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The Survey of Economic Convergence and Spillover Effects between EU and Mediterranean Countries: a Spatial Econometric Perspective

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Abstract

In recent decades, economic growth and its determinants have been important issues in economics. Economists have made attempts to analyze economic relations of countries and to seek ways leading a higher rate of growth. Therefore, various models are drawn in this regard. Recent theoretical growth models have relied on the importance of externalities.

Today, it is found out a new round in global economy in which the economy of different nations have been closed and linked to each other. In new conditions of global economy, joint activities and signing agreements between countries could generate opportunities for them, and their economies converge. When a country raises its investment and improves technology, it spreads out of its borders. Hence, the subject of spillovers is discussed. In the literature, there is particular emphasis on the role of contiguity, trade and economic co-operations in transferring capital and technology resulting in a higher rate of economic growth. Less developed and developing countries can benefit from spillover effects knowledge and technology of developed countries, and they can go through development way more quickly –like Newly Industrialized Asian Countries. It is clear that benefiting from these externalities is influenced by domestic situation and capacity of each economy.

The objective of this study is to analyze convergence and spillover effects between EU and countries on the Southern side of the Mediterranean.

Keywords: Economic Convergence, Spillover Effects, EU, Mediterranean Countries, Spatial Econometrics, Contiguity, Solow-Swan Growth Model.

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I- Introduction

Recent structural changes in the world economy have deeply linked countries around the world to each other. In this way, they have impacts on each others. These impacts are generated through different ways such as contiguity, trade and economic co-operation. Findings obtained from different studies reveal a high rate of international transactions and mutual activities, so that country borders have lost their effectiveness. In the literature, the world economy is considered as a global village and pointed to globalization.

In these competitive conditions, co-operative groups and regional convergence have been made to maintain their commonwealth conditions of countries included. Therefore, a country cannot be effective and co-operation with others generates such opportunities as market expansion, technology transfer, agglomeration economies, economies of scale and regional spillovers.

Recent theoretical models show that a nation's growth rate is affected not only by its domestic conditions, but also by situations of other countries, especially contiguous countries and trade partners. According to the macroeconomic literature, any relationship between economic growth rate and primary level of income of a country is considered as economic convergence. As stated by Abramovitz (1986), convergence implies a long-run tendency towards the equalization of per capita income or product levels.

It is clear that an increase in the stock of reproducible factors and improvement in the level of technology raise the economic growth. Higher growth rate in not the only effect, but also there are some external effects which are known as spillovers. In fact, the effects of accumulation of factors and improvements of technology in an economy are not limited to the borders of that country and they generate some externalities that spill over the barriers of that economy. Thus, developing countries can benefit from current developed nations' knowledge and experiences, because this saves funding and time for them. An examination of methods employed for accessing spillover effects for both developing and developed countries is very important. Thus, the objective of the present study is to examine economic convergence and impacts of spillovers on economic growth of some European countries and their Mediterranean partners. For these purposes, we employ a simple growth model and propose the use of spatial econometric techniques in this regard.

This paper is divided into seven sections. Following introduction, section II provides a short review of some studies on economic convergence and regional spillovers. Section III will discuss the methodology. Section IV presents some evidences for the case of EU and Mediterranean countries, and the focus is on some issues concerning spatial econometrics in section V. Then, obtained results for the case study are discussed in section VI. The paper will close with a summary and conclude comments in Section VII.

II- Literature Review

In economic literature, many studies have focused on economic growth and its determinants. Economists have proposed different growth models. One the famous models in this regard is the Solow-Swan's growth model which considered the relationship between growth rate and primary level of per capita income and propose economic convergence hypothesis. That is, the lower primary level of real income per capita, the higher rate of growth is expected. Barro (1997) examined this hypothesis for about 100 countries over the period 1960-1990. He estimated the speed of conditional convergence by 2.5 percent, and concluded that investment attraction, changes in terms of trade, and so did not significantly affected the growth rates of these countries, while population growth rate and the government size being large had significant negative effects. Rey and Montoury (1999) investigated the role of income per capita convergence in the States of America. They reconsidered the question of US regional income convergence from a spatial econometric perspective. The purpose of the study was actually to provide new insights on the geographical dynamics of the US regional income growth pattern over the period 1929-94. The estimated speed of convergence was 1.9 percent that was consistent to other studies, such as Barro and Sala-i-Martin (1991). Significant positive coefficient of the spatial specified model showed that income growth rates of a state influence growth rates of its neighbor states.

Recent growth models have emphasized on the role of externalities and spillover effects. Lucas (1993) stated that when there are across economy spillovers in accumulating human capital, all economies will converge to the same stead-state, whenever their initial conditions. Coe et al (1994) examined the extent of technology spreading from developed countries to developing countries, and concluded that the spillovers of Research and development (R&D) of developed nations to developing nations are very important. Barro and Sala-i-Martin (1995) considered the role of neighboring countries on economic growth. They found out the weighted mean of incomes per capita of first-order geographical neighbors is significant as an explanatory variable in their specified model. Kubo (1995) theoretically presented that a region's inputs of production have an important role in the output of another regions. Ciccon (1996) observed how a large fraction of growth in total factor production (TFP) spreads out to the neighbors for a large sample of 98 countries. More evidence of regional spillovers is given in Quah (1996). The study shows how, once conducted to the levels in the neighboring regions, the distribution of the product per capita in the regions of the European Union (EU) appears to be more strongly concentrated than the real distribution. Vaya et al (1999) also conducted a study investigating externalities and its effect on economic growth rates of specific regions of Spain and EU. Like Rey and Montoury (1999), they employed the spatial econometric techniques. By considering a simple growth model, they have been concluded that the growth rates of a region are a positive function of the capital stock in its neighbors. Caniels and Verspagen (1999) considered a multi regional – multi country model in which knowledge spillovers among regions determine the growth of them. They have emphasized on the role of contiguity and distant on knowledge spillovers.

III- Specification of the Model

In this section, we first describe the Solow-Swan growth model and then expand that for considering spillovers, like Vaya et al (1999). In the Solow-Swan growth model, the focus is on the relationship between the growth rates and primary levels of per capita income. This model is based upon a neo-classical production function by such assumptions as fixed return to scale of production, decreasing return to scale for each production factor and a positive constant elasticity among factors. Accordingly, two hypotheses are considered: absolute and conditional convergence. Long-run tendency of economies towards a steady-state is known as "absolute convergence". A steady-state is defined as a situation in which different economic variables –including capital stock- grow by constant rates. This hypothesis addresses the important question of whether poor countries, as measured by low per capita incomes, display faster growth rates in per capita income than rich countries with higher per capita incomes (Rey and Montoury, 1999).

The hypothesis has been confirmed for homogenous economies such as states of America and regions of the EU, which have similar economic conditions, whereas it is not concerned with different economic structures. In these conditions, it should be thus expressed on conditional convergence where every country can converge toward its own steady-state. Convergence is indeed conditional, because the stable levels of economic variables depend on the structural factors including the saving rates, population growth rate, and the situation of production function, while these factors are significantly different across different countries. Regarding this hypothesis, a lower level of primary real GDP per capita with respect to the long-run or its steady-state, a higher rate of growth is expected and the speed of convergence increases. The steady-state has a positive relationship with the rate of savings and technology level, but it is affected negatively by the depreciation rate and population growth rate. Therefore, low primary per capita income doesn't indicate high growth, necessarily (Barro and Sala-i-Martin, 1995).

The specified model is like the model proposed in Vaya et al (1999), in which externalities arises from capital accumulation and technology improvement in a region and then spreads out of its borders to neighbors. That is, it is assumed that externalities are produced by rises in investment and technology and spill over to proximate economies. Following Romer (1990) who concluded that technology is a function of the total level of capital; in this model it is assumed that capital accumulation in an economy can lead to generating externalities, and technology is considered as a function of capital intensity –of course not capital stock. Also, technology improvements in other neighbor economies would cause spillovers spreading in that economy. This means that innovations related to investing capital goods can flow out amongst economies in an area. In other words, "investments in reproducible factors will be greater in those regions located in areas with high stocks of these factors, because externalities across regions within the area will increase the returns on these investments. In contrasts, incentives to invest will be lower in a region surrounded by others with low capital intensity" (Vaya et al, 1999).

Regarding these assumptions and the presence of spillover effects in the Solow-Swan model, an economic growth model involving regional spillover effects is specified as follow[1]:

$$GY_{it} = \alpha - (1- e^{-\beta})\, LGDP_{i,t-1} + \varphi\, GY_{pit} + \varphi\, (1- e^{-\beta})\, LGDP_{pi,t-1} \qquad (1)$$

Where GY_{it} and $LGDP_{i,t-1}$ denote annual growth rate of real income per capita for country i at time t and the natural logarithm of real income per capita for that country with one lag of period, respectively. The constant coefficient, α,is a function of the production level in the long-run equilibrium that depends on the return rate of savings and the effective rate of depreciation. β indicates the speed of economic convergence towards a steady state. The larger value of β, the higher speed of convergence will be obtained. A positive significant β implies the approval of convergence hypothesis. That is, "an economy that starts out proportionately further below its own steady-state position tends to grow faster" (Barro and Sala-i-Martin, 1995, p. 382).

The coefficient φ represents the importance of spillover intensity in total returns of a country. A significant positive φ means that both primary incomes per capita (also with significant β) and the growth rates of the contiguous countries affect the growth rate of each country. GY_{pit} and $LGDP_{pi,t-1}$ are defined respectively as the annual rate of real income per capita and the lag period of real income per capita (in logarithm) for countries which have spillover effects spreading to the country i. Because in this paper, the focus is on contiguity spillovers, we can state that GY_{pit} and $LGDP_{pi,t-1}$ are the average of growth rates and primary incomes per capita of neighbors of country i. It is clear that this model is like spatial models, by this definition. Of course, as mentioned in Vaya et al (1999), "the variables measuring the spillover effects find their place in the

1- Note that it is a version of Cobb-Douglas specification. For further discussion on the extraction of this model, see Vaya and et al (1999).

specification as a result of the hypothesis under which the model is built, not as a result of a posterior inclusion".

IV- The EU and Mediterranean Countries

The European Union (EU) was set up after the Second World War. The process of European integration was lunched on 9 May 1950 when France officially proposed to create "the first concrete foundation of a European federation". Now, the EU has 15 member States –Austria, Belgium, Denmark, Finland, France Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, and the United Kingdom- and is preparing for the accession of 13 eastern and southern European countries. It has helped to raise standards of living, built an internal market, launched the euro and strengthened the Union's voice in the world (http://europa.eu.int).

The European Community has a long history of co-operation with the Mediterranean countries. The Euro-Med partnership began in the 1960s with concessionary trade agreements, expanded in the 1970s to include economic and financial co-operation and culminated in 1990 with the adoption of The New Mediterranean Policy. In fact, by this idea that the EU cannot maintain its prosperity and stability, the EU has tried to expand its integration by immediate neighbors.

In 1995, a conference was held in Barcelona by 27 Mediterranean countries -15 EU member States and 12 Mediterranean countries including Algeria, Cyprus, Egypt, Israel, Jordan, Lebanon, Malta, morocco, the Palestinian autonomous territories, Syria, Tunisia and Turkey. Their target was to ensuring a common area of peace and stability, a zone of shared economic prosperity and wider and deeper exchanges between citizens of both areas. Meanwhile, 2010 has been set as "the target date for the gradual establishment of the Euro-Mediterranean Free-Trade Area" (http://europa.eu.int)

This is clear that there are many differences in the economic and social structure of these countries. Regarding to the ranking of countries of the world based upon the GDP-PPP per capita in 2001, Luxembourg has the first place -$ 35895- and Syria has the 140th place -$ 3043- and the ranks of other considered countries are between them. For example France, Sweden and Algeria have 19th, 27th and 109th ranks, respectively (CIA Factbook, 2002). The income gap between EU and some Mediterranean countries, accordance to the GDP-PPP per capita income of 2001 are illustrated in figure 1. It is clear that the smallest gap is equal to $ 4463 and belongs to Israel. Also, Syria has the largest income gap with the EU.

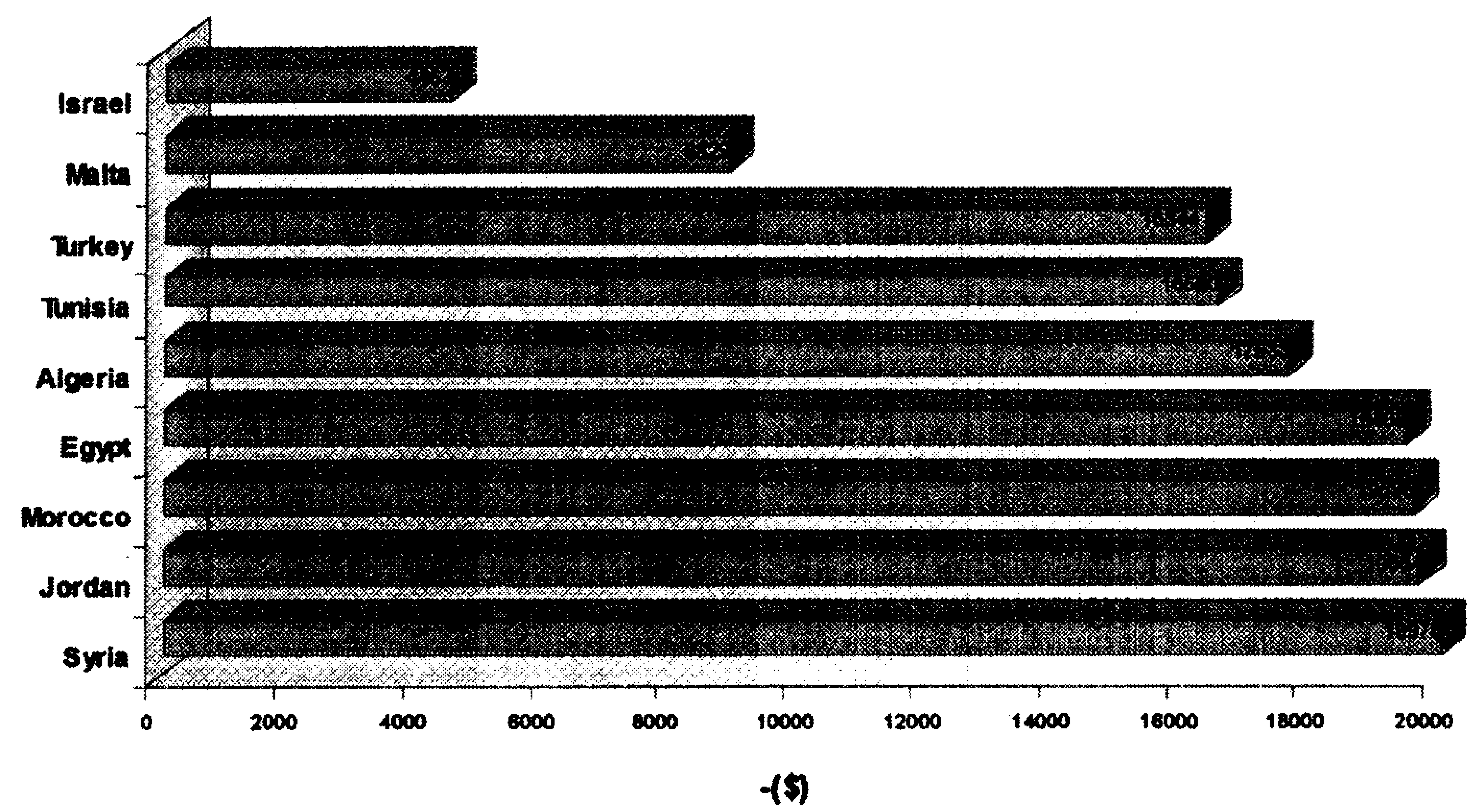

Figure 1: Income gap between the EU and some Mediterranean countries

Meanwhile, regarding to the 2000 population data, the population of the EU and considered Mediterranean countries –with the exception of Palestine- are 814,743 and 1,385,694 thousands person, respectively. The forecasted populations of them by 2025 are respectively 945,898 and 1,622,048 (U.S. Census Bureau, International Database).

V- Spatial Econometrics

The specified model is similar to the specifications in the spatial econometrics. That is, existence of spillovers indicates the dependence of each nation's growth to its neighbors, and this is consistent to spatial econometrics. In fact, "spatial econometrics is a subfield of econometrics that deals with the treatment of spatial interaction (spatial autocorrelation) and spatial structure (spatial heterogeneity) in regression models for cross-sectional and panel data" (Anselin, 1999).

Spatial dependence in a collection of sample data observations implies that one observation associated with a location in space which labeled i depends on other observations at locations $j \neq i$. Formally,

$$Yi=f(Yj), \qquad i=1,2,\dots,n \quad j\neq i \tag{2}$$

in other words,

$$Cov\ (Yi\ ,Yj) = E(YiYj) - E(Yi).E(Yj) \neq 0 \quad \text{for } i \neq j \tag{3}$$

that this violates the Gauss-Markov assumptions.

There are two reasons for spatial dependence of observations. First, data collection of observations associated with spatial units such as zip-codes, census tracts and so on might reflect measurement error, if the administrative boundaries for collecting information do not exactly reflect the nature of the process generating that data. Second, the spatial dimension of socio-demographic, economic or regional activity may truly be an important aspect of a modeling problem. Regional science is based on the premise that location and distance are important forces at work in human geography and market activity. All of these notions have been formalized in regional science that relies on notions of spatial interaction and diffusion effects, hierarchies of place and spatial spillovers (LeSage, 1999, pp. 3-4). These spatial dependences can be in the form of spatial autocorrelation or spatial heterogeneity.

In this way, the locational aspects of sample data should be quantified that this is done through distance and contiguity. That is, observations that are near each other would reflect a greater degree of spatial dependence than those more distant from each other. In other words, the strength of spatial dependence between observations would decline with the distance between them. Meanwhile, contiguity –the relative position to other such units- is another source on locational information.

According to the locational information, a spatial weights matrix W can be generated based upon contiguity or distance. In this paper, we use a simple contiguity matrix, so that its elements take values of 0 or 1 accordance to the absence or presence of a contiguity relationship.[1] That is wij –the element of row i and column j in matrix W- is equal to 1, if the regions of i and j are contiguous, otherwise wij=0. Spatial matrix is a N×N matrix for N observations. For ease of interpretation, the elements of the spatial weights matrix are typically row-standardized, such that for each i, $\sum_j$ wij=1. Premultiplying the spatial matrix by the vector elements of the interested variable, the spatial lag operator of that variable is obtained. The spatial lag may be interpreted as a weighted average (with the wij being the weights) of the neighbors or as a spatial smoother (Anselin, 1999).Then, we can examine spatial dependence through adding the spatial lag to the main model.

$$Y = \beta X + \rho WY + \epsilon$$

where Y is the N by 1 vector of dependent variable, X is the matrix of explanatory variables, and ϵ is the N by 1 vector of random errors. The significant coefficient of WY - ρ - implies the presence of spatial dependence. [2] In fact, the parameter ρ would reflect the spatial dependence in the sample data, measuring the average influence of neighboring or contiguous observations on observations in the vector Y. Presence of spatial dependence means that some part of the total variation in Y across the spatial sample would be explained by each observation's dependence on its neighbors.

In this manner, the growth model stated at equation (1) could be rewritten as:

$$GY_{it} = \alpha - (1- e^{-\beta})\, LGDP_{i,t-1} + \varphi\, W.GY_{it} + \varphi\, (1- e^{-\beta})\, W.LGDP_{i,t-1} + \epsilon_{it} \quad (4)$$

where the definition of the variables are as before. In fact, we formed GY_{pit} as the growth rate variable (GY) multiplied by the spatial matrix (W), and the same is done for $LGDP_{pi,t-1}$. In this spatial model, we can estimate spillovers of

1- The contiguity relationship can be defined as linear, rook, bishop, double linear, double rook, or queen contiguity like movements in chess. For further discussion, see Asgari and Akbari, 2001.
2- This shows spatial autocorrelation. In spatial heterogeneity, there is a spatial dependence between error terms of neighboring regions.

neighboring countries which measured through the coefficient φ.[1] Such a model is named as the mixed regressive – spatial regressive model (Vaya et al, 1999).In this paper, we estimate this model for pooled data of 23 countries (i=1,2,...,23) over a ten year period (t=1,2,...,10). In other words, the vector of each variable has N*T – that is 23*10- observations. In the case of pooled data, we have W1 instead of W, so that for a pooled data collection with N regions and T time periods, we have:

$$W1 = I_T \otimes W \qquad (5)$$

where W is the spatial matrix, I_T is a (T×T) identity matrix and W1 is a [(N*T) × (N*T)] matrix.

It is important to note that there are several ways to examine spatial dependence. Moran's I (Moran, 1948) and Geary's c (Geary, 1954) are probably the best known measures to test for spatial autocorrelation. We use Geary's c test for examining spatial autocorrelation in this paper. Formally,

$$c = (N-1)/2.s_o \left(\sum_i \sum_j wij\,(Yi-Yj)^2 / \sum_i (Yi-\mu)^2\right) \qquad (6)$$

where the definition of variables are as before. μ is the mean of Y and s_o is sum of all weights. This measure follows a normal distribution. The theoretical expected value for Geary's c is 1. A value of Geary's c of less than 1 indicates positive spatial autocorrelation, while a value larger than 1 points to negative spatial autocorrelation (Anselin, 1992, p.133).

Another mean in this regard is the Moran scatterplot suggested by Anselin, 1993, which plots the standardized income of a country against its spatial lag (also standardized) and indicates the nature of spatial autocorrelation (Rey and Montoury, 1999).

VI- Economic Results

According to the background of EU and Mediterranean countries partnership that expressed in section IV, 1990 is chosen as the initial year of

1- It is worthwhile to mention that equation (1) is extracted in accordance with a Cobb-Douglas production function and other assumptions stated in pages 5 and 6, and equation (4) is specified based upon equation (1) by using spatial economic tools.

study. Because of the availability of real income per capita data for all considered countries until 1999, this year is considered as the ending year. [1] Thus, in this section, we first examine spatial autocorrelation of considered countries' growth rates by Geary'c test and then regarding to available data, we estimate the specified growth model stated in equation (4) for EU member States –with exception of Germany – and nine Mediterranean countries - Algeria, Egypt, Israel, Jordan, Malta, morocco, Syria, Tunisia and Turkey– in the period 1990- 99.

Since countries under consideration have different economic – social conditions and are often in various income levels, their growth variances are normally deep. A treatment for this is to use dummy variables. Such variables can be characteristics of current differences in steady – state for countries. They are thus classified into four groups based upon the variance of the growth rate data: up to mean plus two STDV (standard deviations); between mean plus one STDV, and two STDV; between mean and mean plus one STDV; and less to mean. For prevention of dummy variable trap, we add three dummy variables to the model accordance to the first three groups. The model is estimated by using Space Stat ver. 1.9 and TSP 4.3.

By estimating GY versus its spatial lag operator, the estimated coefficient is about 0.47 that is significant at the 99 percent confidence level. That is, the growth rates of first order countries affect the growth rate of considered countries. Figure 2 shows the diffusion of growth rates in countries under consideration. Obtained Geary'c Statistics for GY with first order contiguity matrix is about 0.795 and its mean is 0.996. It is significant at the 90 percent confidence level indicates positive spatial autocorrelation. This result is confirmed by drawing Moral scatterplot for income per capita, too.

1- The sources of data are Penn World Tables (ver.5.6), and World Bank Statistics and Indicators. Real GDP per capita data are in constant dollars (international prices), base year 1985.

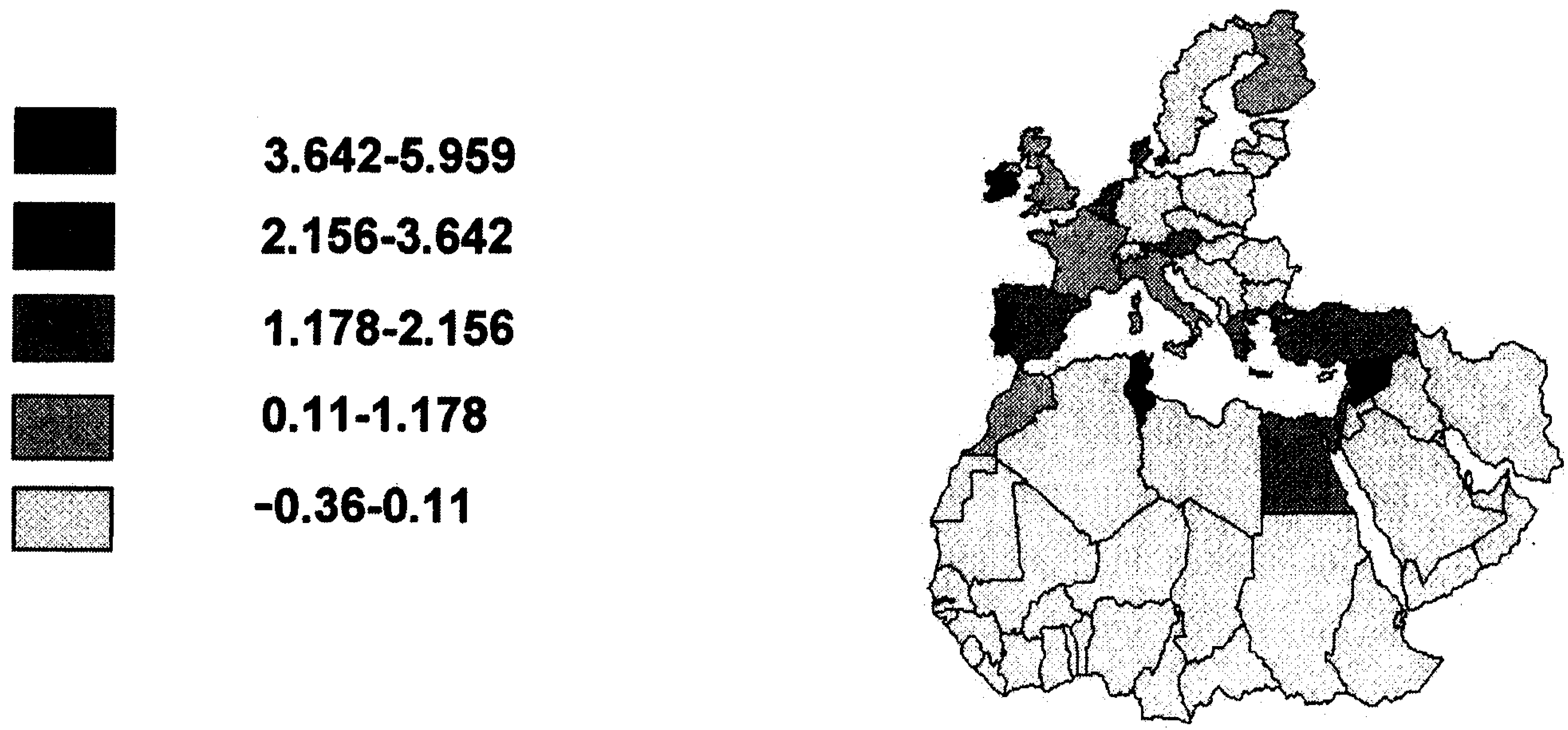

Figure 2: Diffusion of the Growth Rates of EU and Mediterranean Countries (Average 1990-99)

Figures 3 and 4 provide a more disaggregated view of the nature of the spatial autocorrelation for the initial and terminal years. The four different quadrants of the scatterplot identify four types of local spatial association between a country and its neighbors: (HH) a high income country with high income neighbors (quadrant I); (LH) a low income country surrounded by high income neighbors (quadrant II); (LL) a low income country surrounded by low income neighbors (quadrant IIL); and (HL) a high income country with low income neighbors (quadrant IV).Quadrants I, III pertain to positive forms of spatial dependence, while the remaining two present negative spatial dependence (Rey and Montoury,1999).

As figure 3 shows, in 1989, nine European countries are classified as HH cluster in our sample and 8 of 9 considered Mediterranean countries are classified as LL. Meanwhile Portugal is in quadrant III. Only Ireland is in quadrant II. Spain, Italy and Israel are in HL cluster each are high income countries bordering poorer countries. Figure 4 is similar to figure 3, with one exception that in1999 Ireland has shifted to quadrant I. As these two figures show, Luxembourg has the highest income.

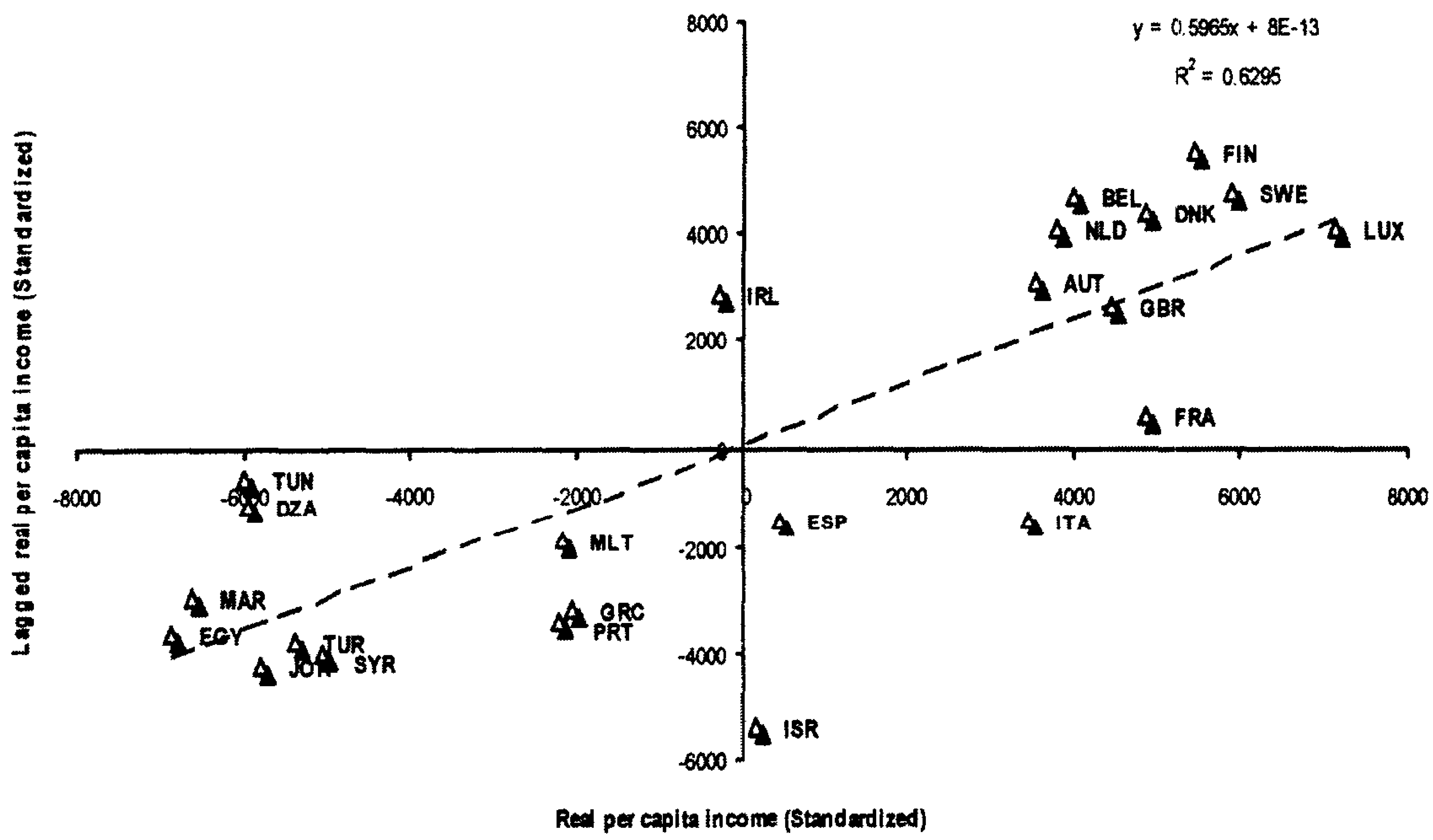

Figure 3: Moran Scatter Plot of Real GDP Per capita of EU and Mediterranean Countries, 1989

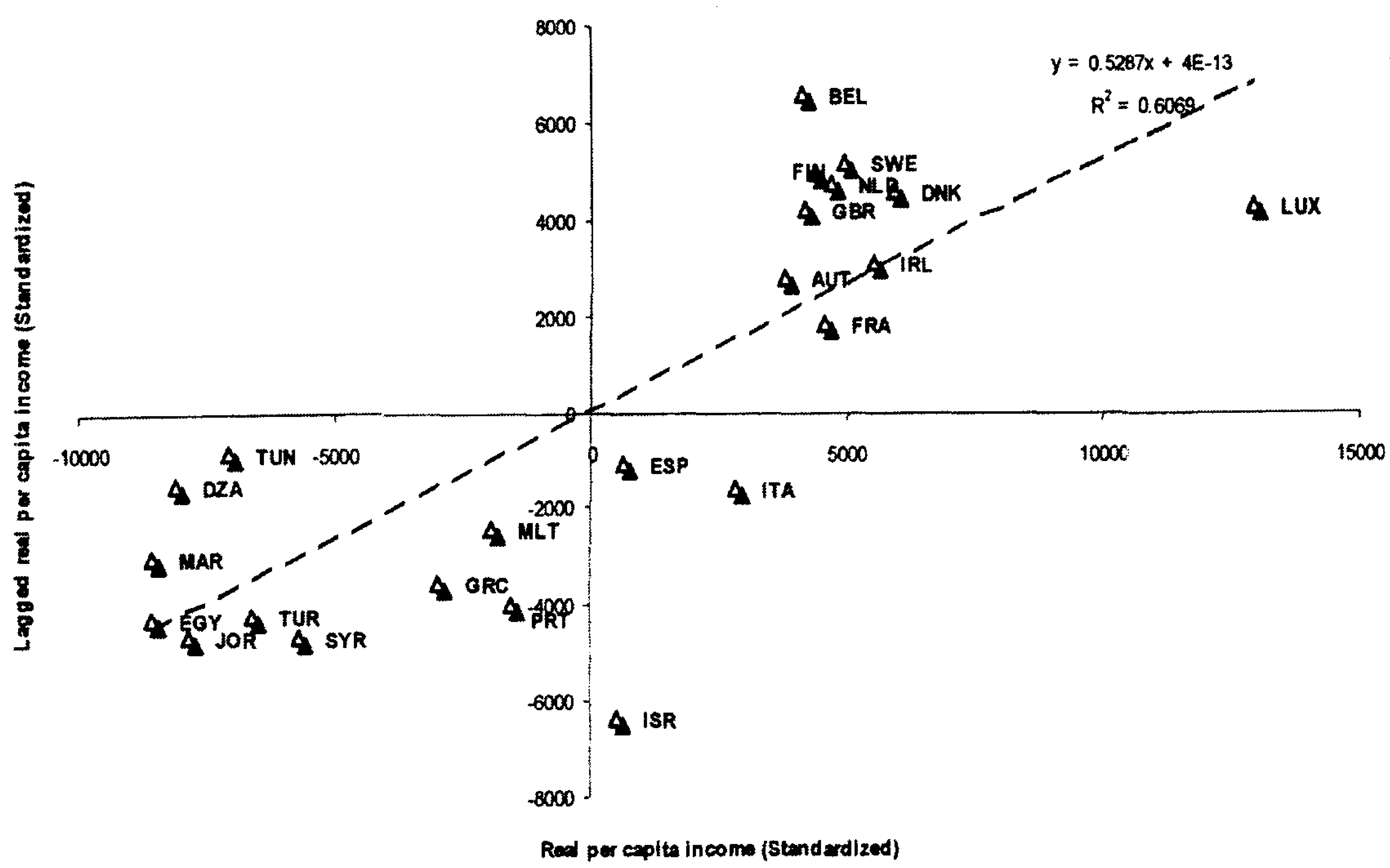

Figure 4: Moran Scatter Plot of Real GDP per Capita of EU and Mediterranean Countries, 1999

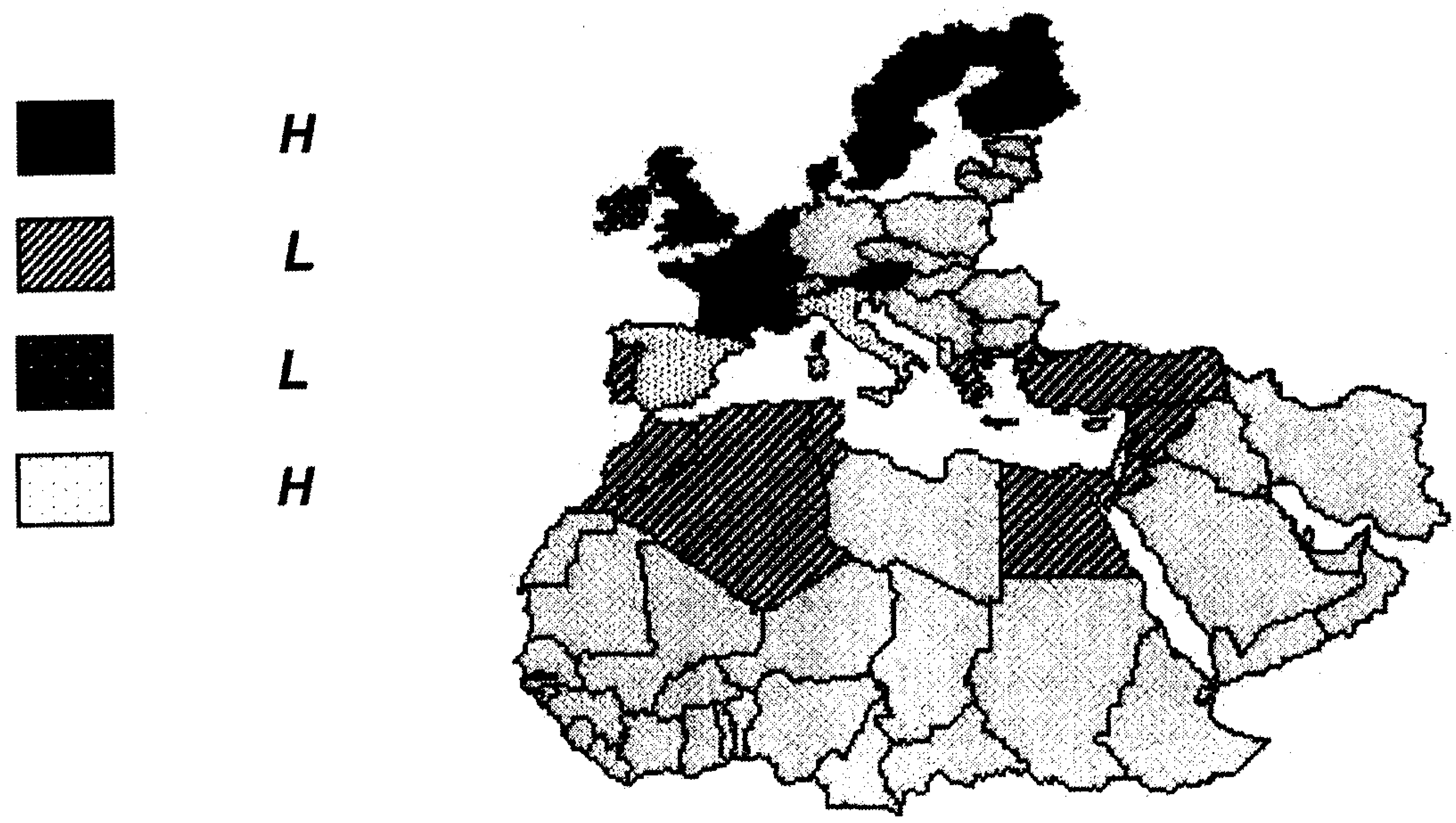

Figure 5: Clustering EU and Mediterranean Countries Based upon Real Income per Capita, 1989

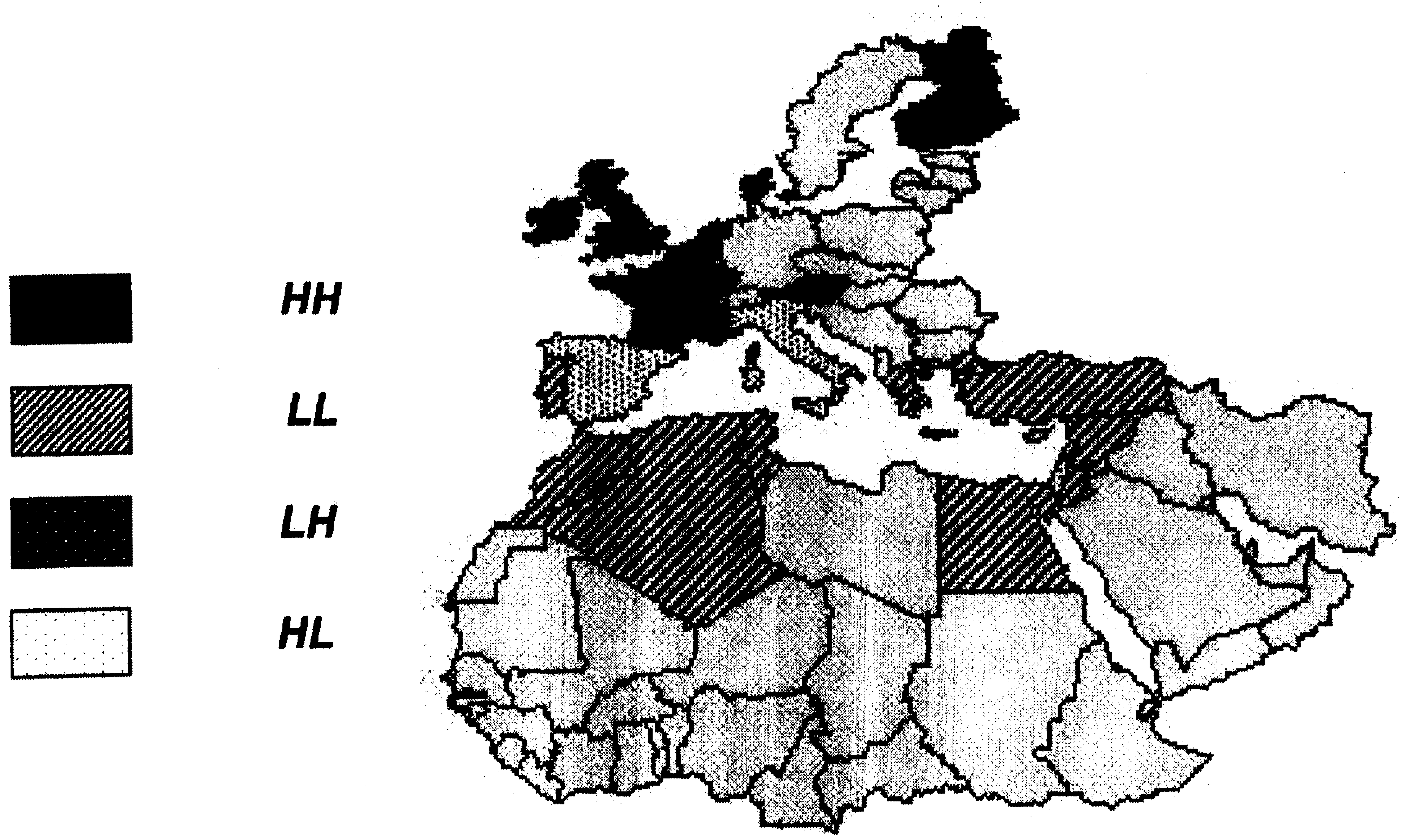

Figure 6: Clustering EU and Mediterranean Countries Bbased upon Real Income per Capita, 1999

Figures 5 and 6 present a different perspective on spatial autocorrelation at the initial and terminal years of our sample, respectively. Viewing figures 2-6 together suggests that spatial dependence is accepted.

Without entering spillover effects, we can estimate the annual growth rate as a function of lag period of real income per capita: [1]

$$\hat{G}Y_{it} = -0.02 - (1-e^{-0.004})\, LGDP_{i,t-1} \qquad (7)$$
$$(0.17) \quad (0.003)$$
$$R^2=0.07$$

As the equation shows, in this case, the speed of convergence of 23 considered countries is obtained 0.4 percent and is not significant. As mentioned before, by considering spillover effects of contiguity, the model is as equation (4). This equation is non-linear and estimated through Maximum Likelihood (ML) method. Equation (8) shows the estimation results for considered countries in 1990-99:

$$\hat{G}Y_{it}=0.058 - (1- e^{-.005})LGDP_{i,t-1}+0.21\times W.GY_{it} +0.21\times(1- e^{-0.005}).LGDP_{i,t-1} \qquad (8)$$
$$(0.016) \qquad\qquad (0.17) \qquad\qquad (0.07)$$
$$R^2=0.70$$

In this equation, the estimated coefficient of β is not significant yet, which means that the current situation of countries do not have a meaningful difference with their steady-states, and the lag period income capita variable does not have the expected positive contribution in growth rate. It is interesting to note that convergence hypothesis is not confirmed in this sample.[2]

The estimated coefficient of spillovers, φ, is about 0.21 and is significant at 99 confidence level. In other words, the significant level of this coefficient implies strong effect of neighboring countries on the growth rate. This rejects the null hypothesis of the absence of across-country spillovers. Thus, a 1 point increase in the weighted growth rate of the neighboring countries is associated with an increase of 0.21 in the growth rate of a region. The estimated value indicates that a proportion of the growth rate of each considered country is due

1- Values in parentheses are standard errors.
2- In Vaya et al, the estimated speed of convergence is 2.2 percent and is statistically significant.

to contiguous effect and this confirms the idea of regional spillovers. Therefore, Mediterranean countries can benefit from spillover effects of the EU and increase their growth. In fact, it is an advantage for Mediterranean countries that are near EU countries which have high stock of capital and high level of technology. Benefiting from spillovers can accelerated through expansion of relationship and co-operation. The estimated value is less than those obtained by Vaya et al.[1]

The estimated coefficient of intercept is about 0.058 that is highly significant. Because the estimated value of β is not statistically significant in our sample, we do not say anything about the effects of income per capita of neighbors. Meanwhile, the estimated coefficient for three considered dummy variables are significant at high confidence levels.

It is interesting to note that nor convergence hypothesis neither spillover effects are accepted in considered Mediterranean countries. But, both estimated coefficients of β and φ are statistically significant for EU countries. The estimated rate of convergence for the EU is 2.2 percent which is consistent to Vaya et al (1999). That is 2.2 percent of the gap between current real incomes per capita and the steady-state is omitted in each year in EU countries. The estimated coefficient of spillovers for EU countries is about 0.67 which is also similar to the results of Vaya et al (1999).

VII- Conclusion Remarks

Notwithstanding the fact that there are spillover effects on growth of considered countries, the convergence hypothesis is not confirmed. The estimated coefficient of W.GY shows that the weighted average of contiguous countries has the expected positive contribution on growth of each country, as can be verified from the spatial autocorrelation test and the scatterplot diagrams which plot income per capita against its spatial lag. Of interest for us are the position countries in diagrams. Accordance to these positions, we can cluster them based upon their incomes and incomes of their neighbors.

1- Vaya et al obtained a value of 0.68 for this coefficient for the regions of EU in 1975-92.

Consequently, Mediterranean countries can benefit from the EU spillovers and increase through expanding trade, joint activities and regional co-operations. It also can be along the avenue of globalization and can generate peace and stability in the region. A final issue that must be kept in mind is the effects of others neighboring countries rather than the EU on considered Mediterranean countries have common borders with some others African countries that they deal with very low come levels and growth and even negative growth rates they can have negative effects on contiguous countries. Mediterranean countries which are contiguous with European countries can benefit from their spillovers and have positive effects on other neighbors.

Appendix

Country Code	Country Name
BEL	Belgium
AUT	Austria
DNK	Denmark
ESP	Spain
FIN	Finland
FRA	France
GRC	Greece
IRL	Ireland
ITA	Italy
SWE	Sweden
LUX	Luxembourg
NLD	Netherlands
PRT	Portugal
GBR	United Kingdom
DZA	Algeria
MAR	Morocco
TUN	Tunisia
EGY	Egypt, Arab Rep.
ISR	Israel
JOR	Jordan
SYR	Syrian Arab Republic
TUR	Turkey
MLT	Malta

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