spain			
Hungary	LL		LL	Sweden			
Iceland		HH	HH	Switzerland	HH		HH
Ireland			HH	Turkey	LL		
Italy				Ukraine	LL	LL	LL
Latvia	LL	LL		United K.	HH		HH

The randomization approach is used in the context of a numeric permutation approach to describe the computation of pseudo significance levels for global and local spatial autocorrelation statistics. In order to determine how likely it would be to observe the actual spatial distribution at hand, the actual values are randomly reshuffled over space 999 times. Table 3

point out that some Eastern Europe countries (Albania, Moldova, Montenegro, Serbia, and Ukraine) display LL-type autocorrelation for all variables. Besides some countries of West part of Europe (Belgium, Denmark, France, Germany, and Netherlands) shows HH-type auto correlation for all variables. We also provide the LISA maps (figures 7 to 9) as a visual representation of our results.

Figure 7: LISA Cluster Map of per capita GDP

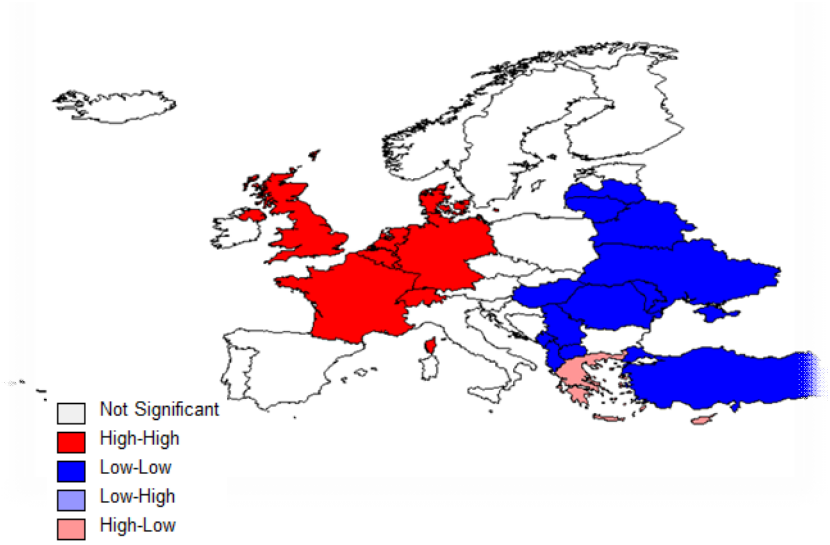


Figure 8: LISA Cluster Map of Democracy Index

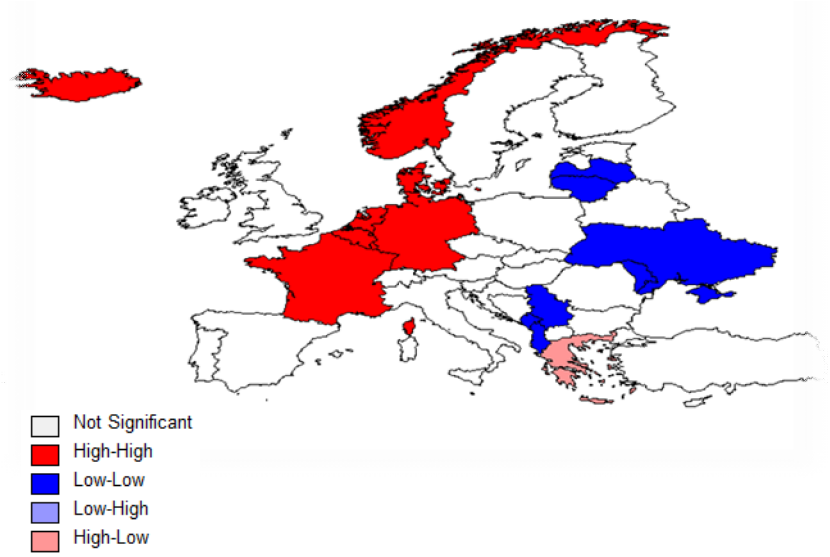
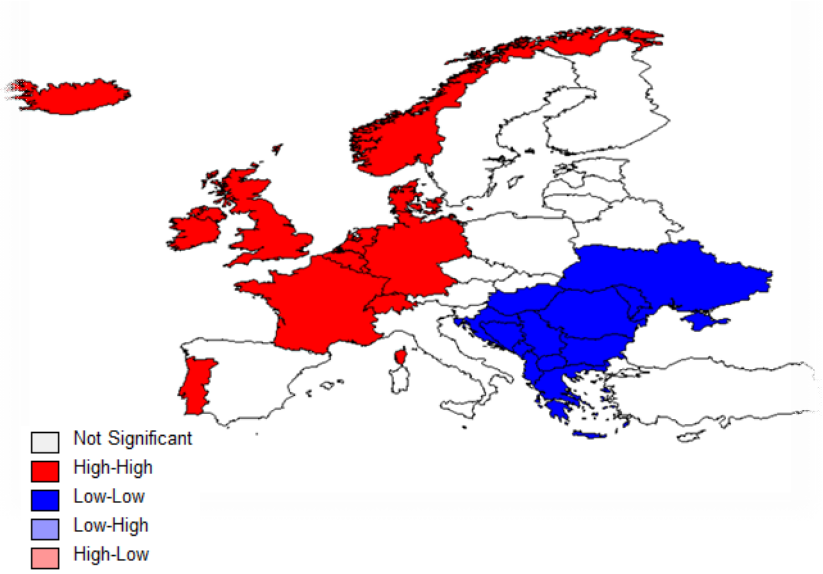


Figure 9: LISA Cluster Map of Economic Freedom Index



4. CONCLUDING REMARKS

The aim of this paper is to examine spatial distribution of democracy, economic freedom and economic growth by using spatial data and techniques for European countries. For this purpose we use quartile maps, Moran's Scotterplots and LISA (Local Indicators of Spatial Association) statistics.

We investigate spatial distribution of per capita GDP in the period of 1995-2009, democracy index in 2006-2008 and economic freedom index over 1995-2009. First of all, our quartile maps show that there is an important development level gap between West and East part of Europe. Secondly, when we estimate spatial autocorrelation by means of Moran's I, our results indicate positive (and significant) global autocorrelation for all of our variables and thus indicating the geographical location of a country influences its level of per capita GDP, democracy index and economic freedom. These results are corroborated by the corresponding Moran's Scatterplots that display most of the Eastern Europe countries (particularly Albania, Moldova, Montenegro, Serbia, and Ukraine) in the LL quadrant and the western ones (as Belgium, Denmark, France, Germany, and Netherlands) in the HH quadrant. Thirdly, LISA statistics confirm the significant presence of local spatial autocorrelation and highlight spatial heterogeneity in the form of two distinct spatial clusters of high and low values of per capita GDP, level of democracy and economic freedom. And finally, we can say that there is an important spatial heterogeneity and spatial disparity in terms of our all variables. Distributions of our all variables are coinciding with each other.

Besides, similar to former studies our findings display that there are positive relations among per capita GDP, democracy and economic freedom. West European countries have a long term democracy background and economic freedom experience. But East European countries have been included to this process step by step in the last two decades. For this reason, West European countries have big advantages about relationships among growth rates, democracy and economic freedom.

We determine that nucleus countries of Europe are primarily Germany and France and additionally Belgium, Denmark and Netherlands. Because these countries (especially Germany and France), as both economic development level and economic size and population, are driving force for remain of Europe. Our analysis contains positive results on these countries. At the same time, these countries have a big share in compose of the European Coal and Steel Community (ECSC) that was formally established by the Treaty of Paris (1951) which created basis for the modern day the European Union. In this context, it can be concluded that economic weakness of Germany and France means impotence and powerlessness for all of the Europe.

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