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TRADE, ECONOMIC GROWTH AND ENVIRONMENT: EVIDENCE FROM CROSS-COUNTRY COMPARISONS

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ABSTRACT

The present study illustrates the environmental consequences of trade on patterns of economic growth. Stressing the concept of the well known inverted-U curve hypothesis (the Environmental Kuznets curve), this work attempts to show whether economic growth is affected by the influence of Foreign Direct Investments to provide a stimulus to competition among countries. By using a panel data approach, the paper has two aims: 1) to examine the environmental impact resulting from fertiliser use in European, Accession and Mediterranean countries; and 2) to analyse the impact on agricultural pollution of Foreign Direct Investments. Results suggest reduction of pollution when countries open their economies to international trade and increase in fertiliser use with an inflow of foreign capital.

1. INTRODUCTION

Over the past decades literature has been increasing on the debate of trade, environment and economic growth and theoretical and empirical attempts have been drawn on finding a linkage among these variables. To study the environmental performance in a certain economic system depends upon the necessity to define a given spatial scale of analysis combining the inter-relationship between different ecological systems and production process, mechanisms of environmental policy and patterns of domestic and international trade to favour a sustainable economic growth.

Considering the potential trade effects of differential pollution control regulation among countries, a considerable new theoretical work is devoted to reconciling environmental factors with classical models of international trade. d'Arge and Kneese (1972), Pethig (1976), Siebert (1977), McGuire (1979), Baumol and Oates (1998), Carraro and Siniscalco (1992) and Krutilla (1991) examine the environmental quality and its assimilative capacity as a natural factor of endowment. From a theoretical point of view, the concept of environmental endowment depends upon how it can be utilised in the production process and how it can affect, in line with Ricardo, one country's comparative advantage and its pattern of economic growth.

Empirical evidence in this area recognises three main groups of studies to determine: 1) how the economic growth affects the environment; 2) how environmental regulations effect trade and 3) how pollution intensity of production has changed over time. This paper describesa study carried out to answer these questions.Empirical evidence on the simultaneous effect between environment and economic growth was initiated by the pioneering work of Grossman and Krueger (1993) and a growing literature (Selden and Song, 1994; Shafik, 1994; Holtz-Eakin and Selden and Song, 1995) known as the Environmental Kuznets Curve (EKC, hereafter) has been developed. The EKC hypothesis proposes an inverted U-shape between various indicators of environmental degradation and per capita income. Therefore, one country's economic growth will redress the environmental impacts of the early stages of economic development and technological progress will lead to improving environmental performances in line with countries' development patterns.

On this premise, the EKC hypothesis distinguishes three determinants of environmental quality: the *scale* of economic activity, the *composition* of economic activity and the *income effect* (also called technique effect) on demand and supply of pollution abatement. The scale effect is represented by the GDP. The higher the output produced, the higher the level of pollution. The composition effect reflects differences in pollution levels related to different pollution sources. Changes in the structure of the economy (i.e., the relative factor abundance) reflect the effect of the changing of the composition of output. The technique effect reflects the positive marginal propensity to pollute at low level incomes, which invert to negative as income rises.

The defining feature of this literature is a series of strong assumptions which when relaxed give rise to arguments against the current trade liberalisation agenda. Despite this, several studies found strong evidence for the EKC relationship, which receives support in this work. The impacts of trade on environment vary in degree and by location. Stern (1999) includes a simple indicator of openness to international trade as a proxy for trade liberalisation. Suri and Chapman (1998) provide a robust empirical work of the impact of trade on the EKC. In agriculture, there is evidence that reducing subsides and trade distortions helps to reduce environmental damages by lowering fertiliser and pesticide use and increasing efficiency with which soil and water resources are used (Runge, 1987; Harold and Runge, 1993; Johnstone, 1996). An additional feature is known as pollution haven and industry flight hypothesis. The first states that poor countries relax their environmental regulation in order to attract foreign investments. The industry flight hypothesis is based upon the idea that stringent environmental regulations: a) drive up firms' production costs; b) make it difficult to find proper sites for new investments and c) have a direct effect on prices of inputs which cause firms to migrate. Empirical analysis captures a pollution haven and the industry flight hypothesis using Foreign Direct Investments (FDI, hereafter) as a proxy. FDI involve partial or total ownership of a firm in one country by a firm in another country, implying active control of production processes. Some observers argue that FDI in Accession Countries (AC, hereafter) and countries of the Mediterranean basin promote environmental quality (Goldenman, 1999; OECD, 1999). Yet, there is evidence that FDI have not been as remedial to the environment as predicted. Ensuing sections consider this concern under the EKC analysis.

Basing the research on the conclusions of Suri and Chapman (1998), in this paper we discuss the EKC hypothesis for fertiliser use accounting for trade liberalisation and FDI. We apply a panel data analysis and consider "two-way" fixed and random effect models to analyse whether time affects pollution levels. The structure of the article is organised as follows: section 2. describes the methodology of the fixed and random effect model; section 3. presents the dataset; section 4. shows the empirical results; and section 5. concludes.

2. METHODOLOGY: FIXED VERSUS RANDOM EFFECT

Several empirical studies on agriculture have been based on deforestation (see Allen and Barnes, 1985; Rudel, 1994, Tole, 1998) and only few have considered fertiliser or pesticide use in agriculture as an environmental variable (Vause, 2001). To allow for investigations between fertiliser use and income the simple cross-country regression, among other factors, uses model of the form:

$$y_i = \alpha + \sum_{j=1}^{k} \beta_j x_{ij} \qquad [1]$$

where y_i is fertiliser use in country i $(i = 1,....N)$ and x_{ij} is the explanatory variable j in country i. The simple model in (1) assumes a common structure of income and other variables across countries. The effect on fertiliser use in all explanatory variables is the same for every country, i.e. every country has the same α and β_j. For example, we can say that a 1% increase of per-capita GDP (Gross Domestic Product) in Italy has the same effect on fertiliser use as a 1% increase of the same variable in Morocco. As far as countries differ in factors that affect the income-environment relationship and are too various to get the same results. To avoid the weakness of a cross-section analysis some authors (Grossman and Krueger, 1995; Holts-Eakin and Selden, 1995) use panel data to estimate fixed or random effect models. The fixed effect models take the form:

$$y_{it} = \alpha_i + \sum_{j=1}^{k} \beta_j x_{ijt} \qquad [2]$$

where the subscript α_i allows for an individual effect to vary in each country. By including the fixed country effect, β_j s (the effect of the explanatory variables) are the same across country and in each time period. In other words, although there are different EKCs across countries, the curves have the same shape. This restriction implies that similarities in development-environment relationship do exist across countries over a period of time.

However, it may be possible that similarities exist *within* a country over a period of time. For example, it is more reasonable to expect that the economic structure of Italy in 1980 is similar to that in 1990, rather than the economic structure of Morocco for any period of time. The random effect model over time is as follows:

$$y_{it} = \alpha_i + \sum_{j=1}^{k} \beta_{ij} x_{ijt} \quad [3]$$

where β_{ij} s explanatory variables will not differ *within* but *across* countries over time. Therefore, the shape of the EKC in country i will depend upon β_i and the vector β can be interpreted as an average income/fertiliser use, where each individual country can differ from this average by Ω[1]. If Ω is small, the fixed effect model is consistent and efficient in using income to investigate the EKC on average. If Ω is large, the random effect model is consistent because large heterogeneity across-countries does exist. In this case, the fixed effect model is consistent but not efficient. A Hausman test statistic, distributed asymptotically as χ^2 with k degrees of freedom, tests the null hypothesis that the random effect model is correct (Green, 2000; Johnston and Di Nardo, 1997).

2.1 Two-way fixed effect model

Following Wallace and Haussian (1969), Nerlove (1971) and Amemiya (1971) we also consider a panel data estimator that allows for a "two-way" fixed effect model to include a time-specific effect other than the individual country. According to Green (2000), we expand the fixed group model to introduce the time effect as follows:

$$y_{it} = \alpha_i + \gamma_t + \sum_{j=1}^{k} \beta_j x_{ijt} \quad [4]$$

where γ_t is the time-specific effect. On this basis, we analyse whether fertiliser use appears to differ across time period that is not accounted for by income related variables. A simple F-test (in this case Chow test) statistic is applied to test the null hypothesis that the two-way fixed group and time effect does not differ.

3. DATA

Our sample includes the EU countries, two representative ACs (Poland and Turkey), and some countries of the Mediterranean basin (Algeria, Egypt, Morocco, Jordan, and Tunisia) over the time period 1980-1990. Environmental data on fertiliser (per 1000 tons) and land use are taken from the FAO web site[2]. In this study we use the natural log transformation of per capita fertiliser because, in line with Stern (1999), a logged dependent variable acts as asymptotic control, ensuring that the fertiliser per capita does not fall below zero at any point. All fertilisers are included according with the FAO. The choice of this broad definition does not allow for inconsistency arising from more restrictive fertiliser definitions. Most of the macroeconomic data (GDP, GNP - Gross National Product - and FDI) valued at 1987 international Dollars are taken from the World Bank Atlas 1992. The reason that accounts for the GDP and GNP as explanatory variables distinguishes the scale from the technique effect (Antweiler, Copeland and Taylor, 2000). The scale of economic activity - the GDP - is measured by economic activity within a country's border, whereas the GNP per capita reflects the income of residents inside and outside one country's border. Substantial differences between these two variables separate the scale effect from the technique effect. The scale of economic activity is measured per unit area (Km^2), while its intensity by the square of GDP per Km^2. The intensity of economic activity also captures the composition effect of the EKC hypothesis[3]. The "openness" variable is a proxy for trade liberalisation, whose source is the Penn World Table (Mark 5.6) web site.[4]

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[1]The $\beta_i = (\alpha_i, \beta_{1i}, ..., \beta_{ik})'$ matrix coefficient has a distribution $\beta_i = \beta + v_i$, with $E(v_i) = 0$, $E(v_i v_i') = \Omega$ and $E(v_j v_i') = 0$ for $i \neq j$ (see Koop and Tole, 1999).

[2] www.fao.org

[3] The state of the art of this article lacks in data recalling the value of the physical capital stock per worker for Mediterranean and Accession Countries over the time period considered.

[4] www.pwt.econ.upenn.edu

3.1 Functional form

The functional form of our EKC hypothesis is a linear approximation to measured fertiliser use by considering fertiliser at specific site-country at time as follows:

$$y_{it} = \alpha_j \sum_{j=1}^{k} \beta_{ij} \; x_{ijt} + \Downarrow_{ijt} \quad [5]$$

$$\beta_{ij} x_{ijt} = x_o + x_1 GDP_{ijt} + x_2 GDP_{ijt}{}^2 + x_3 GNP_{ijt} + x_4 GNP_{ijt}^2 + x_5 GDP * GNP + \\ + x_6 \Phi_t OPEN_t + x_7 FDI_t \quad [6]$$

and $\Phi_t = \phi_0 + \phi_1 OPEN1_t + \phi_2 OPEN2_t$

where $OPEN1_t = OPEN(RELGNP)$ and $OPEN2_t = OPEN(RELGNP)_t^2$ ε_{ijt} = standard error. GDP per Km^2 measures the scale effect of our EKC and the square of GDP captures a certain degree of the composition effect. The impact of income gains on fertiliser use depends on the existing composition of income per-capita or the existing composition of output. The square of per-capita income accounts for the existing output. The OPEN variable is the openness of one country to international trade and it is measured by the sum of exports and imports over the total GDP. OPEN1 and OPEN2 consider the interaction between a measure of relative income - (RELGNP), one country's income relative to the sample income average - and the square of the RELGNP with the openness variable. This method allows for further openness impacts to depend upon each country characteristics as soon as a country develops.

4. EMPIRICAL RESULTS

Table 1 reports the summary of descriptive statistics for the data. Table 2 shows and tests for classical regression (CR) estimated by simple OLS (Ordinary Least Squares), the fixed effect model (FE) - or Least Squares Dummy Variable model - with individual specific constant terms estimated by partitioned ordinary least squares and Random model (REM), respectively.

Table 1. Summary Statistics for data.

	Mean	Standard Deviation
GDP per Km	94875270.0	155187525.
GDP per Km squared	.329849677E+17	.791806033E+17
Log per capita GNP	13.9758766	11.6451324
Log per capita GNP squared	330.373866	292.827683
Log relative GNP	9.96603165	5.87950575
Openness	181822133.	290138218.
FDI	49630219.5	547672088.

An examination of Table 2 indicates strong support for the environmental Kuznets curve when a panel data is used. Two steps can be addressed to choose between a simple OLS regression and a panel data model. First, the row labelled “LM test” represents the Lagrange Multiplier test by which a CR model is tested against a panel data. A low *p-value* is in favour of panel data analysis.

Second, a Hausman test statistic is used to test the null hypothesis that the random effect model is correct. A low p-value does reject the REM. Therefore, we have carried out our analysis for the estimation of the EKC on the basis of the FE model.

Table 3 represents the estimated two-way fixed and random effect model. The Hausman test indicates, once again, that we are able to reject the null hypothesis of no correlation between the individual group and time effect and the income variables. Furthermore, a Chow test is used to test the joint significance of the two way fixed effect model. A low p-value suggests that we are able to reject the null hypothesis that fixed group and time effect does not differ. In fact, from Figure 1, which depicts the time-effects, we can see a linear trend of the time coefficient. This implies that countries in our sample did not have big changes in fertiliser use over the period 1980-1990. Besides, the European Environment agency argues that "*phosphorus fertiliser consumption in most EU countries peaked around the early 1980s, and the use of nitrogen fertilisers peaked around the mid- to late 1980s. In the Accession Countries, fertiliser consumption has declined markedly, but may increase from its current low level due to increased agricultural production*"[5]. Table 4 and 5, illustrate estimated coefficients for country and time effects.

Table 2. Estimates for alternative models (standard errors in parenthesis)

Estimation Model Variable/Column	OLS	Fixed Effect Model	Random Effect Model
Constant term	-1.433574922 (2.7864921)		-.9474967606*** (2.5518621)
GDP	.4733495781E-07** (.55416259E-08)	.3488063576E-07 (.54592601E-08)	.4287807202E-07 (.49826506E-08)
GDP^2	-.6670836453E-16** (.10064552E-16)	-.4747956254E-16 (.96497975E-17)	-.5947415611E-16 (.89447903E-17)
LGNP	1.517877867** (.33075724)	1.205225725** (.47143707)	1.390645974 (.33156937)
$LGNP^2$	-.58581134E-01** (.13554546E-01)	-.4601909913E-01** (.19395263E-01)	-.5382150121E-01 (.13644375E-01)
OPEN	-.9516577263E-07** (.17279074E-07)	-.4201241846E-07** (.18062615E-07)	-.7750821723E-07 (.15917936E-07)
OPEN1	.6080560219E-08** (.11108005E-08)	.2523910089E-08** (.11711018E-08)	.4890272503E-08 (.10270622E-08)
OPEN2	-.2016503757E-19 (.14906083E-19)	-.4068462581E-21 (.13337231E-19)	-.13039317E-19*** (.12832931E-19)
LRELGNP	.5313404164** (.16487644)	.5264364665** (.17518861)	.5139028679 (.15344496)
FDI	.9407109801E-10 (.79543409E-09)	.1612074861E-08*** (.88470287E-09)	.92540077E-11*** (.71944432E-09)
MEDIT	.7351244639E-07 (.69913053E-07)	.8440717965E-07 (.69989587E-07)	.86604091E-07*** (.63603913E-07)
NONEU	-.1392445507E-08** (.12912532E-09)	.3922265554E-09 (.42660551E-09)	-.1261494240E-08 (.14647391E-09)
Observations	242	242	242
F test	46.36 (*p-value* .00000)	26.30 (*p-value* .0000)	
R^2	.689160	.801078	.68320
LM test	*33.25 (1 df, p-value .00000)*		
Hausman Test	*62.50 (11 df, p-value .00000)*		
Turning points	42.309$	48.643$	41.427$

(i) ** and *** indicate statistical significance at 95% and 90% confidence levels, respectively.

[5] European Environment Agency, Water stress - Environment in EU at the turn of the century (Chapter 3.5), http://reports.eea.eu.int/92-9157-202-0/en/page305.html.

Table 3. Estimates for two-way Fixed and Random effect models (standard errors in parenthesis).

Estimation Model Variable/Column	Fixed Model with Time effects	Random Effect Model
Constant term	1.402972203 (2.6549773)	1.724112350 (2.7342316)
GDP	.20925660E-07** (.53146038E-08)	.25676286E-07** (.51296460E-08)
GDP^2	-.21743805E-16** (.94592003E-17)	-.291768270E-16** (.91901200E-17)
LGNP	.8882857410** (.42893395)	.9531059441** (.38443705)
$LGNP^2$	-.34933850E-01** (.17617361E-01)	-.380285317E-01** (.15811218E-01)
OPEN	-.338197193E-07** (.16726808E-07)	-.485745962E-07** (.16101393E-07)
OPEN1	*.18855539E-08**** (.10826187E-08)	.287986753E-08** (.10413178E-08)
OPEN2	.7516299683E-20 (.12420601E-19)	.1910657789E-20 (.1910657789E-20)
LRELGNP	.4588695921** (.16209809)	.4491994115** (.15634117)
FDI	.307695843E-08** (.84227687E-09)	.181140940E-08** (.77317979E-09)
MEDIT	-.4409446112E-07 (.71716066E-07)	-.2484254029E-07 (.68493313E-07)
NONEU	.1571759276E-09 (.40105696E-09)	-.875739660E-09** (.23859822E-09)
Observations	242	242
F test	25.44 (p-value .00000)	
R^2	.846727	.68320
LM test	*33.30 (1df,* p-value *.00000)*	
Hausman Test	*31.64 (11 df,* p-value *.00000)*	
Turning Points	*33.231$*	*27.6913$*

(i)** and *** indicate statistical significance at 95% and 90% confidence levels, respectively.

Table 4. Estimated Fixed Effects.

Group	Coefficient	Standard Error	t-ratio
Austria	1.53088	0.98247	1.5582
Belgium	0.76542	1.00611	0.76077
Denmark	1.84155	1.01513	1.81409
Finland	2.6587	1.01404	2.62188
France	2.39599	1.00608	2.38151
Germany	1.84269	1.01315	1.81879
Greece	1.99092	0.94624	2.10403
Ireland	-12.488	3.75589	-3.3249
Italy	1.16574	1.07023	1.08924
Netherland	1.11092	1.02199	1.08702
Portugal	1.11112	0.96977	1.14575
Spain	-0.35031	1.00577	-0.3483
UK	1.30454	1.04302	1.25074
Sweden	0.9759	1.16052	0.84092
Norway	-5.74435	1.10615	-5.19311
Poland	2.38205	0.96673	2.46404
Turkey	1.423	0.92167	1.54393
Morocco	-4.27035	1.00912	-4.23176
Egypt	3.83187	1.05714	3.62474
Tunisia	2.8945	1.12397	2.57525
Jordan	0.79305	1.25574	0.63154
Algeria	-7.16588	1.26901	-5.64684

Table 5. Estimated Time Effects.

Year	Coefficient	St. Error	t-ratio
1980	0.47893	0.65241	0.73409
1981	-0.13027	0.60321	-0.21596
1982	-1.00691	0.59518	-1.69178
1983	0.31127	0.6106	0.50977
1984	0.25908	0.61692	0.41996
1985	0.30687	0.62493	0.49106
1986	1.02402	0.61806	1.65681
1987	-4.33571	0.7329	-5.91585
1988	1.22209	0.60626	2.01579
1989	0.48713	0.60562	0.80436
1990	1.34417	0.6409	2.09731

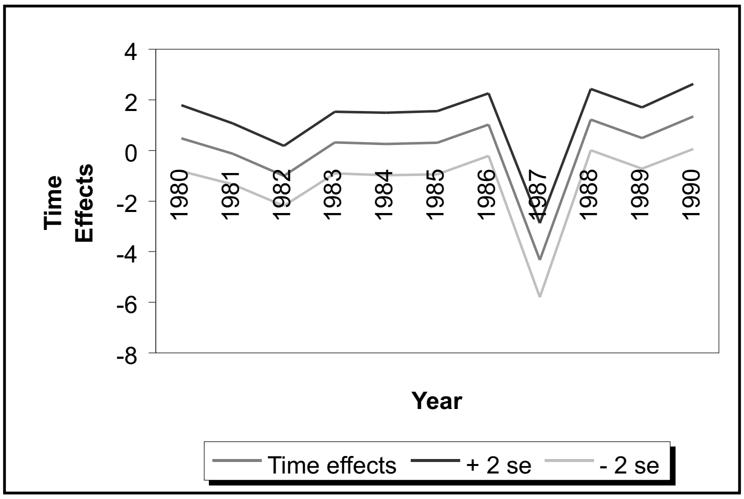

Fig. 1. Time effect with 2 standard error.

An important feature of our analysis is the negative sign of the OPEN variable in all models considered. This would confirm that a lax of trade restriction would lower fertiliser use, whereas the FDI coefficient is not statistically significant in all models. This would also confirm that increasing in FDI would deteriorate the environment. We suppose that the effects of FDI are particularly devoted to the industrial rather than agricultural sector or we can argue in favour of a pollution haven hypothesis for non-European countries[6].

Furthermore let us consider the two dummy variables. MEDIT represents a dummy variable taking the value of 1 for those countries that have their geographical borders with the Mediterranean area and 0 for those which don't[7]. MEDIT shows a negative sign in the two-way fixed effect model, whereas the NONEU dummy has a positive coefficient. Both dummies are not statistically significant at 0,1 confidence interval level. We can argue that taken together Accession and Mediterranean countries would start to decrease their fertiliser use at a lower level compared with European countries, all having the same turning point[8]. The positive sign of the NONEU dummy variable would confirm the predictions of the Environment European Agency (2001), in view of the fact that some of the Accession countries still have higher fertiliser use. In part this is true since the agriculture sector still accounts for a great proportion of the GDP of these countries. In addition, countries like Turkey, Morocco, Egypt, Tunisia and Algeria that show lower relative per-capita income compared to EU countries would be in line with the EKC hypothesis, where environmental damage tends to increase in those countries with lower per-capita income or at the first stage of their economic development.

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[6] Further study needs to be addressed to argue the pollution haven hypothesis.

[7] Countries that assume value of 1 are France, Greece, Italy, Portugal, Spain, Turkey, Morocco, Egypt, Tunisia, and Algeria.

[8] Dummy variables have their effect only on the intercept term. The slope of the EKC does not change.

Table 6. Non-Mediterranean Countries. Estimates for two way fixed and random effect models (standard errors in parenthesis).

Estimation Model Variable/Column	OLS	Fixed Model with Time effects	Random Effect Model
Constant term	-1.280205650 (2.829097)	1.402972203 (2.6549773)	1.724112350 (2.7342316)
GDP	.4753010736E-07 (.55690434E-08)**	.20925660E-07** (.53146038E-08)	.25676286E-07** (.51296460E-08)
GDP^2	-.66976132E-16** (.10116146E-16)	-.21743805E-16** (.94592003E-17)	-.291768270E-16** (.91901200E-17)
LGNP	1.516367244** (.33190501)	.8882857410** (.42893395)	.9531059441** (.38443705)
$LGNP^2$	-.587315317E-01** (.13621100E-01)	-.34933850E-01** (.17617361E-01)	-.380285317E-01** (.15811218E-01)
OPEN	-.950689463E-07** (.17336296E-07)	-.338197193E-07** (.16726808E-07)	-.485745962E-07** (.16101393E-07)
OPEN1	.607373333E-08** (.11144856E-08)	.18855539E-08*** (.10826187E-08)	.287986753E-08** (.10413178E-08)
OPEN2	-.2011656681E-19 (.14954667E-19)	.7516299683E-20 (.12420601E-19)	.1910657789E-20 (.1910657789E-20)
LRELGNP	.5209607653** (.16810138)	.4588695921** (.16209809)	.4491994115** (.15634117)
FDI	.7636360740E-10 (.7636360740E-10)	.307695843E-08** (.84227687E-09)	.181140940E-08** (.77317979E-09)
MEDIT	.7516887267E-07 (.7516887267E-07)	-.4409446112E-07 (.71716066E-07)	-.2484254029E-07 (.68493313E-07)
NONEU	-.139077024E-08** (.12975427E-09)	.1571759276E-09 (.40105696E-09)	-.875739660E-09** (.23859822E-09)
Observations	240	242	242
F test	45.92 (p-value .00000	25.44 (p-value .00000	
R^2	.689020	.846727	.68320
LM test	33.30 (1df, *p-value* .00000)		
Hausman Test	31.64 (11 df, *p-value* .00000)		
Turning Points	40.405$	32.331$	27.6913$

(i) ** and *** indicate statistical significance at 95% and 90% confidence levels, respectively.

In our analysis we also studied the EKC estimates for different sub-samples: Mediterranean and non-Mediterranean countries, European and non-European Countries. For simplicity, Table 6 reports the results for the Non-Mediterranean Countries (whose sample is formed by central and northern European countries and Poland) which show a lower turning point (32.331$, see Table 6) than that of the entire sample (33.231$, see Table 3). We argue in favour of the EKC hypothesis where environmental quality tends to improve in countries with stringent environmental regulations. Most of the northern European countries (the Netherlands, for example) started to implement environmental laws many years ahead of most of the southern countries. The economic growth gap between North and South Europe is, in this case, still relevant. As far as the OPEN variable is concerned, we still argue in favour of improvement in environmental quality when liberalised trade strategies are implemented.

5. CONCLUSION

In this paper we have examined the Environmental Kuznets curve for per capita fertiliser use over a sample of European, Accession and Mediterranean countries. We added a trade component ("openness" to the international trade) and a measure for international capital flows (FDI) to the basic model, finding the inverted U-shape curve. We have discussed the use of a panel data approach against the OLS simple regression and argued in favour of the former. We have carried out our discussion on the basis of the fixed effect model, accounting also for time period effects. The correlation between country effect and income variables in the EKC study suggests the potential role played by other variables that can take different values across countries over time. These variables reflect the structure either of a country's economic system or the comparative advantages given by different environmental regulation regimes.

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