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## A COMPARATIVE SPATIAL ANALYSIS OF THE POSSIBLE EFFECTS OF ECONOMIC CRISIS IN GREECE AND RUSSIA ON PROVINCES IN TURKEY

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**Abstract:** *After 2008 global financial crisis some Europe countries which have excessive debt burden especially Greece, Iceland, Spain etc. effected negatively more than the others. On the other hand decrease in oil prices effected negatively some exporter countries for instance Russia, Venezuela etc. in this period. Greece and Russia are neighbor countries that has significant role on Turkey's foreign trade. In this aspect, it has been occurred some potential risks for provinces in Turkey which exporting to Greece and Russia.*

*This study aims to examine the possible effects of Greek and Russian economic crisis for provinces of Turkey by using spatial data and techniques. To identify risky areas first, it is created different choropleth maps of Turkey by using province based export data in particular Greece and Russia. Second, spatial dimensions of potential risks are discussed.*

*To test spatial dimensions of the variables, we perform an exploratory spatial data analysis on export values for provinces of Turkey. While our choropleth maps indicate that the some part of the country is significantly more related to foreign trade of the countries than the others, the tools of spatial statistics reveal the presence of spatial dependence across provinces. The presence of heterogeneity is reflected in the distribution of LISA statistics. Overall, this paper is original in terms of analyzing spatial dimensions of a current economic issue for provinces across Turkey.*

**Key Words:** *Export, Economic Crisis, Spatial Analysis, Exploratory Spatial Data Analysis (ESDA)*

**JEL Codes:** *F14, R12*

## INTRODUCTION

The main goal of all countries is economic growth. The most important case that negatively affect economic growth is the economic crisis. With an inclusive definition, economic crisis is a violent fluctuations in prices and/or amounts that beyond acceptable change limits in any goods, services, production factor or financial markets (Kibritçioğlu, 2001:174).

Besides the reasons stemming from internal dynamics, a country may also being affected seriously by a crisis which occurs elsewhere in the world. In a globalizing world the interdependence of international economic relations is increasing gradually. Thus a crisis occurring in a country can become regional and even global crisis in a short time. The most powerful example of this is 2008 global financial crisis that started in USA and spread all over the world immediately.

Many countries are faced with a new crisis without yet recovered from the effects of the global crisis. Crisis in Greece and Russia are the most recent ones of these. Greece became the epicenter of Europe's debt crisis after Wall Street imploded in 2008. With global financial markets still reeling, Greece announced in October 2009 that it had been understating its deficit figures for years, raising alarms about the soundness of Greek finances<sup>1</sup>. Since then, Greece has been supported by the so called Troika (the International Monetary Fund, the European Central Bank and the European Commission).

On the other hand, external shocks came to the fore in case of Russia. The main economic cause of crisis in Russia is the decline of international oil and gas prices. Since about 70 per cent of Russia's exports in value terms are oil and natural gas, demand for the ruble strongly decreased as a consequence of plunge in the oil price. Hence, the 59 per cent drop in average oil prices, from about \$108 per barrel to about \$44 per barrel, led to a dramatic decline in foreign exchange earnings (Götz et al. 2015:227).

The most important trade partners of the countries are often their neighbors. Therefore, the effects of the crisis in the neighboring can be felt more quickly and strongly. On the other hand Countries' prosperity depends largely on their cities' capacity to generate wealth, increase productivity, and to be the driver behind innovation. It, too, is clear that cities are the origin and the epicenter of

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1 [http://www.nytimes.com/interactive/2015/business/international/greece-debt-crisis-euro.html?\\_r=0](http://www.nytimes.com/interactive/2015/business/international/greece-debt-crisis-euro.html?_r=0)  
(Access date: 22.08.2015)

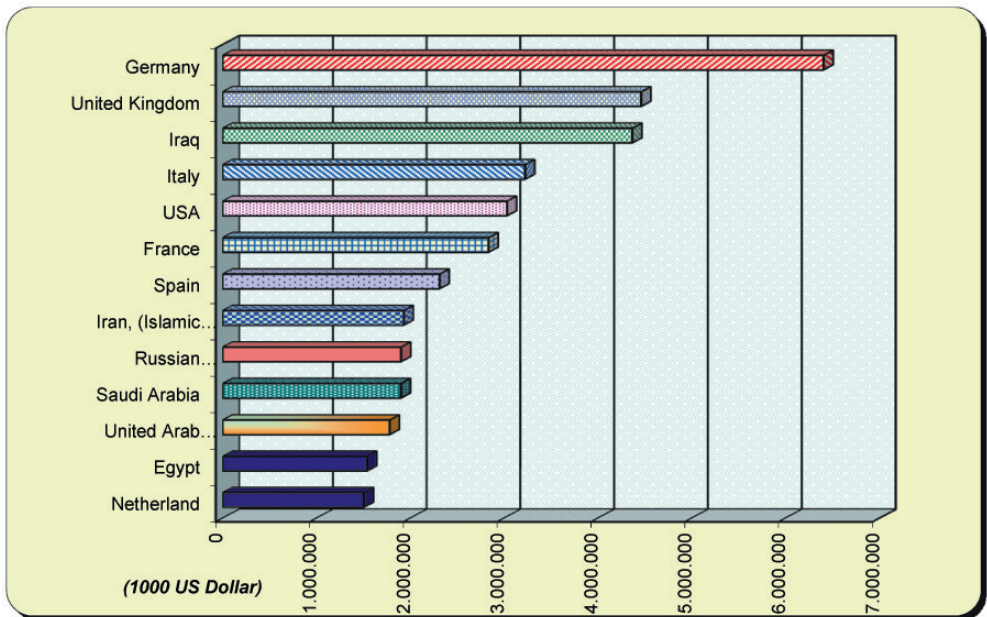
a crisis that will manifest itself in the most virulent and persistent form (Cohen, 2011:9). For this reason, province level analysis have crucial role to understand the impacts of crisis in details. From this point of view, it is aimed in this study to examine possible effects of ongoing crisis in Greece and Russia which are Turkey's neighbor to Turkish economy at province level.

In this regard, export figures for 2014 and 2015 from Turkey provinces to Greece and Russia were examined. The reason of using export data to identify potential risks at the provincial level is possible recession in export is among the leading indicators of crisis (Yücel and Kalyoncu, 2010). Export contraction may negatively affect employment depending on province's economic structure (Kalkan and Başdaş, 2009). On the other hand, according to a study conducted for Turkey, share of a province's export in total country is an important indicator of province's socio-economic development (Sakarya and İbişoğlu, 2015).

When we look at the situation of Greece and Russia in Turkey's export it is seen that both countries are important trade partners of Turkey. But especially Russia has one of the biggest share in Turkey's export.

Table 1 demonstrates the list of top countries has been made export from Turkey for the first half of the 2015. Russia comes 9<sup>th</sup> in this list. For the same period in 2014, Russia was the 6<sup>th</sup> country according to data of Turkish Exporter Assembly. Data shows the pivotal role of Russia in Turkey's export income. In comparison to Russia, Greece has more modest position in Turkey's export as 24<sup>th</sup> country. For the same period in 2014 Greece was the 26<sup>th</sup> country.

In the next sections of the study, after a literature overview potential risks of crisis will be analyzed with different Turkey choropleth maps by using province based export data in particular Greece and Russia. Then spatial dimensions of potential risks will be discussed.

**Table 1.** Top Countries in Turkey's Export

**Source:** Turkish Exporter Assembly, June, 2015.

## LITERATURE OVERVIEW

The effects of an economic crisis on a country's economy is a frequently analyzed issue. However, the number of studies analyzing the effects of the crisis on the provinces in the country is less. In fact, the crisis does not affect all regions of the country at the same level. For this reason, analyzing the effects of the crisis at region and province level became crucially important.

Lee et al. (2009), examined 2008 global recessions' impact on Britain's cities. According to findings not all the cities has affected from the crisis equally. In contrast to expectations, London and the South East has not affected the most from the recession. Greatest job losses have been in ex-industrial areas such as the West Midlands. One of the key factors for this result is the skill levels of the workforce. Cities with highly skilled populations have experienced the smallest increases in unemployment, those with low skill levels have experienced the largest increases (Lee et al. 2009:4).

During the 4<sup>th</sup> quarter of 2009 a survey carried out by the URBACT on the impact of economic crisis on European cities and their responses to it. According to responses from 131 cities from 24 EU countries and Switzerland over %80 of ci-

ties reported that they had been severely affected by the crisis. The most common reason cited by cities for the problems faced by businesses was drying up of both private credit and private markets – with sectors most affected being construction and (export led) industry. Report shows that some cities are more resilient due to a local economy based on SMEs operating locally and self-financed rather than dependent on bank credits; an economy based on the service sector; lower connection to international markets and an important internal demand.

Marelli et al. (2012) have investigated first, has there been a reversal in employment and unemployment dynamics at a regional level during the crisis (2007–10) compared with the previous period (2004–07) second, have the western regions behaved differently in response to the crisis compared with the eastern regions and finally are the differences between the two groups of regions related to structural or institutional variables? An important result is that, in general, a 2007–10 trend reversal was common to many European regions, thus confirming that the crisis hit the regions which had been more successful in the recent past more heavily. Spatial dimensions of effect is also analyzed in the study. It is found either unobserved and spatially correlated relevant explanatory variables or significant spatial spillovers. Another specific result is that western European (OMS) regions were sensitive to sector specialization, in that the construction sector was a negative factor, both in terms of employment and unemployment.

Psycharis et al. (2014), analyzed the determinants of regional development in Greece before (2005–2008) and during (2009–2011) the economic crisis. To explain spatial dimensions of effects, the Spatial Autoregressive Model (SAR) and the Spatial Error Model (SEM), have been used. Results highlight that the most urbanized and high income level regions are more affected by the economic crisis. However, these regions had been the ones that most benefited during the upturn of the economic activity.

Gluschenko (2015), investigated whether the global crisis has had a persistent effect on inter-regional inequality in real incomes and integration of regional goods markets. Income inequality is found not to be affected by the crisis, although it caused halting rise in real incomes in the country. No significant changes were found in the degree of spatial market integration in Russia that could be assigned to the crisis (Gluschenko, 2015:10).

Kabadayı (2013) examined the effects of 2008 Mortgage Crisis on the cities of Turkey. To analyze effects of the crisis he used current bank credit per capita and

external trade structure. According to results, relatively less developed cities were affected by crisis less than developed cities of Turkey.

Another study that examines effects of crisis in Turkey at province level is belong to Kalkan and Başdaş (2009). In the study relationship between export structure of provinces and unemployment rate after 2008 global crisis is examined. According to Kalkan and Başdaş (2009) more integrated global economy and more export-oriented provinces have growing unemployment problem with the crisis. On the other hand, impact level of provinces of crisis varies according to regional differences of countries they export. It has also seen in the research that while the MENA region's share in the total export of the provinces' increases there has been limited fall in employment.

There is not much study that makes spatial analysis of economic crisis (especially in terms of export) at province level in the literature. In particular, the study of spatial analysis in Turkey is very limited. Another regional export study that ESDA<sup>2</sup> analysis used in literature cannot be found. With this aspect, this paper makes contribution to the literature.

## DATA

In this study, the change in export performance of provinces in Turkey after the economic crisis in Greece and Russia is analyzed. Province based export data is obtained from Turkish Exporter Assembly<sup>3</sup>. Data belongs to 1 Jan – 30 Jun for years 2014-2105. These periods were selected to make comparison the effects of the crisis. To test spatial dependency Exploratory Spatial Data Analysis is used. This analysis is performed with GeoDa programme.

## METHODOLOGICAL BACKGROUND

### Distributions of Variables

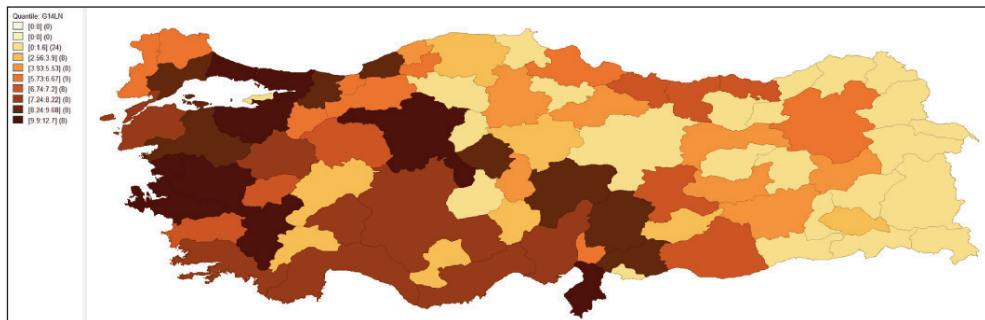
First of all we look at quantile maps (below) by using GeoDa program. The darker areas indicate a greater level of relative of all variables in these distributions, while the lighter areas show that lower values of our variables.

2 Here are some of the studies in this regard: Rey and Montouri (1999), Ying (2000) Manfred et al. (2001), Le Gallo and Ertur (2003), Perobelli and Haddad (2003), Van Oort and Atzema (2004), Dall'erba (2005), Voss et al.. (2006), Ezcuerra et al. (2007, 2008), Battisti and Di Vaio (2008), Celebioglu and Dall'erba (2010), Altay and Celebioglu (2012), Altay and Celebioglu (2015).

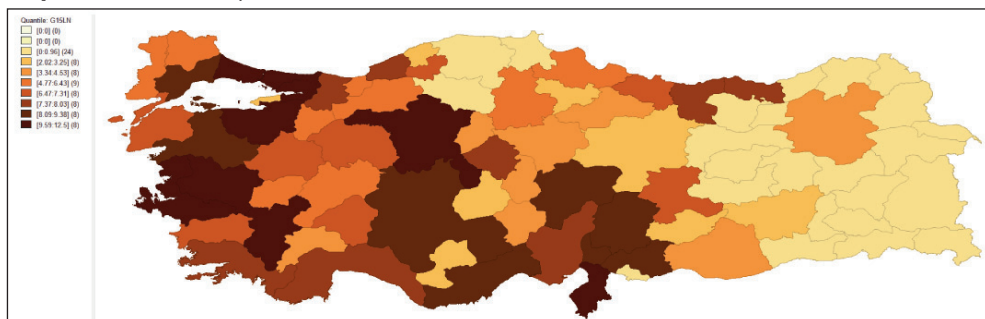
3 Look at Turkish Exporter Assembly website: <http://www.tim.org.tr/en/>



**Map 1.** Province Level Export Values to Greece in 2014



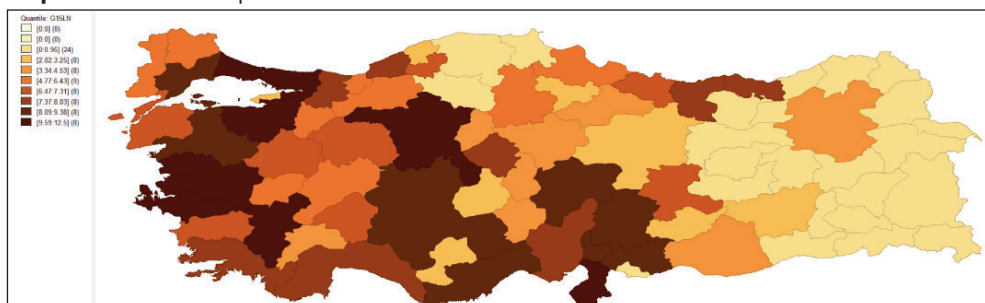
**Map 2.** Province Level Export Values to Greece in 2015

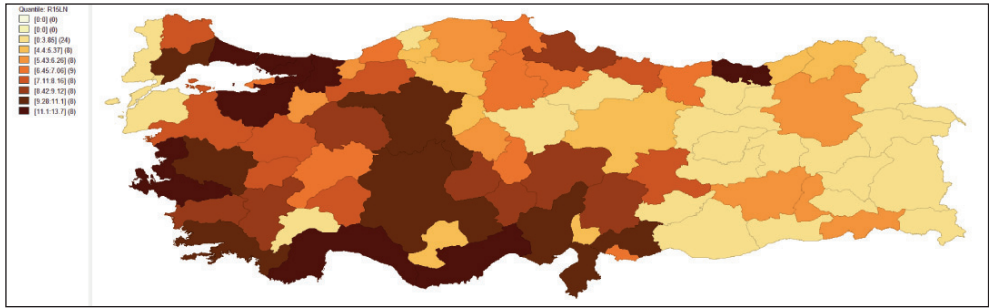


Although total export from Turkey to Greece in first half of 2014 is 747.915.568 dollar, for the same period of 2015 export number is 663.518.708 dollar. Turkey has lost more than 11 percent of export income from Greece.

Map 1 and Map 2 show regional disparities about exportation to Greece for 2014 and 2015. After Greece financial crisis (in 2015), some Turkish provinces (such as Erzurum -94%, Şanlı Urfa -89%, Bartın -89%, Zonguldak -75%, Diyarbakır -79%, Manisa -36%, Hatay -29%, Antalya -19%, İstanbul -17%, Ankara -15%, Gaziantep -15%) have experienced significant decrease in export to Greece.

**Map 3.** Province Level Export Values to Russia in 2014



**Map 4.** Province Level Export Values to Russia in 2015

Although total export from Turkey to Russia in first half of 2014 is 3.012.893.801 dollar, for the same period of 2015 export number is 1.900.380.684 dollar. Turkey has lost almost 37 percent of export income from Russia.

According to Map 3 and Map 4, exportation from some Turkish provinces (such as Şanlı Urfa -100%, Burdur -80%, Kastamonu -79%, Malatya -78%, Batman -68%, Bursa -59%, Bilecik -58%, Gaziantep -42%, Ankara -41%, Manisa -39%, İstanbul -38%, İzmir -31%) to Russia sharply decreased in 2015.

These quantile maps (map 1-4) show that there is important disparity for the variables. For this reason, we use Exploratory Spatial Data Analysis (ESDA) for the data set.

## Exploratory Spatial Data Analysis

### 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). We have used two basic approaches to define 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 (Anselin, 1988).

Based on these two concepts, we decided to create a weight matrix to investigate the distribution of our variables of interest: queen neighbor matrix. Queen Weight Matrix indicate whether spatial units share a boundary or not. If the set of boundary points of unit  $i$  is denoted by band ( $i$ ). We give the queen neighbor



matrix only below:

$$w_{ij} = \begin{cases} 1, & \text{bnd}(i) \cap \text{bnd}(j) \neq \emptyset \\ 0, & \text{bnd}(i) \cap \text{bnd}(j) = \emptyset \end{cases} \quad (1)$$

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.

### 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 values correlate with low neighboring values low) 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 than what a quantile map or box plot does. 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 formulated as follows:

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

Where  $w_{ij}^*$  is the (row-standardized) degree of connection between the spatial units  $i$  and  $j$  and  $x_{ij}$  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 (-0.0125). 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.

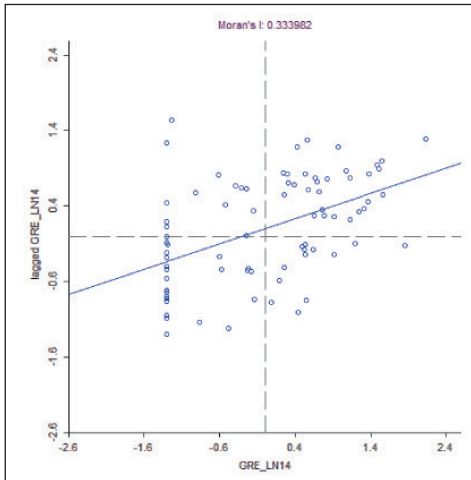
**Table 2.** Moran's I and P Values

Variables	K_7	K_8	K_9	ROOK	QUEEN
Greece 2014	0,3579 (0,001)	0,3487 (0,001)	0,3423 (0,001)	0,3315 (0,001)	0,3340 (0,001)
Russia 2014	0,3572 (0,001)	0,3495 (0,001)	0,3410 (0,001)	0,4104 (0,001)	0,4084 (0,001)
Greece 2015	0,525527 (0,001)	0,50992 (0,001)	0,502782 (0,001)	0,531091 (0,001)	0,532843 (0,001)
Russia 2015	0,395626 (0,001)	0,383558 (0,001)	0,376831 (0,001)	0,438739 (0,001)	0,445064 (0,001)

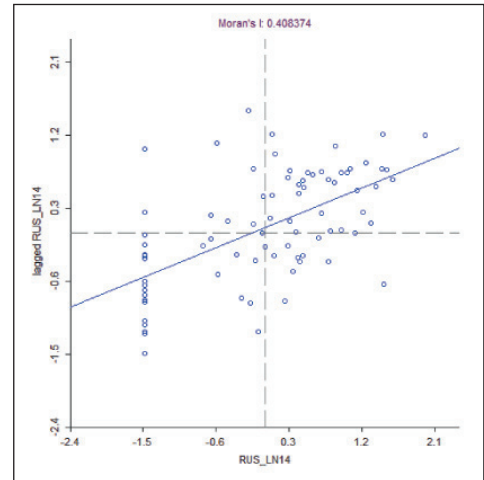
**Note: P values into brackets.**

The results of Moran's I are given in table 2 above. 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. Because of Moran's I value of export numbers is the highest value for queen matrix, we decided to use queen.

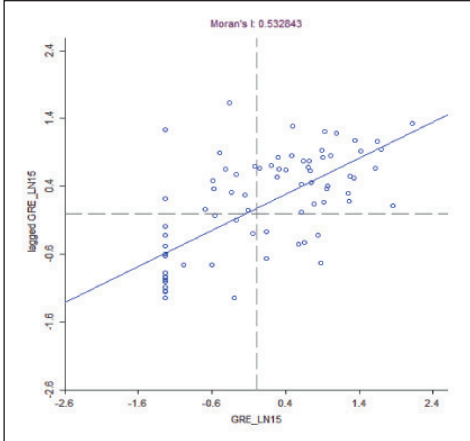
**Figure 1.** Moran's Scatterplot for Export from Turkish Provinces to Greece in 2014



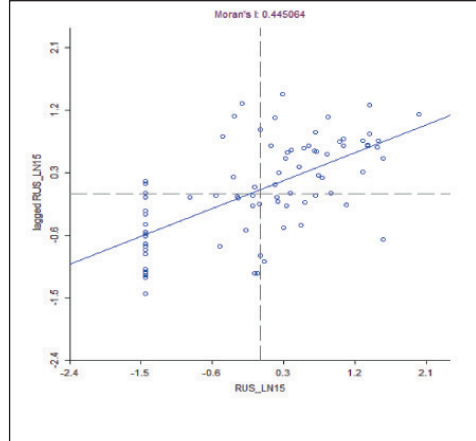
**Figure 2.** Moran's Scatterplot for Export from Turkish Provinces to Russia in 2014



**Figure 3.** Moran's Scatterplot for Export from Turkish Provinces to Greece in 2015



**Figure 4.** Moran's Scatterplot for Export from Turkish Provinces to Russia in 2015



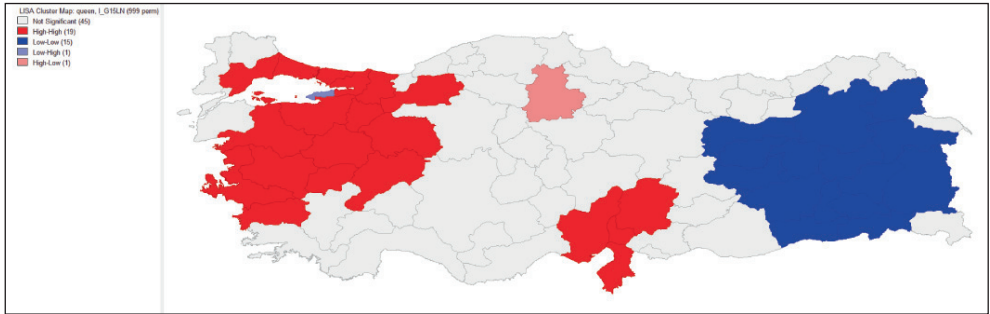
### LISA Analysis of the Variables

LISA statistics (Local Indicators of Spatial Association) can be defined 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 three types defined in the Moran scatter plot above, LISA 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).

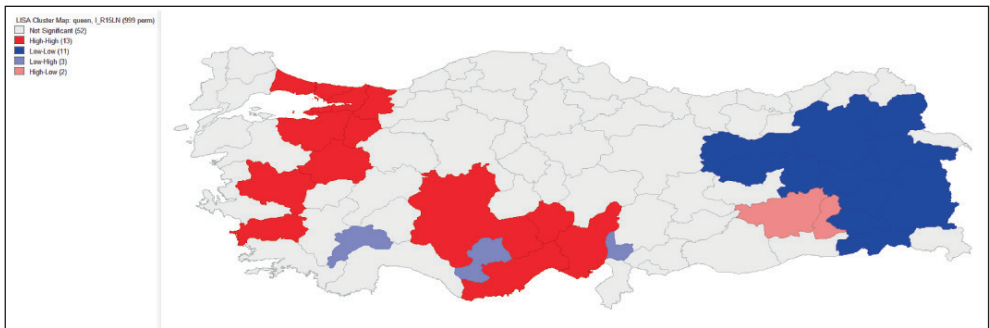
Anselin (1995) formulated the Local Moran's statistics for each region  $i$  and year  $t$  as the follows:

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

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 5%) of the LISA statistics are given in table 3. Their significance level is based on a randomization approach with 999 permutations of the neighboring provinces for each observation.

**LISA Map 1.** Province Level Export Values to Greece in Turkey (2015)

According to LISA Map 1, provinces have blue color (mostly in East and South East Anatolian provinces - Ağrı, Batman, Bingöl, Bitlis, Diyarbakır, Elazığ, Erzincan, Erzurum, Kars, Mardin, Muş, Siirt, Şırnak, Tunceli, Van) show that this part of the country is a negative concentration center for export to Greece. It is expected that this provinces won't be affected by possible crisis in Greece because of low trade relationship. On the other hand, red areas (mostly in West and Middle Anatolian provinces- Adana, Afyon, Aydın, Balıkesir, Bilecik, Bolu, Bursa, Eskişehir, Hatay, İstanbul, İzmir, Kahramanmaraş, Kocaeli, Kütahya, Manisa, Osmaniye, Sakarya, Tekirdağ, Uşak) are positive concentration centers therefore open to risks against possible decrease in demand depend on crisis in Greece. White color provinces show statistically insignificant country values in the LISA Map 1.

**LISA Map 2.** Province Level Export Values to Russia in Turkey (2015)

It can be clearly understood from LISA Map 2 that provinces which have low-low values in the East and South East regions (Ağrı, Bingöl, Bitlis, Erzincan, Erzurum, Kars, Muş, Siirt, Van, Şırnak, Tunceli) have insignificant level of exportation Russia. This implies that possible crisis in Russia will have very low impact to these provinces. Besides the provinces which have high-high values (Aydın, Adana, Afyon, Bilecik, Bursa, Çel, İstanbul, Kocaeli, Konya, Kütahya, Manisa,

Niğde, Sakarya, Yalova) is located in West and Middle part of the country. These cities have possibility to be affected negatively in case a crisis occurs in Russia. Because they have strong export relationships with Russia.

**Table 3.** Provinces with significant LISA statistics at 5% (spatial weight matrix queen)

	HH	LL	LH	HL
<b>Greece 2015</b>	Adana, Afyon, Aydın, Balıkesir, Bilecik, Bolu, Bursa, Eskişehir, Hatay, İstanbul, İzmir, Kahramanmaraş, Kocaeli, Kütahya, Manisa, Osmaniye, Sakarya, Tekirdağ, Uşak	Ağrı, Batman, Bingöl, Bitlis, Diyarbakır, Elazığ, Erzincan, Erzurum, Kars, Mardin, Muş, Siirt, Şırnak, Tunceli, Van	Yalova	Çorum
<b>Russia 2015</b>	Afyon, Adana, Aydın, Bilecik, Bursa, İçel, İstanbul, Kocaeli, Konya, Kütahya, Manisa, Niğde, Sakarya, Yalova	Ağrı, Bingöl, Bitlis, Erzincan, Erzurum, Kars, Muş, Siirt, Van, Şırnak, Tunceli	Burdur, Kahramanmaraş, Osmaniye	Batman, Diyarbakır

## CONCLUSIONS

The impacts of ongoing crisis in Greece and Russia to Turkish economy has shown itself through the export channel. Turkey's export revenues from Greece and Russia decreased respectively 11% and 37% in the first half of 2015 compared to the previous year. Especially provinces that makes export to these countries have been affected more than others from the crisis. While east region of the country is not affected by the crisis, crisis is still a potential risk for the provinces in many industrialized western regions.

Provinces which have a strong export relationship with both countries and intensively affected by both crisis such as Ankara, Aydın, Balıkesir, Denizli, Gazi Antep, İstanbul, Kahraman Maraş, Kütahya, Manisa, Sakarya, Samsun, Tekirdağ, Zonguldak should develop new export strategies and diversify export markets.

In regards to the findings of previous studies on this subject, it can be said that there can be increase in unemployment in the provinces declining export revenue. On the other hand the provinces that have affected negatively by the crisis can adversely affect neighborly related provinces. In case of continuation of the crisis in Greece and Russia, in some provinces in Turkey there is a possibility of deepening economic problems. Therefore, it is important to do further studies on this subject.

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## Appendix: Location and Names of all Provinces in Turkey

