Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345 (Online)
An Open Access, Online International Journal Available at www.cibtech.org/sp.ed/jls/2014/03/jls.htm
2014 Vol. 4 (S3), pp. 1627-1634/Iman
Research Article

THE ESTIMATION PARAMETERS OF KUZNETS SPATIAL ENVIRONMENTAL CURVE IN THE EUROPEAN COUNTRIES: (A CASE STUDY OF CO2 AND PM10 AND INCIDENCE OF TUBERCULOSIS)

***Iman Danaeifar**
Young Researchers and Elite Club, Behbahan Branch, Islamic Azad University, Behbahan, Iran
**Author for Correspondence*

ABSTRACT
Environmental Kuznets Curve is one of the most well - known concepts in the field of environmental economics that has developed during the past twenty years in various aspects. One of the new improvements in the study of EKC relationship is paying attention to spatial nature of environmental phenomena. The concept of the spatial environmental Kuznets curve (SEKC) is entirely similar to that of EKC, except that it considers spatial autocorrelation of environmental pollutants as one of the explanatory variables. The present investigation attempts by using spatial panel data model to examine the spatial environmental Kuznets curve (SEKC) for two global (CO_2) and local (PM10) pollutants and Incidence of tuberculosis, in geographical scope of 30 European Countries over the period of 1992–2008. According to the results, there is an inverse U-shaped relationship between income and carbon dioxide and particulate matter there.

***Keywords**: Spatial Environmental Kuznets Curve, Spatial Panel Data Model*

INTRODUCTION
Environmental pollution is a major challenge. So that the countries in addition to the policies and action of the within its borders, is followed the environmental issues organization in the field of international. Air pollution is an example of pollution. Industrialized societies, has led to more utilization and more intensive of fossil fuels such as coal, oil and gas in order to use in production and transportation. Combustion of these fuels releases carbon dioxide into the atmosphere. Therefore, producer countries of these materials play an important role in this field. In recent decades, have been studied environmental issues from different aspects. Initiate public attention to environmental issues occurred during the 1960s and main focus of attentions was on the industrial pollution due to increasing growing industrial economies. In the economic production system, only part of the used energy is converted into goods and services and the remaining goes back to the environment as waste, namely pollution. Nature is only partially able to make the balance between input, output and waste. In other words, can be recovered the nature is limited. This power greatly reduced with an increase in human interference in nature. With expansion of human knowledge, human artifacts are remains directly and indirectly detrimental effects on human life as residual, wastes, contaminated gases and other factors. In general, pollution including air pollution, water pollution, noise pollution solid waste pollution. The air pollution is one of phenomena of the recent century. The more important air pollutants including carbon monoxide, carbon dioxide, sulfur oxides, aerosols and ozone; carbon dioxide gas is one of more important gases that contribute to climate change and global warming and Therefore, is known as cross – border contamination. 60 percent of greenhouse gases are caused by carbon dioxide emission. This gas among other types of gases have high portion in creating air pollution.
Over the last three decades, risks and environmental damages is more visible. These damages are caused by a combination of factors such as population growth, economic growth, energy consumption and industrial activities. On the other hand, the relationship between economic development and environment is a complex and important issue. If in the context of sustainable development, economic activities and environment to be considered in combination, environment and economic development are complementary factors that causing the ecological balance and economic activity will not disruptive factor for such balance (Emadzadeh *et al.*, 2007). Most of economic studies conducted in the field of

environment economics, seeking to have the issue that is find a significant relationship between environmental degradation and economic growth.

The result of the research in this field has led to the application pattern for created environmental Kuznets curve (EKC). EKC pattern that is illustrates an inverted U-shaped relationship between environmental degradation (pollution emission) and capita income (economic growth), argues that first environmental degradation increased along with the enhancement in the capita income, but then it after reaching a certain level of economic growth, environmental degradation is stops and then decreases. According to this hypothesis, the relationship between economic growth and environmental quality, positive and negative, is not fixed during the course of development of a country.

Statement of the Problem

Environmental Kuznets Curve is one of the most well - known concepts in the field of environmental economics that has developed during the past twenty years in various aspects. One of the new improvements in the study of EKC relationship is paying attention to spatial nature of environmental phenomena**.** The idea of spatial environmental phenomena Kuznets curve is quite similar to environmental Kuznets curve, except that the phenomena of spatial autocorrelation of environmental pollution is regarded as one of explanatory variables of model (Myrshojayan and Rahbar, 2011). The idea of spatial-environmental Kuznets curve is based on the concept of spatial autocorrelation of environmental phenomena. The simplest definition for the concept of spatial auto-correlation is existence of the relationship between close spatial units. Concept of spatial autocorrelation can be defined as: if the set S is contains n geographical units, spatial autocorrelation is the relationship between variables of each of n units and also is the measure of geographical proximity for all n (n-1) subsets of two-part sets S.

Sadeghi and Saadat (2004) using data during 1967 – 2001s have investigated the population growth, economic growth and their effects of environmental in Iran. The result indicated the existence of one-way causal relationship between population growth to environmental degradation and as well as, the two-way relationship between environmental and economic growth. Pazhooyan and Moradhasel (2007) using panel data techniques have been tested the effect of economic growth on air pollution in form of environmental Kuznets curve hypothesis for 67 countries (including Iran). This study investigated the effects of economic growth, population, environmental laws, the number of vehicles and openness degreed of economic on carbon dioxide emission rate; is confirmed the existence environmental Kuznets curve in these countries. Zibaei and Shaykh (2009) investigated the relationship between economic growth and environmental diversity (species known mammals, birds and plants) in form of cross-sectional data model including 121 countries. Their results is confirmed that there was environmental Kuznets curve for development countries and is rejected for developing countries. Saleh *et al.,* (2009) examining the causal relationship between gross domestic product and the volume of carbon dioxide in Iran found that only causal relationship is the existence one-way communication from the volume of carbon dioxide to gross domestic product. On the other hand, since volume carbon dioxide growth rate is greater than gross domestic product growth rate, Iran's place in environmental Kuznets curve is in the first part and upward, resulting in the present situation, the increase in capita income of country lead only to enhancement of environmental pollutants. Mirshojaeian and Rahbar (2011) are examined the environmental Kuznets curve in countries of Asia, their article tried to using spatial panel data models, estimated the spatial-environmental Kuznets curve for two pollutants carbon dioxide and aerosols in geographic areas of countries in Asia at period of 1999 to 2007. Their results are indicating an inverse U-Shaped relationship between capita income and capita production of carbon dioxide gas and as well as positive relationship among capita income and production of aerosols per m^3. Shafik (1994) in an article entitled econometric analysis is examined the relationship between environmental quality and capita income. In this study, environmental quality is considered as the dependent variable in the regression. Estimation method of model in this study was ordinary least squares method and is used of data from 149 countries for the period 1960 – 1990. The results indicated that there was a positive and uniformity relationship between capita carbon dioxide emission and capita income. Also calculation of the elasticity of carbon dioxide emission according to the income shows that for every one percent increase in revenue, there was 1.6

percent increase in carbon dioxide emission. Rupasingha *et al.*, (2004), with investigating the variables influencing on capita production of toxic wastes in the form of Bayesian spatial error model, found that there was a N-shaped relationship between capita income and toxic waste production. Their results showed that the overflow from a nearby geographical area is significant and effective. Maddison (2006), have argued that if there was a spatial autocorrelation phenomenon, eliminate it from environmental Kuznets curve can lead to biased results. His study is centralized on examined variables affecting on local capita pollutant emission of VOC, NOx, SO_2 and CO. His study finds that spatial overflow is one of explanatory significant variables of spatial environmental Kuznets model. But it also refers to the fact that his study does not indicate which this phenomenon is due to the imitating governments of the environmental policy each other, or comes from technologies emission, products or life patterns in space dimension. Ciriaci and Palma (2010) using geographically weighted regression and the information of provinces in Italy, are investigated the environmental Kuznets curve in spatial form. The above research identifies the L-shaped relationship for four pollutants CO_2, CH_4, NMVOC and Coin the southern provinces and some of central provinces of Italy.

This research tries to using of spatial panel data model, is estimated spatial-environmental Kuznets curve for global carbon dioxide emission and local aerosols pollutants and Incidence of tuberculosis of the geographical areas in 30 European countries at period from 1992 to 2008.

MATERIALS AND METHOD

Methods

The usual method of estimation the environmental Kuznets curve is using the spatial econometric models. (Anselin, 1988) this method that is designed for overcome on the spatial dependence between observation and spatial heterogeneity, once was introduced in book of "spatial econometric, methods and models". Spatial dependence means that in data has a spatial component, observation is affected on other observation elsewhere in the region. Spatial heterogeneity also means that when moving between views, the distribution of sample data has no fixed mean and variance. These two assumptions in conventional econometric are disturbing for Gauss – Markov assumptions and ignoring of them in the conventional model, will lead to bias and inconsistency of results (Florax and Visit, 2003).

Since the late 80s, there has been significant growth in the spatial econometrics. Today, a wide range of spatial auto-regressive models, Bayesian spatial models auto-regressive prices, local linear spatial models, models for the dependent variable models auto-regressive vector error correction models, or spatial panel data models can be found that working with entering spatial weightings matrix and using a maximum likelihood (ML), is provided the estimates without unbiased and adapted (Sage and Pace, 2009). According to the concept of spatial autocorrelation and overflow of environmental phenomena from one geographical unit to other units, usually spatial auto-regressive are used for the estimated the spatial environmental Kuznets curve. Equation 1 shows the general structure of spatial auto-regressive models.

Eq. 1.

$$y = \rho W_1 y + X\beta$$
$$u = \lambda W_2 u + \varepsilon$$
$$\varepsilon \cong N(0, \sigma^2 I_n)$$

Where Y is n × 1 vector indicating of the dependence variable, X is matrix of explanatory variables of n × k and W_1 and W_2 are the matrix spatial weighted n × n. In this relationship n is indicating the number of cross-sectional observations and k is showing the number of explanatory variables. ρ is expression of the coefficient of the spatial lag dependent variables (W_1 y),λ represents the spatial lag coefficient of the residuals(W_2 y) and the characteristic β is expression the affects explanatory variables on dependent variable y.

The four assumptions following were we conducted toward four categories of spatial autocorrelation models, each of which are used based on conditions:

1. X=0, W_2=0: that are known as First-order spatial autoregressive models (FAR).
2. W_0=0: that are known as mixed autoregressive-regressive models (SAR).

3. W_1=0: that are named the spatial errors models.

4. The general relationship that are known general spatial model.

Since spatial autoregressive models are shaped of competition and or a combination of two SAR and SEM models, often for estimating spatial environmental Kuznets curve is the question whether the overflow spatial environmental phenomena in term in terms of the spatial lag dependent variable model swill emerge(SAR)or spatial lag component of the waste(SEM),thus generally instead auto regressive estimation models, two models are estimated and then the Lag range multiplier(LM) is investigated, and has been chosen as the best estimate. Lagrange multipliers for spatial econometric models beginning were invented by (Anselin *et al.,* 1996). But Florax, *et al.,* (2003) was able to develop method that can show the well function in both models, SEM, SAR.

In this way, first the delay statistic LM (LM Lag) and SEM LM (LM Error)is calculated an dies tested statistical significance. Under 5%statisticalprobabilityofdelay static or LM error is means that the accepting of the result of estimating of models of SEM and SAR. If both statistics is below the critical value (6.635), is turn to strong statistical calculation of lag error (LM) and robust statistical of lag (LM).

Rejection of one of these two models will means achieving to our desirable models. If again both statistics are greater than the critical value, it must be admitted that the spatial delay can be explicated as spatial delay of dependent variables or is appear to spatial autocorrelation of the residuals. But it can also be due to the amount of Lagrange multipliers (the coefficient is greater) will select the best model. The last thin growth mentioning is the use of two sets of data models sectional or panel data of the spatial auto-regressive. What equation (1) shows the cross-sectional structure of the model is that most studies have used spatial autoregressive.

When the number of geographic units is low and estimating the model is faced with the problem of the degree of freedom, the spatial regression models using panel data that have been developed by (Elhorst, 2010), gives much better results. Both codes model software such as Space Stat, GEODA, R, and Matlab can be found. In this paper, due to the number of European countries, spatial autoregressive panel data models and Matlab software is used.

In this section,to determine the relationship between economic grow than environmental quality in terms of spatial, spatial environmental Kuznets curve of the European countries for world pollutant carbon dioxide emissions are estimated. The purpose of this section, in addition to further understanding of how spatial modeling of environmental studies is to examine the question that in model which spatial auto correlated environmental phenomena have been observed, what are relationship between capita income of European countries and emissions of carbon dioxide and aerosols? According to the information a variable and the fact that a necessary condition for the implementation of spatial econometric models, is complete information for all the observations, data variables for the period of30 European countries from 1992 to2008were obtained from the World Bank website.

Equations (2), (3) and (4) are show primary structure panel data of SAR and SEM models for the emission of carbon dioxide and aerosols. in this equation, LOG (CO2) the natural logarithm of capita production of carbon dioxide (ton), LOG (PM10) the natural logarithm of aerosols production per unit space ($\mu g/m^3$), LOG (TUB) Natural logarithm of the incidence of tuberculosis (per 100,000 people), LOG (GDPPC) logarithm of real capita gross domestic product in countries (purchasing power parity, based on constant values in international dollars, 2005), $(LOG (GDPPC))^2$ squared logarithm of real capita gross domestic product in countries, IND- SHARE shares of total value added of the industrial sector in gross domestic product, AGRI- SHARE valuable contribution agricultural sector in the total gross domestic product, FOSSIL fossils fuel energy consumption (the total), ENERGY-PRO energy production (thousand tons of oil equivalent), POP-DENS population density, GASOLINE road sector gasoline fuel consumption capita (kg oil equivalent), α expression variables explanation of the dependent variable Y is the parameter ρ represents the coefficient of the spatial lag dependent variable (W_1y), λ represents the coefficient of the spatial lag residuals (W_2u), W represents the spatial weight matrix is $n \times n$.

Eq. 2.

Panel SAR: $LOG(CO_{2\,it}) = \alpha_1 LOG(GDPPC_{it}) + \alpha_2 (LOG(GDPPC_{it}))^2 + \alpha_3 IND\_SHARE_{it} + \alpha_4 AGRI\_SHARE_{it} + \alpha_5 FOSSIL_{it} + \alpha_6 ENERGY\_PRO_{it} + \alpha_7 POP\_DENS_{it} + \alpha_8 GASOLINE_{it} + \rho \sum W \times LOG(CO_{2\,it}) + \eta_i + \varepsilon_{it}$

Panel SEM: $LOG(CO_{2\,it}) = \alpha_1 LOG(GDPPC_{it}) + \alpha_2 (LOG(GDPPC_{it}))^2 + \alpha_3 IND\_SHARE_{it} + \alpha_4 AGRI\_SHARE_{it} + \alpha_5 FOSSIL_{it} + \alpha_6 ENERGY\_PRO_{it} + \alpha_7 POP\_DENS_{it} + \alpha_8 GASOLINE_{it} + \eta_i + u_{it};\ u_{it} = \lambda \sum W \times u_{it} + \varepsilon_{it}$

Eq. 3.

Panel SAR: $LOG(PM10_{it}) = \alpha_1 LOG(GDPPC_{it}) + \alpha_2 (LOG(GDPPC_{it}))^2 + \alpha_3 IND\_SHARE_{it} + \alpha_4 AGRI\_SHARE_{it} + \alpha_5 FOSSIL_{it} + \alpha_6 ENERGY\_PRO_{it} + \alpha_7 POP\_DENS_{it} + \alpha_8 GASOLINE_{it} + \rho \sum W \times LOG(PM10_{it}) + \eta_i + \varepsilon_{it}$

Panel SEM: $LOG(PM10_{it}) = \alpha_1 LOG(GDPPC_{it}) + \alpha_2 (LOG(GDPPC_{it}))^2 + \alpha_3 IND\_SHARE_{it} + \alpha_4 AGRI\_SHARE_{it} + \alpha_5 FOSSIL_{it} + \alpha_6 ENERGY\_PRO_{it} + \alpha_7 POP\_DENS_{it} + \alpha_8 GASOLINE_{it} + \eta_i + u_{it};\ u_{it} = \lambda \sum W \times u_{it} + \varepsilon_{it}$

Eq. 4.

Panel SAR: $LOG(TUB_{it}) = \alpha_1 LOG(GDPPC_{it}) + \alpha_2 (LOG(GDPPC_{it}))^2 + \alpha_3 IND\_SHARE_{it} + \alpha_4 AGRI\_SHARE_{it} + \alpha_5 FOSSIL_{it} + \alpha_6 ENERGY\_PRO_{it} + \alpha_7 POP\_DENS_{it} + \alpha_8 GASOLINE_{it} + \rho \sum W \times LOG(TUB_{it}) + \eta_i + \varepsilon_{it}$

Panel SEM: $LOG(TUB_{it}) = \alpha_1 LOG(GDPPC_{it}) + \alpha_2 (LOG(GDPPC_{it}))^2 + \alpha_3 IND\_SHARE_{it} + \alpha_4 AGRI\_SHARE_{it} + \alpha_5 FOSSIL_{it} + \alpha_6 ENERGY\_PRO_{it} + \alpha_7 POP\_DENS_{it} + \alpha_8 GASOLINE_{it} + \eta_i + u_{it};\ u_{it} = \lambda \sum W \times u_{it} + \varepsilon_{it}$

One of the most important variables in equations(2),(3) and (4) the spatial is weight matrix or matrix W that indicating the geographical arrangement sectional views(here countries) in the model is desired. In general, location is appears as the spatial econometric is ting wishing from conventional econometric models in two forms. Prime, location in the coordinate plate is shown vial attitude and longitude geographical and Second neighborhood and proximity that are reflecting the relative position in the space of a regional unit than the other units. Way to expressed termini the locations in this study will be used is methods of spatial proximity. So that, first the adjacency matrix or the neighborhoodfor30 countriessurveyedduring1992and 2008have been formed, so that the neigh boors or adjacent is considered the one value and to anon-neighboring countries zero value. Therefore, the adjacency matrix, a30 × 30symmetric matrix with zero elements on the main digs on al and off-diagonal element sari zero and one. After making matrix, it is time to normalize. This means that the matrix W is altered in such a way that the sum of each row is equal to a number one. Prerequisite for estimating panel data and time series models, reject the null hypothesis of unit root tests, or in other words is confirming the survival (reliability) of the dependent and independent variables. In the first for to estimating of model to ensure that non-false regression and following be uncertain results, it is necessary to examine how static variable staking. To do this target we used from Im, Pesaran and Shin (2003) test. Look for non-stationary variables in levels, to do the durability test of variables on the difference first-order, we have seen that with once making a difference variables is static, probe r confidence level for each of the variables is smaller than 5%. Therefore, we can say that the null hypothesis, that there is a unit root for the variables under consideration, be refuted. Therefore, all variables with once making a difference will be stationary. Hence instead of the variables of level in the equations (2),(3) and (4) is used from the first - order difference of the variables. Table 1 summarizes there salts of Im, Pesaran and Shin unit root test for the variable Therefore, f level and the first order difference.

Table 1: Test Manayy Variables

Manayy test of a first-order difference Im,Pesaran and Shin w-stat	Manayy test level variable Im, Pesaran and Shin w-stat	Variable name
-3.93	- 0.2	LOG (CO2)
-3.8	-0.48	LOG (PM10)
-6.9	-1.9	LOG (TUB)
-4.5	-1.9	LOG (GDPPC)
-3	-1.11	(LOG(GDPPC))2
-4.45	-2.04	IND_ SHARE
-4.4	-2.1	AGRI_ SHARE
-3.9	-2.2	FOSSIL
-4.3	-0.49	ENERGY_PRO
-3.68	-2.3	POP_DENS
-3.99	-1.76	GASOLINE

Source: Research Findings - Table statistics at 5% = - 2.68

Because variables of model with once making a difference are stationary, therefore, the first order difference of the variables used to estimate equation. Now you can make estimates any of the models in Panel SAR and Panel SEM using fixed effects or random effects. Choosing between fixed and random effects methods based on Hausman test and Choosing between the two models Panel SAR and Panel SEM based on compare the value and sign if I cancel Lag range multi pliers will be con ducted that described above, but based on what (Elhorst, 2003)refers to, First, random effects model is designed for a number of cross-sectional observations(N) is large, Second, the validity of this method, especially in the experimental studies is debated and discussion by method logical debate and controversy. Therefore, in this study, only the fixed effects method is used for estimating the two models Panel SEM Panel SAR.

With regard to table of spatial over flow of CO_2 pollutant and PM10 and Incidence of tuberculosis in the model Panel SAR is allocated positive and significant coefficient (RHO) to self. Probabilitiesbelow5% of the statistic lag LM, or LM error statistic, respectively, means that are accepting the estimated SAR and SEM models. If both parameters, delay LM, or LM error are lower than the critical value (6.635), turn to compute LM lag robust static test and LM error o bust. If we rejection one of these two, means of will achieving a desired model. According to the table, and comparing the Quad coefficients of LM We came to the conclusion that it will be both SAR and SEM models as the spatial over flow structure(as the dependent variable lags, or spatial lags of waste components) accepted, However, operation of the Panel SAR model is slightly better than the Panel SEM Model.

Indian Journal of Fundamental and Applied Life Sciences ISSN: 2231– 6345 (Online)
An Open Access, Online International Journal Available at www.cibtech.org/sp.ed/jls/2014/03/jls.htm
2014 Vol. 4 (S3), pp. 1627-1634/Iman

Research Article

Table 2: Estimation Results of the Environmental Kuznets Curve for the Environment Variables and CO2 Emissions of PM10 and Incidence of Tuberculosis in European

Δ LOG (TUB)				Δ LOG(PM10)				Δ LOG(CO2)				Dependent variable
SEM Model		SAR Model		SEM Model		SAR Model		SEM Model		SAR Model		Independent variable
Coefficient	Statistics	Coefficient	statistics	Coefficient	Statistics	Coefficient	statistics	Coefficient	Statistics	Coefficient	Statistics	
0.47	3.46	0.45	3.83	0.005	2.5	0.003	4.3	0.29	3.2	0.3	7.6	DLOG (GDPPC)
-0.18	-2.93	-0.17	-2.3	-0.04	-2.08	-0.03	-2.6	-0.405	-3.2	- 0.05	-4.8	$D(LOG(GDPPC)^2$
0.016	4	0.012	2.1	0.82	2.97	0.9	2.98	0.82	2.5	0.9	5.1	DIND_ SHARE
0.024	4.29	0.023	2.7	0.624	2.83	0.7	3.7	0.51	4.1	0.4	3.5	DAGRI_ SHARE
0.15	3	0.1	6.6	0.07	3.9	0.06	4.8	0.062	9.2	0.07	7.5	DFOSSIL
0.23	3.8	0.21	2.03	0.042	3.6	0.05	3.06	0.04	6.3	0.04	6.3	DENERGY_PRO
0.28	4.46	0.26	2.05	0.0049	3.04	0.005	2.07	0.67	2.5	0.76	2.89	DPOP_DENS
0.47	5.4	0.42	2	0.24	2.96	0.2	2.7	0.056	2.6	0.06	3.4	DGASOLINE
----	----	0.18	3.03	----	----	0.8	8.8	---	---	0.9	4.4	RHO
0.2	3.5	-----	-----	0.765	2.58	---	---	0.82	2.1	---	----	LAMBDA
	0.43		0.47		0.59		0.62		0.48		0.54	
	5.98 (0.01)		5.93 (0.01)		5.93 (0.01)		6.04 (0.00)		5.11 (0.02)		5.34 (0.01)	.LM Lag (Prob.)
	5.72 (0.01)		5.67 (0.02)		1.63 (0.45)		5.03 (0.03)		4.93 (0.04)		4.11 (0.05)	LM Error (Prob.)
	1.12 (0.63)		1.19 (0.55)		1.89 (0.44)		1.64 0.45))		0.65 (0.95)		1.65 (0.45)	LM Lag Robust (Prob.)
	9.12 (0.00)		10.07 (0.00)		8.18 (0.000)		12.85 (0.000)		12.11 (0.000)		10.87 0.00))	LM Error Robust (Prob.)

Source: Research Findings - Table statistics at 5%

CONCLUSIONS

This study attempted to examine the spatial auto correlation of ecological phenomena as the cornerstone for spatial studies in environmental economics research, methodology for their modeling in terms of spatial environmental Kuznets curve and finely study of the most important finding and research of investigators, to is prepare the way to empirically test a model for other European countries. Based on the obtained results, the existence of an inverted U-shaped relationship between capita income, CO_2 and PM10 and Incidence of tuberculosis are confirmed.

REFERENCES

Anselin L (1988). Spatial Econometrics: Methods and Models. *Studies in Operational Regional Science*, *Springer*.

Anselin L *et al.*, (1996). Simple Diagnostic Tests for Spatial Dependence. *Regional Science and Urban Economics* **26** 77-104

Ciriaci D and Palma D (2010). Geography, Environmental Efficiency and Italian Economic Growth: A spatially-Adapted Environmental Kuznets Curve. MPRA Paper From University Library Of Munich, Germany

Emadzadeh M, Bastanifar I and Ebrahimi S (2007). Investing And Predicting Simultaneous Environmental – Economic Effects of Projects (The Case Of Isfahan Science and Technology Town). *Quarterly Journal Of Quantitative Economics* **4** 51 – 74.

Florax RJGM, Folmer H and Rey SJ (2003). Specification Searches in Spatial Econometrics the Relevance of Hendry's Methodology. *Regional Science and Urban Economics* **33** 5.

Le Sage J and Pace RK (2009). *Introduction to Spatial Econometrics* (Taylor and Francis, Inc).

Maddison DJ (2006). Environmental Kuznets Curves: A Spatial Econometric Approach. *Journal of Environmental Economics and Management* **51** 218–230.

Myrshjayan Hosseini H and Rahbar F (2011). Spatial Environmental Kuznets Curve In Asian Countries: (Case Study Of CO2 And PM10). *Journal of Environmental Studies* **58** 1 – 14.

Pourkazemi MH and Ebrahimi I (2008). Examining Environmental Kuznets Curve in Middle' East, *Iranian Economic Research* **34** 57 – 71.

Rupasingha A *et al.*, (2004) The Environmental Kuznets Curve for US Counties: A Spatial Econometric analysis with Extensions. *Papers in Regional Science* **83** 407–424.

Sadeqhi H and Saadat R (2004). Population Growth, Economic Growth And Environmental Impacts In Iran(A Causality Analysis). *Journal of Economic Research* **39**(64) 163 -180.

Saleh I, Shaabani Z, Yazdani S and Sadat Barikani H (2009). Investigation Of Causality between GNP And Greenhouse Gases (Case Study: Carbon Dioxide In Iran). *Journal Agricultural Economic and Development* **66** 19 – 41.

Shafik N (1994). Economic Development and Environmental Quality: An Econometric Analysis. *Oxford Economic Papers* **46** 757– 773.

Zibaei M and Shaykh Zayn Aldin A (2009). Biodiversity and Economic Growth: A Cross –Country (With Emphasis on Developing Countries). *Journal of Environmental Studies* **49** 61 – 72.