ISSN : 0974 - 7435 Volume 10 Issue 8

2014

BioTechnology

An Indian Journal

FULL PAPER

BTAIJ, 10(8), 2014 [2831-2838]

Correctly handle the contradiction relationship between economic growth and ecological environment system based on the research of provincial dynamic panel model

Wei Huo
Wentian College, Hohai University, Anhui, 243031, (CHINA)
E-mail : alainhuowei@163.com

ABSTRACT

The industrial structural transformation and regional industrial transfer has further enhanced the economic linkages among various regions in China, the industry scale and development model in a region could not only influence the ecological environment in local area, but also exert an influence especially on the ecological environment in surrounding area, such pertinence of ecological environment among regions is not allowed to be ignored. For this purpose, relevant spatial factors are introduced based on the kuznets curve hypothesis of ecological environment, and the contradictory relationship between economic growth and ecological environment system is analyzed through applying provincial dynamic panel model. The research results indicate that China basically satisfies the assumption of EKC, and there exists significant spatial correlation in the destruction of ecosystem environment; the estimation model based on geographical weightings is better than economic weighting model obviously, namely the main reason of leading to the destruction overflowing of ecological environment system is the geographical factors instead of non-economic factors.

KEYWORDS

Economic growth; Ecological environment; Provincial dynamic panel model.

INTRODUCTION

The relationship between the destruction of ecological environment system and economic growth has always been the hot issue in economic research field. Due to the assumption relationship between national income and ecological environment, there exists the inverted u-shaped curve relationship between the destruction of ecological environment and average per capita income, namely the destruction degree of ecological environment is increasing with the rise of income in beginning times of economic development; but after the average per capita income achieves certain level (economic “inflection point”), the destruction degree of ecological environment begins to drop, and then environmental quality would improve gradually. Such inverted U-shaped curve is called Environment Kuznets Curve (EKC).

On the premise that there exists mutual spatial influence among regions, this paper has incorporated spatial correlation into EKC model and studied the contradictory relationship between economic growth and ecological environment system through applying the model of provincial dynamic panel data, which has very good reference significance on the regulatory efforts of China’s strengthening ecological environment protection policy and realizing sustainable development.

RESEARCH DESIGN

Provincial measurement method

The basic thoughts of provincial metering is to introduce the mutual relationship among regions into model, and the basic linear regression model is modified through spatial weight matrix, the reflecting method of ‘inter-provincial’is different according to model specification. Provincial econometric model is mainly divided into 2 kinds: one is the spatial lag model, another kind is the spatial error model.

Spatial Autoregressive Model (SAR) is mainly applied into studying the case that there exists influence of adjacent regional behaviour on that of other areas in whole system (overflow effect). The model expression is :

$$\mathbf{y} = \rho(\mathbf{I_T} \otimes \mathbf{W_N})\mathbf{y} + \mathbf{x}\beta + \varepsilon \quad \mathbf{(1)}$$

In type (1), y is explained variable; x is the exogenous interpretation variable matrix of $n \times k$; ρ is the spatial regression coefficient; W_N is the spatial weight matrix of $n \times n$ order; $(I_T \otimes W_N)y$ is the spatial lagging explained variable; ε is the random error term vectors.

The mutual relationship among regions in Spatial Error Model (SEM) could be embodied by the structure association of error term, when there exists difference as the mutual action among regions is in different position, M then such model is required to be applied, its expression is:

$$\begin{cases} \mathbf{y} = \mathbf{x}\beta + \mu \\ \mu = \lambda(\mathbf{I_T} \otimes \mathbf{W_N})\mu + \varepsilon \end{cases} \quad \mathbf{(2)}$$

In type (2), ε is random error term vector, λ is the space error coefficient of $n \times 1$ cross section’s explained variable vector, μ is the random error vector of normal distribution. Parameter λ measures the spatial dependence role in sample observation value, namely the influence orientation and degree of observed value y in adjoining areas on observation value y in local area. Parameter β reflects the influence of explanatory variable x on explained variable y.

For above two types of model, spatial lagging explained variable $(I_T \otimes W_N)y$ is introduced into spatial autoregressive model, thus the problem of endogenous explanatory variable will be generated, and the biased estimator is obtained through OLS estimation at this moment; the error term of spatial error model is not independently distributed, but embodying spatial correlation of $(E[\varepsilon_i \varepsilon_j] \neq 0)$, OLS estimator is unbiased at the moment, but it is no longer valid. Obviously, OLS method is not suitable to handle spatial correlation problem. The estimation should be performed through applying the method of instrumental variable, maximum likelihood method or generalized least squares estimation method and so on. Provincial econometric model is estimated through applying maximum likelihood method.

The setting of provincial weighting

The setting of provincial weighting model W is the key of provincial econometric model, which is also the embodiment of influence approach among regions. This paper will adopts the geographic weight matrix and economic weight matrix to describe the model.

(1) Geographic weighting matrix follows the adjacent decision rules of Rook, namely the two places with the common boundary are considered as they are adjacent. The setting approach of matrix w is as followings: the element on the main diagonal is 0, if i region is adjacent with j region, thus w_{ij} is 1, otherwise it is 0. During the empirical estimation, w needs standardized processing, the sum of each element on the line is 1 through making element divide the sum of element on the line in the meantime.

(2) Actually, the mutual influence relationship among regions is not completely the same, because the influence strength of less developed areas is smaller than developed area, while developed regions are able to generate greater radial and attraction force to backward areas all round, namely it has more intense spatial influential force. Thus Guangping Lin has setted the economic weight matrix on the basis of binary weight matrix, its form is: $W = w \times E$, where w is geographic weighting matrix; E is the weight matrix of quantitating the economic disparity among regions. This paper is to measure the regional economic level through calculating the mean value of proportion that the real GDP in each region takes account in that of all areas during the inspecting period, and assuming these regions with strong economic power would generate strong spatial influence to surrounding region, otherwise it is weak. The economic spatial weight matrix W is the mean value of proportion of geographical spatial weight w in GDP of all regions, that is the product of diagonal matrix in diagonal element, its concrete form is :

$$\mathbf{W} = \mathbf{w} \times \mathbf{diag}\left(\frac{\overline{\mathbf{y}_1}}{\bar{\mathbf{y}}}, \frac{\overline{\mathbf{y}_2}}{\bar{\mathbf{y}}}, \ldots, \frac{\overline{\mathbf{y}_n}}{\bar{\mathbf{y}}}\right),$$

$$\textbf{Where, } \overline{\mathbf{y}_i} = \frac{1}{\mathbf{t}_1 - \mathbf{t}_0 + 1}\sum_{t=t_0}^{t_1} \mathbf{y}_{it},$$

$$\bar{\mathbf{y}} = \frac{1}{\mathbf{n}(\mathbf{t}_1 - \mathbf{t}_0 + 1)}\sum_{t=t_0}^{t_1}\sum_{i=1}^{n} \mathbf{y}_{it} \qquad (3)$$

In type (3), t is the periods of inspecting time, n is the number of inspected areas, y is the GDP of inspected area. As the setting of different spatial weight matrix will produce great influence to the results of model estimation. This paper is to perform provincial autocorrelation test and provincial panel data analysis through applying these two methods respectively.

Index sand data sources

As environmental pollution has directly caused the destruction of ecological environment system, so this article selects 5 kinds of exhaust gas regarding the research about the relationship between economic growth and ecological environment system, namely sulfur dioxide C_{SO_2} , smoke C_{YC}, dust C_{FC}) and waste water (chemical oxygen demand (cod) C_{COD}, ammonia nitrogen C_{AN}), and their principal pollutant is the yard stick of environmental quality.

For economic growth, the measurement of per capita $GDP(x)$ is selected. In order to get rid of the influence from fluctuant price level, per capita GDP of each year all take the price in 2003 as base period correction. According to the availability of data, the panel data in this paper contains related data during the year 2003~2008 of 31 regions in China (excluding Hong Kong, Macao and Taiwan regions), the part index number before 2003 has caused the shortage of comparability in original data because of the statistical caliber difference. All the data is obtained through clearing up the data during the year according to “China Statistical Yearbook”. In order to eliminate the possibly existing heteroscedasticity among variables, logarithmic treatment is performed to all variables.

Model specification

A logarithmic quadratic model is setted according to EKC hypothesis, the explained variable is the per capita emissions of contaminant, explanatory variable is average per capita income, so the EKC basic model of standard parameterization is:

$$\ln y_{it} = \alpha_0 + \beta_1 \ln x_{it} + \beta_2 \ln^2 x_{it} + \mu_{it} \quad (4)$$

In type (4), i is regional indicators (i=1,...,N);t is time index (t=1,...,T). μ_{it} is assumed to be normal random perturbation terms. In such model,assuming that parameters β_1, β_2 is syngenetic, namely the parameter neither depends on special individuality, nor relies on special time, which indicating that although the environmental conditions and economic development level among regions may be not the same, each area has the same EKC relationship, and the identical EKC turning point would appear, and only $\beta_1 > 0 and \beta_2 < 0$, EKC relationship is setted up.

For the spatial autoregressive model (SAR), the weighted value of explained variable which illustrates spatial correlation is added into type (4), and then it is extended to provincial panel model:

$$\ln y = \alpha_0 + (R_T \otimes W_N)\ln y + \beta_1 \ln x + \beta_2 \ln^2 x + \mu \quad (5)$$

In type (5), $R_T = \begin{pmatrix} \rho_1 & 0 & 0 & 0 \\ 0 & \rho_2 & 0 & 0 \\ \cdots & \cdots & \cdots & \cdots \\ 0 & 0 & 0 & \rho_T \end{pmatrix}, X = \begin{pmatrix} X_1 & 0 & 0 & 0 \\ 0 & X_2 & 0 & 0 \\ \cdots & \cdots & \cdots & \cdots \\ 0 & 0 & 0 & X_T \end{pmatrix}$. In practical application, in addition to adding the stability of spatial weight matrix W_N, it also assumes spatial autoregressive coefficients ρ has time invariance, namely: ! $\rho_1 = \rho_2 = ... = \rho_T = \rho$, thus model (5) could be represented as:

$$y = \alpha_0 + \rho(I_T \otimes W_N)y + \beta_1 \ln x + \beta_2 \ln^2 x + \mu \quad (6)$$

For spatial error model (SEM), considering the model of cross-section data: $u_t = \lambda_t W_N u_t + \varepsilon_t$, $t = 1,2,...,T$, which could be denoted as $\varepsilon_t = (I_N - \lambda_t W_N)^{-1} u_t$, $\varepsilon_t = B_{t,N}^{-1} u_t$ in short, order $B_{t,N} = (I_N - \lambda_t W_N)$. The spatial error model (SEM) of panel structure could be represented as as well: $\varepsilon = B_{tN}^{-1}\mu$, where $B_{tN} = [I_{NT} - (\Theta_t \otimes W_N)]$, Θ_t is the matrix when $T \times T$ dimensional diagonal line is λ_t. If $\lambda_1 = \lambda_2 = ... = \lambda_T = \lambda$, the spatial error model is

$$\begin{cases} \ln y_{it} = \alpha_0 + \beta_1 \ln x_{it} + \beta_2 \ln^2 x_{it} + \varepsilon \\ \varepsilon = B_{tN}^{-1}\mu \end{cases} \quad (7)$$

Where $B_{tN} = [I_{NT} - (\lambda \otimes W_N)]$. Its covariance matrix is: E $E[\varepsilon\varepsilon] = B_{NT}^{-1}\left(\sum_T \otimes I_N\right)B_{NT}^{-1}$. In type (6) and (7), the covariance matrix of $\alpha_0, \beta_1, \beta_2$ is equal with type (4), ρ、λ is the required spatial autoregressive coefficients and spatial error coefficient, indicating the correlation degree between environmental pollution in this region and other adjoining areas. At the same time, according to the estimation results of regression coefficient $\hat{\beta}_1$、$\hat{\beta}_2$, the inflection point (TP) of environmental kuznets inverted U-shaped curve is:

$$\ln\left(GDP/P\right)_{it} = -\frac{\hat{\beta}_1}{2\hat{\beta}_2} \quad (8)$$

$$TP = (GDP/P)_{it} = \exp\left(-\hat{\beta}_1 / 2\hat{\beta}_2\right) \quad (9)$$

THE MODEL TEST OF PROVINCIAL PANEL DATA

The panel data is generated from the mixture of time series data and cross-section data, and there also exists the (spurious regression) problem which is the most likely to be produced through constructing regression model by applying nonstationary time series. Thus before actual operation, unit root test must first be performed on panel data. In order to determine the intrinsic causal relationship among variables, this paper has selected Hausman checkout to establish that the panel data model is suitable to fixed effects or random effects.

The quantitative analysis of provincial panel data should perform spatial correlation test first. The statistics of testing regional spatial correlation mainly includes the statistics of Walds, Lratiop and Lmsar, LMerror and spatial correlation index,Moran's I based on the estimation hypothesis test of maximum likelihood. Their original assumptions are $H_0 : \rho = 0 or \lambda = 0$.

Unit root test

The unit root test method of panel data mainly contains test method such as LLC, IPS, ADF and PP etc. In order to overcome the deviation brought by one inspecting method, the operability of Eviews software is simultaneously considered, many methods are selected to perform unit root test on data variables of each panel and the first order difference variables. The results are shown in TABLE 1.

TABLE 1 : The unit root inspection result of variable's panel data

Roots of unity Test method				
Test	LLC test statistic (P)	IPS test statistic (P)	ADF test statistics (P)	PP test statistics (P)
$\ln C_{COD}$	-13.5217 (0.0000)	1.37403 (0.9153)	38.4729 (0.9918)	62.2869 (0.4659)
$\Delta\ln C_{COD}$	-72.7318 (0.0000)	-10.2425 (0.0000)	173.458 (0.0000)	271.746 (0.0000)
$\ln C_{FC}$	-15.8368 (0.0000)	1.10988 (0.8665)	44.4857 (0.9545)	72.6809 (0.1665)
$\Delta\ln C_{FC}$	-87.2138 (0.0000)	-14.0147 (0.0000)	146.607 (0.0000)	213.241 (0.0000)
$\ln C_{SO_2}$	-5.11083 (0.0000)	2.31010 (0.9896)	20.8061 (1.0000)	28.0823 (0.9999)
$\Delta\ln C_{SO_2}$	-34.5452 (0.0000)	-3.72286 (0.0001)	110.215 (0.0002)	207.642 (0.0000)
$\ln C_{AN}$	-5.11083 (0.0000)	2.31010 (0.9896)	20.8061 (1.0000)	28.0823 (0.9999)
$\Delta\ln C_{AN}$	-34.5452 (0.0000)	-3.72286 (0.0001)	110.215 (0.0002)	207.642 (0.0000)
$\ln C_{YC}$	-24.7276 (0.0000)	0.22437 (0.5888)	55.6133 (0.7034)	86.0060 (0.0235)
$\Delta\ln C_{YC}$	-83.8074 (0.0000)	-6.59213 (0.0000)	92.5553 (0.0072)	148.345 (0.0000)
$\ln x$	6.44973 (0.0000)	1.61837 (0.9472)	34.9902(0.9978)	55.0498(0.7219)
$\Delta\ln x$	64.4647 (0.0000)	-5.0239 (0.0000)	108.550(0.0002)	158.353(0.0000)
$\ln x^2$	-5.98933 (0.0000)	1.3732 (0.9152)	41.6500(0.9781)	69.1410(0.2490)
$\Delta\ln x^2$	-66.6471 (0.0000)	-5.4077 (0.0000)	111.139(0.0001)	156.974 (0.0000)

The unit root test of above all variables has intercept term. We could see from TABLE 1 that, all the pollutants reject null hypothesis through the first order difference, namely all $\ln C_{COD}$, $\ln C_{FC}$, $\ln C_{YC}$, $\ln x$, $\ln x^2$ could be considered as the first-order integration (I (1)) variable.

Hausman test

Hausman test is used to make choice in fixed effect model and random effect model. The null hypothesis of Hausman test is that there is no difference in the coefficients of random effect model and fixed effect model. If the null hypothesis is accepted, it suggests that random effects model should be selected, otherwise the fixed effect model should be selected. The inspection results are shown in TABLE 2:

TABLE 2 : Hausman inspection result

Hausman test	C_{COD}	C_{FC}	C_{YC}	C_{SO_2}	C_{AN}
Chi-Sq.Statistic	4.849	4.879	1.455	1.319	9.293
Chi-Sq.d.f.	2	2	2	2	2
P	0.034	0.022	0.000	0.007	0.009

We could know from the Hausman inspection results in TABLE 2 that all the small probability P are smaller than the significant level threshold of 5%, thus the null hypothesis that there is no difference between the coefficient of random effect model and fixed effect model should be rejected, so the fixed effect model should be selected.

Based on the inspection result of above spatial panel data model, this paper has adopted the fixed effect model, and the selection of spatial model is judged through spatial correlation test.

Spatial autocorrelation test

As all the spatial correlation test such as Moran's I, Lmerr, Lmsar, Lratios, Walds etc are proposed focusing on the regression model of single cross-section, and they could not be directly used in panel data model. Thus this paper has applied $C = I_T \otimes W_N$ in spatial correlation test, namely the spatial weight matrix is replaced with augmented one, thus these checkout could be expanded to panel data analysis. This paper has used 2 tests of Lmerr, LMsar statistics,which are shown as followings:

$$\mathbf{LMerr} = \frac{\left[\mathbf{e}'(\mathbf{I_T} \otimes \mathbf{W_N})\mathbf{e}/(\mathbf{e}'\mathbf{e}/\mathbf{NT})\right]^2}{\mathbf{tr}\left[(\mathbf{I} \otimes \mathbf{W_N^2}) + (\mathbf{I_T} \otimes \mathbf{W_N'W_N})\right]},$$

$$\mathbf{LMsar} = \frac{\left[\mathbf{e}'(\mathbf{I_T} \otimes \mathbf{W_N})\mathbf{y}/(\mathbf{e}'\mathbf{e}/\mathbf{NT})\right]^2}{\left[\left(\mathbf{W}\hat{\mathbf{y}}\right)'\mathbf{M}\left(\mathbf{W}\hat{\mathbf{y}}\right)/\sigma^2\right] + \mathbf{tr}\left(\mathbf{W_N^2} + \mathbf{W_N'W_N}\right)} \quad \mathbf{(10)}$$

In type (10), $W\hat{y} = (I_T \otimes W_N)X\hat{\beta}$, $M = I_{NT} - X(X'X)^{-1}X'$. The two statistics comply with $\chi^2(1)$ distribution. LMerr and LMsar,as well as its spatial correlation test in stable form, not only could be used to test spatial correlation, but also could provide clue to model set, and help itself to make choice between spatial autoregressive model and spatial error model. Upon the problem of selecting model, the current practice is to estimate the constrained model through applying OLS method without considering spatial correlation, then the spatial correlation test is performed. If LMsar is more significant than LMerr statistics, then the proper model is the spatial autoregressive model, and vice versa. ANselin and Rey demonstrate that this method could provide basis for selecting spatial econometric model through applying monte carlo experiment method.

This paper has performed test to the spatial correlation of regional economy growth according to standardized geographic binary weight matrix and economic weight matrix, the test results of spatial autocorrelation is shown in TABLE 2 and TABLE 3.

Look from the inspection results, the spatial autocorrelation of contaminant COD and dust could not pass the checkout based on the case of 2 weighting. This is because COD exists shorter time in nature, the dust is not easy to spread, which results into that the spatial spillover effects of these two pollutants is smaller. The test statistics of spatial correlation in other 3 pollutants is significant, thus we think there exists significant spatial correlation among these 3 pollutants. TABLE 3 and 4 show that the statistic value of LMsar is bigger than LMerr's statistic value, namely the test value of spatial autoregressive is bigger than the critical value of spatial error inspection, thus the spatial autoregressive panel estimation method (SAR) is selected to estimate four kinds of model (non -fixed effect model, fixed space effect model, fixed time effect model effect model of fixed time and space).

TABLE 3 : The spatial correlation test based on geographical spatial weight matrix

Geographical weightings	C_{COD}(P)	C_{AN}(P)	C_{SO_2}(P)	C_{YC}(P)	C_{FC}(P)
LMsar	5.774(0.016)	243.686(0.000)	247.064(0.000)	681.078(0.000)	7.120(0.008)
LMerror	0.244(0.621)	2.945(0.008)	2.951(0.028)	24.137(0.000)	0.428(0.513)
Moran's I	-0.028(0.675)	0.090(0.050)	0.090(0.035)	0.258(0.000)	0.034(0.403)

TABLE 4 : The spatial correlation test based on economic spatial weight matrix

Economic weight	C_{COD}(P)	C_{AN}(P)	C_{SO_2}(P)	C_{YC}(P)	C_{FC}(P)
LMsar	0.597 (0.442)	2.820 (0.010)	2.930 (0.029)	37.279 (0.000)	0.800 (0.371)
LMerrpr	0.244 (0.621)	2.582 (0.013)	2.582 (0.048)	33.990 (0.000)	0.098 (0.754)
Moran's I	-0.00 (0.976)	0.096 (0.052)	0.096 (0.042)	0.282 (0.000)	0.096 (0.051)

RESULTS ANALYSIS

Regarding the beingness assumed by EKC, look from the estimation curve form of 3 pollutants, SO_2 and ammonia nitrogen is of quadric form, the smoke is linear type of linearly decreasing, this paper thinks it is due to that the turning point of smoke and dust in China is relatively low, its discharge has exceeded its turning point and represented declining trend. Thus the relationship between the destruction of ecological environment and economic growth basically complies with the inverted u-shaped curve relationship assumed by EKC. Meanwhile, EKC assumes to introduce spatial correlation factors, the relationship between ecological environment system and economic growth has been analyzed through applying provincial dynamic panel model. The results indicate that, the destruction of ecological environment system and average per capita income basically conforms with EKC assumption, and there exists significant spatial correlation among ammonia nitrogen pollutants, SO_2, smoke and dust based on 2 weight, thus both economic factors and geographical factors have significant role in the spillover effects of China's environmental pollution, a further conclusion has been derived that the role of geographical factors is bigger than economic factors.

Although EKC hypothesis think that economic growth will finally lead to the improvement of ecological and environmental quality,solving the destruction problem of ecological environment still needs the economic growth itself, but we must clearly know that the virtuous circle between economic growth and ecological environment would not come true automatically. Thus we think, accelerating the transformation of economic growth pattern, promoting the upgrading and updating of industrial structure, strengthening the regulatory efforts of environmental policy etc are the important task of Chinese governments at all levels in the future in implementing the scientific concept of development and realizing sustainable development.

There exists significant spatial correlation in environmental quality among Chinese provincial region. Some local government in China are to develop economy at the cost of environment, it not only causes environmental pollution itself, but also certainly influences the environmental quality in surrounding areas. If such short-termism of local governments in some areas cannot get specification and guidance,it would inevitably results into the further deterioration of China's overall environmental quality. As the regional environmental problems like cross-border pollution has become serious increasingly, despite which economic development level that a region is in, the environmental cooperation of cross-administrative district has already become the contradiction in coordinating economic development and environmental pollution in local government. Building a harmonious society is the inevitable choice,which has bright guiding significance to the industry selection in China's central and western regions. As the constant depth of regional industry transfer, the closely combined industry with more and more technology,labor, resource starts to enter central and western regions, but the government should vigorously support environmental efficiency industrial development with high technology content,less energy consumption, and enhance the entry threshold of industry, abandon these backward industries of high pollution and energy-extensive consumption. The adjustment of industrial structure should be on the premise of preserving the ecological environment, the traditional backward development mode of treatment after pollution could not be repeated. This requires China's central and local governments to coordinate the economic development and environmental protection strategy in Chinese various areas with the strategic insight of “the national game” in the strategy process of implementing“west development” and “rise of central china,only selecting the development strategy of “combing development and management” could realize the win-win of economic development and environmental quality.

ACKNOWLEDGMENT

New professional building of revitalization plan project management of Anhui education department in 2013, No.2013zytz088.

REFERENCE

[1] A.Jalil, F.M.Syed; Environment Kuznets Curve for CO2 Emissions: A Cointegration Analysis for China, Energy Policy, **37**, 5162-5172 **(2009)**.
[2] D.Roodman; How to do Xtabond2: An Introduction to Difference and System GMM in Stata, Stata Journal, **9(1)**, 86-136 **(2009)**.
[3] F.Kahrl, D.R.Holst; Growthand Structural Change in China's Energy Economy, Energy, **34**, 894-903 **(2009)**.
[4] IEA; World Energy Outlook2007, International Energy Agency, **(2007)**.
[5] IEA; CO2 Emissionsfrom Fuel Combustion 2009 Highlight Edition, International Energy Agency, **(2009)**.
[6] IPPC; Climate Change2007, Cambridge University Press, **(2007)**.
[7] D.Greenaway, R.Kneller; Exporting, Productivity and Agglomeration: A Difference in Difference Analysis of Matched Firms, European Economic Review, **52(5)**, 919-939 **(2008)**.
[8] V.Amendolagine, R.Capolupo, N.Petragallo; Export Status and Performance in a Panel of Italian Manufacturing Firms,Southern Europe Research in Economic Studies Working Paper, **27**, **(2010)**.
[9] A.Silva, A.P.Africano and O.Afonso; Learning-by-Exporting: What We Know and What We Would Like to Know[J], FEP Working Paper, **364**, **(2010)**.
[10] H.Gao; The transformation of environmental pollution and economic growth, Finance Economics, **4**, **(2009)**.