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Economic Competitiveness and Environmental Policy: An Application of the Heckscher-Ohlin-Vanek (HOV) Model

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Abstract

The relationship between trade liberalisation and the environment has been the subject of a growing body of literature in recent years. As can be seen from the differing assessment of instrument types for environmental protection, one of the important factors for the relationship between environmental protection and economic competitiveness are regulatory stringency and efficiency. This concerns e.g. performance versus ambient standards, sale technology versus clean technology/clean production, process change versus demand side measures, legislation versus economic instruments. The model based on the Heckscher-Ohlin-Vanek (HOV) model and I focus on the issue of whether environmental regulations influence patterns of the nine Mediterranean developed countries region's international trade over 2000–2013. The results indicate that more environmental policy stringency in the region decrease net exports.

Keywords: Environmental Regulation, Trade, Heckscher-Ohlin-Vanek (HOV) model, Mediterranean region.

1- Introduction

Trade liberalization has the potential to contribute to overall improvements in environmental performance (Frankel and Rose, 2002; Copeland and Taylor, 2003). At the same time, countries might lose a comparative advantage in trade as a result of the countries' stringent environmental regulations.

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Earlier empirical investigations tend to fail to find a significant and convincing link between environmental outcomes and freer trade. Reductions in trade barriers will have both positive and negative impacts on the environment. The direction and magnitude of these effects will depend on the trade liberalization-induced changes in production patterns, the state of the environment, and the environmental regulations and policies in place to preserve and improve environmental quality (e.g., Shortle and Abler, 2001).

There are two major competing hypotheses in the comparative advantage literature: one hypothesis predicts that regions with relatively weak environmental policy will specialize in dirty production industry while the other hypothesis predicts that environmental policy has little or no effect on the trade patterns, instead standard factors, such as differences in factor endowments or technology and determine trade (see Copeland and Taylor, 2003).

Economic analysis would suggest that environmental policies raise production costs and hence encourage reduced specialization in the production of polluting outputs in countries with more stringent environmental regulations, e.g. Pethig (1976), Siebert (1977), McGuire (1982). That is, countries with less stringent environmental policies could increase their comparative advantage in the production of environmentally sensitive goods. However, this standard trade theory is challenged by a more recent revisionist view. Porter and van der Linde (1995) argue that tight environmental policies are actually positive forces driving private firms and the economy as a whole to become more competitive in world markets by spurring innovation in environmental technologies. These conflicting views have since then led to a heated debate, i.e. see Stewart (1993) for an overview.

Tobey (1990, 1993) approaches this problem empirically by examining environmental policy and patterns of world trade. Following earlier studies on shifting patterns of international trade by Leamer(1984) and Bowen (1983), Tobey employs a cross section Heckscher-Ohlin-Vanek (HOV) model to test the hypothesis that the stringency of environmental policies is directly related to the exports of pollution intensive commodities. Pollution-intensive commodities are defined by Tobey as the products of those industries whose abatement costs in the United States are equal to or greater than 1.85 percent of total costs. According to this criterion, among the 64 agricultural and manufacturing commodities under investigation, 24 of them are labeled as pollution-intensive commodities. Using econometric methods, Tobey aggregates the 24 commodities into five groups and regresses the net exports from each group on US endowments of 11 resources and a dummy variable which indicates the stringency of a country's environmental policies. The statistical results indicate that there is no significant linear relationship between the stringency of environmental policy and the net exports of the pollution-intensive commodities. That is, environmental policy has no significant impact on patterns of world trade. Tobey also tests the impact of environmental policy on trade patterns by investigating the bias in the regression residuals when the variables representing countries' environmental endowments are not included in the HOV model. If environmental policy does have an impact on net exports, then countries with stringent policy should have a negative expected sign in the error term, while the residuals of the countries with lenient policy should be positive. By examining the residuals, however, Tobey finds no assumed distribution of the error terms and thus concludes that the impact of environmental policy on world trade patterns is not significant.

The aim of this paper is to examine the impact of environmental regulations on net exports of the Mediterranean developed countries (Albania, Bosnia and Herzegovina, Spain, France, Greece, Italy, Croatia and Slovenia) over 2000–2013. In the former I will test whether the stringency of a region's environmental regulations influences its net exports.

The rest of this paper is organized as follows. Section 2 reviews the relation between trade and environmental policy. In section 3, I introduce the environmental performance index. Section 4 reviews Leamer's (1984) representation of the HOV model, which serves as the building block for our econometric model. Section 5 presents three econometric specifications of the basic model, moving from a basic cross-country model, to panel data model and the econometric results for the model. The main conclusions are summarized in Section 6.

2- Trade and Environmental Policy

National environmental policies typically affect production costs. Although the size of the effect is subject to debate, differences in national environmental policies or in the vigor of enforcement efforts at least potentially constitute one determinant of comparative advantage.

Absent differences in technology or relative factor abundance, low-standard countries would have comparative advantage in dirty industries. Environmentalists accordingly fear that lower income countries will become “pollution havens” due to their willingness to put economic growth ahead of environmental safeguards. A separate but related concern is that nations will compete for global markets and foreign direct investment (FDI) by reducing environmental standards (race to the bottom) or will be reluctant to raise standards unilaterally due to competitiveness concerns (regulatory chill) (Macrory et al., 2005).

Recent conflicts between free traders and environmentalists reflect several types of linkages and associated issues at the interface between trade and environment policies. From the environmentalist perspective, there are at least four distinct concerns. The first is that expansion of trade may produce environmental damage, either directly, if new export opportunities encourage polluting industries to expand their operations and/or increase pollution associated with transport of goods, or indirectly, as conventional gains from trade raise national incomes and consumption. A related second concern is that some countries will use weaker environmental protection as a way of increasing their international competitiveness. A third issue is that individual countries seeking to maintain high environmental standards may be restrained by GATT/WTO rules from using trade policy for this purpose. Finally, GATT/WTO rules may inhibit international cooperation to reduce environmental threats by restricting the use of trade sanctions to enforce multilateral environmental agreements (MEAs).

Although both situations reflect the potential role of environmental standards as a source of comparative advantage, the two differ in their implications for efficiency and welfare. Trade based on differences in preferred standards, i.e., the existence of pollution havens, does not necessarily imply economic inefficiency (Copeland and Taylor 2002). Researchers have purposed two major hypotheses to explain the impact: the pollution haven hypothesis and the factor endowment hypothesis.

With trade liberalization, industrial structure of a country shifts in line with its comparative advantage causing it producing and trading the goods it makes relatively well in the absence of market and policy failures.

Comparative advantage of a country can be determined by its endowments of capital and labor as well as endowments of natural resources. The idea under the pollution havens hypothesis is that comparative advantage can also be determined by differences in environmental regulations among countries which may be created by differences in demand and supply conditions of environmental quality.

Factor endowment hypothesis is the main alternative to the pollution haven hypothesis. It suggests the direction of trade is determined by the relative abundance of factor endowments (labor and capital in most models) in each country. Thus, if dirty goods are more capital intensive, it should be produced in the North, instead of South. The problem with empirical tests of the two hypotheses is few country governments are believed to make trade and environmental policy separately. Or, there are many factors driving trade policy and environmental policies simultaneously. Rich countries are likely to be both capital abundant and have stricter pollution policy. Poor countries may be on the opposite. Unfortunately, many of the empirical works in this field use cross-sectional country level data and could hardly get around the endogeneity problem.

Some researchers argue that openness could improve developing countries' environment by increasing local income, introducing more energy efficient production technology, and increasing competition and crowding out less efficient factories that might be heavy polluters.

Developed countries concerns on environmental regulation are the erosion of their competitive position due to the movement of pollution-intensive industries to countries with lower standards (Busse 2004).

Busse (2004)1 finds no evidence to support the pollution-haven hypothesis that industries facing above-average abatement costs with environmental regulations would relocate their activities in pollution havens. The exception is iron and steel products, where a negative and statistically significant link is established, implying that higher compliance with international treaties and conventions and more stringent regulations are

1- This study based on a Hecksher-Ohlin model used comprehensive new database for environmental regulations across 119 countries and five-high polluting industries.

associated with reduced net exports.[1] Neither did (Busse 2004) and Baumert and Kate (2002) find likely evidence that the Kyoto Protocol will drive industry to developing countries. Labor cost and skills, market size, political stability, income levels, physical infrastructure, and a wide range of government policies (eg. relating to tax, financial and investment) are typically the main investment considerations.

Evidence based on the pollution-intensity of trade does not seem to support the perception that developing countries are gaining a comparative advantage in pollution intensive production because of lax environmental regulations. The tendency, at least in the last decade, is rather that developed countries are strengthening their position in polluting industries, which suggests that classical factors of comparative advantages predominate over differential environmental standards. This is not surprising, since polluting industries tend to be very capital intensive, and since abatement costs, even in countries with the most stringent regulations, represent only a small percentage of production costs (WTO, 1999).

3- Environmental Performance Index[2]

Environmental sustainability has emerged as a critical policy focus across the world. While a great deal of attention has recently been focused on climate change, other issues including water quality and availability, air pollution, deforestation and land use changes, biodiversity, and the sustainability of agriculture and fisheries have also gained prominence on the public agenda. Governments are increasingly being asked to explain their performance on a range of pollution control and natural resource management challenges with reference to quantitative metrics. The move toward a more data-driven empirical approach to environmental protection promises to better enable policymakers to spot problems, track trends, highlight policy successes and failures, identify best practices, and optimize the gains from investments in environmental protection.

1- High-income countries, where environmental regulations are usually more stringent in comparison to middle or low-income countries, have experienced a considerable decline in the export-import ratio of iron and steel products since the late 1970s.
2- See http://www.smartkpis.com/blog/2011/01/12/2010-environmental-performance-index/

The EPI measures two core objectives of environmental policy:

1. Environmental Health, which measures environmental stresses to human health; and
2. Ecosystem Vitality, which measures ecosystem health and natural resource management.

The 2010 EPI relies on 25 indicators that capture the best worldwide environmental data available on a country scale. We chose the indicators through a careful analytical process that included a broad review of the environmental science literature, in-depth consultation with scientific experts in each policy category, evaluation of candidate data sets, identification of proxy variables where necessary, and expert judgment. The EPI also incorporates criteria from other policy assessments, including the Millennium Ecosystem Assessment, the Intergovernmental Panel on Climate Change, the Biodiversity Indicator Partnership, and the Global Environmental Outlook. Although several significant gaps in issue area coverage remain, the 2010 EPI offers a comprehensive look across the pollution control and natural resource management challenges every country faces.

The 25 indicators reflect state-of-the-art data and the best current thinking in environmental health and ecological science. Some represent direct measures of issue areas; others are proxy measures that offer a rougher gauge of policy progress by tracking a correlated variable. Each indicator corresponds to a long-term public health or ecosystem sustainability target. For each country and each indicator, a proximity-to-target value is calculated based on the gap between a country’s current results and the policy target. These targets are drawn from four sources: (1) treaties or other internationally agreed upon goals; (2) standards set by international organizations; (3) leading national regulatory requirements; or (4) expert judgment based on prevailing scientific consensus.

The data matrix covers all of the countries for which an EPI can be calculated. In a few cases-such as for the access to water and sanitation, water quality index, emissions from land use change and carbon-dioxide emissions per electricity generation metric – imputation methods were used to fill gaps. Where country values are imputed they are clearly denoted in the separately downloadable spreadsheet. Further information on the imputation methods is available in the indicator metadata.

The aggregation process proceeds in the following steps:

1. Scores are calculated for each of the ten core policy categories based on one to four underlying indicators. Each underlying indicator represents a discrete data set. The ten policy categories are as follows:

(1) Environmental Burden of Disease; (2) Water Resources for Human Health; (3) Air Quality for Human Health; (4) Air Quality for Ecosystems; (5) Water Resources for Ecosystems; (6) Biodiversity and Habitat; (7) Forestry; (8) Fisheries; (9) Agriculture; and (10) Climate Change.

This level of aggregation permits analysts to track countries' relative performance within these well-established policy areas or at the disaggregated indicator level.

2. Scores are next calculated for the objectives of Environmental Health and Ecosystem Vitality with weights allocated.

3. The overall Environmental Performance Index is then calculated, based on the mean of the two broad objective scores. The rankings are based on the Index scores.

More generally, the EPI provides a powerful tool for evaluating environmental investments and improving policy results. Target-based environmental performance benchmarks make cross-country comparisons possible on an issue-by-issue and aggregate basis. Comparative analysis provides information on policy options, a context for evaluating performance, and a basis for holding governments accountable for environmental results.

4- The Basic Model

In this section we first present a basic model (based on Leamer's (1984) exposition) that justifies the link between net exports and endowments. We then discuss several extensions and complications that add some nuances to the basic model, and discuss their implications for our model specifications.

Perhaps the most basic proposition of Leamer (1984) is that the pattern of net exports across countries is determined by the Hecksher-Ohlin theorem, which states that a country with balanced trade will export the commodity that uses intensively its relatively abundant factor and will import the commodity that uses intensively its relatively scarce factor. While this proposition is very familiar among students of international economics, the empirical implementation of this argument is not necessarily straightforward.

In particular, it is not clear what exactly should be the dependent variable to be explained.

Assuming Leontieff technology, the framework in Leamer (1984) begins with the system of equations that relate factor supplies to factor demands as follows:

$$K = a_{k1}Y_1 + a_{k2}Y_2 \tag{1}$$

$$K = a_{L1}Y_1 + a_L Y_2 \tag{2}$$

K and L are the amounts of two factors of production, call them capital and labor, available in a given country. These amounts are country-specific and are assumed to be internationally immobile. The Y's denote the quantity produced in the given country of two commodities (labeled by the subscripts 1 and 2). The a's are the traditional factor intensities determined by the available production technologies in each sector, and they represent the units of each factor required to produce a unit of output. Equations (1) and (2) represent a system that can be solved for outputs Y as a function of the inputs K and L and the factor intensities.

In matrix notation, this setup can be generalized to a model with multiple products and multiple factors of production as long as the latter do not exceed the number of products, or as long as the model is just identified or under-identified. Then:

$$Y = A^{-1}V \tag{3}$$

where Y is the vector of product outputs and V is the vector of endowments. The A is the vector of factor intensities, which is invertible as long as the production technologies are different across sectors so that the ratios of factor intensities across sectors are not identical.

Still following Leamer (1984), the production of the world economy as a whole can also be written in the same format:

$$Y_w = A^{-1}V_w \tag{4}$$

Assuming that countries consume commodities in the same proportions, the country consumption levels can be expressed as:

$$C = sY_w \quad (5)$$

where Y_W is the world's output vector and s is the proportion consumed by each country. Hence the vector of net exports is simply the product of the inverse of the vector of factor intensities across product clusters and the difference between each country's vector of endowments and the world's vector of endowments. An often forgotten step in the derivation of testable hypotheses is that the key dependent variable is net exports, not gross exports or gross imports. This is clear after considering the fact that net exports are the difference between domestic production and consumption:

$$NX = Y - C = A^{-1}(V - sV_w) \quad (6)$$

In principle, empirical models of the neo-classical trade theory should be estimated with net exports as the dependent variable, and excess factor endowments as the explanatory variables. In turn, the signs of the estimated coefficients on the endowment variables, or the values inside the inverted A matrix, reflect the factor intensities of production.

At this point, it is important to note that the inverted vector A contains factor intensities across product clusters, not relative factor abundances across countries. However, each country's consumption share (relative to the world) is a weighted average of its factor shares (also relative to the world's endowments), so that s is:

$$K / K_w > s > L / L_w \quad \text{or} \quad K / K_w < s < L / L_w \quad (7)$$

That is, a capital-abundant country will have $K / K_w > s > L / L_w$, while a labor abundant country will have $K / K_w < s < L / L_w$.

5- Our Model

I estimate the following regression across countries:

$$\text{Net Exports}_{it} = \alpha + \beta V_{it} + \gamma ESI_{it} + \mu\ GDPP_{it} + \mu_t + \phi_i \quad (8)$$

where V is a vector of country-specific factor endowments, ESI is an index of environmental regulation stringency and GDP per capita. Factures endowments are land, capital, labor, natural resources (such as energy). Factures endowments in the model are agricultural land (% of land area), Forest area (% of land area), energy production (kt of oil equivalent), gross fixed capital formation (current US$) and labor force.

The resulting estimates of the coefficient γ are never statistically significant in any of the specifications that Tobey tests.

Total domestic demand is captured by the GDP per capita. GDP per capita can also reflect consumption preferences that are correlated with income. However, it may also capture the size of the domestic market. If income per capita captures pure demand effects, then the sign of this variable on the value of net exports should be negative, because imports rise and exports fall with domestic demand. This is especially true for the superior goods. In contrast, if scale effects are significant, then the expected sign of the income variable can be positive.

Agricultural land (AGL_{it}) refers to the share of land area that is arable, under permanent crops, and under permanent pastures. Arable land includes land defined by the FAO as land under temporary crops (double-cropped areas are counted once), temporary meadows for mowing or for pasture, land under market or kitchen gardens, and land temporarily fallow. Land abandoned as a result of shifting cultivation is excluded. Land under permanent crops is land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee, and rubber. This category includes land under flowering shrubs, fruit trees, nut trees, and vines, but excludes land under trees grown for wood or timber. Permanent pasture is land used for five or more years for forage, including natural and cultivated crops.

Forest area (FL_{it}) is land under natural or planted stands of trees of at least 5 meters in situ, whether productive or not, and excludes tree stands in agricultural production systems (for example, in fruit plantations and agro-forestry systems) and trees in urban parks and gardens.

Energy production (EP_{it}) refers to forms of primary energy--petroleum (crude oil, natural gas liquids, and oil from nonconventional sources), natural gas, solid fuels (coal, lignite, and other derived fuels), and combustible renewable and waste-and primary electricity, all converted into oil equivalents.

Gross fixed capital formation (K_{it}), formerly gross domestic fixed investment, includes land improvements (fences, ditches, drains, and so on); plant, machinery, and equipment purchases; and the construction of roads, railways, and the like, including schools, offices, hospitals, private residential dwellings, and commercial and industrial buildings. According to the 1993 SNA, net acquisitions of valuables are also considered capital formation. Data are in current U.S. dollars.

Total labor force (L_{it}) comprises people ages 15 and older who meet the International Labour Organization definition of the economically active population: all people who supply labor for the production of goods and services during a specified period. It includes both the employed and the unemployed. While national practices vary in the treatment of such groups as the armed forces and seasonal or part-time workers, in general the labor force includes the armed forces, the unemployed, and first-time job-seekers, but excludes homemakers and other unpaid caregivers and workers in the informal sector.

Environmental Performance Index (EPI_{it}): is an index for environmental regulation stringency.

The EPI provides a basis for examining the relationship between economic competitiveness and environmental protection. Top-ranked EPI countries emerge as among the most productive and competitive in the world. But industrialization and economic development do lead to environmental stresses, the risk of degradation of ecosystems, and the depletion of natural resources.

5-1- Data Sources

The time period covered in the estimations are 2000-2013 across the Mediterranean developed countries (Albania, Bosnia and Herzegovina, Spain, France, Greece, Italy, Croatia and Slovenia). Data are obtained from the World Bank's 2014 World Development Indicators' (WDI's) CD-Rom and on-line WDI 2014[1].

5-2- The Results

I test the stationarity of variables in the model. Therefore, I make the unit root test of Levin, Lin & Chu and Im, Pesaran & Shin W-stat to test for it. The results show that all variables are stationarity at level (Table 1).

1- http://publications.worldbank.org/wdi

Table 1: Variables Stationary Tests in Region

Variables	Levin, Lin & Chu- Test		Im, Pesaran and Shin W-stat -Test	
	Statistic	Prob	Statistic	Prob
$GDPP_{it}$	-4.76166	0.0000	-5.38136	0.0000
AGL_{it}	-5.70375	0.0042	-5.23834	0.0001
FL_{it}	-3.76847	0.0001	-3.94342	0.0000
EP_{it}	2.66335	0.0000	4.02245	0.0000
K_{it}	-5.33756	0.0000	-5.22526	0.0000
L_{it}	5.20648	0.0000	3.58352	0.0000
EPI_{it}	-3.84714	0.0000	-3.42445	0.0000

I estimate the equation (1) using fixed and random effects using 2000–2013 panel data for the Mediterranean developed countries (Albania, Bosnia and Herzegovina, Spain, France, Greece, Italy, Croatia and Slovenia). All results are discussed in Table 2.

Given that OLS will yield biased results in the presence of unobserved heterogeneity, either random effects or fixed effects could be employed to obtain consistent results. While the fixed effects model treats the μ_t and ϕ_i as regression parameters, the random effects model treats them as components of the random disturbance. I employ a Hausman test to test for the inconsistency of the random effects estimate. Furthermore, since heteroscedasticity may be present in the sample because of large variations in the variables, it needs to be tested for in the estimations. A likelihood-ratio test is used that compares a feasible general least squares regression (FGLS henceforth) that is corrected for heteroscedasticity with one that is not. Where the null hypothesis of homoscedasticity could be rejected, robust standard errors are used. A final methodological issue concerns serial correlation in the error term. A Wooldridge test for autocorrelation in panel data is used to test for autocorrelation.

Ignoring first order serial correlation still results in consistent, but inefficient estimates of the coefficients and biased standard errors (Baltagi, 2006). Therefore, where necessary, additional FE models with (FGLS) correcting for AR(1) and FE regressions with Driscoll and Kraay (1998) standard errors are estimated and compared with the results of the other specifications.

In order to test whether or not the residuals from a fixed effects estimation of regression model are spatially independent, I perform

Pesaran’s (2004) CD test. The null hypothesis of the CD test states that the residuals are cross-sectionally uncorrelated. Correspondingly, the test’s alternative hypothesis presumes that spatial dependence is present.

Table 2: The Determinants of Region’s Net Exports

Variables	Random Effect	Fixed Effect(1)
C	2.55** (1.88)	5338.974* (11.49)
$GDPP_{it}$	-812664.3* (-2.35)	-304847.4* (-3.13)
AGL_{it}	-7.62* (-3.20)	-1.36 *** (-1.91)
FL_{it}	-1.25 * (-0.16)	4.53** (2.41)
EP_{it}	109123.3 (1.47)	197840.7* (2.99)
K_{it}	-.2048358* (-5.95)	-.1607917* (-8.51)
L_{it}	3579.187* (5.71)	1156.326* (2.66)
EPI_{it}	7039117 (0.06)	-1.01* (-5.98)
R^2	0.5881	0.7284
Groups	9	9
Number of observation	126	126
Time periods	14	14
Breusch and Pagan LM test	72.19	
Prob > chi2	0.0000	
Modified Wald Test for group-wise heteroskedasticity(3)		2.0e+05
Prob > chi2		0.0000
Pesaran’s test of cross sectional independence		94.455
Prob		0.0000
Hausman Test (2)	$\chi^2(4)$= 18.48	
Prob > chi2	0.0010	
Wooldridge test for autocorrelation in panel data	14.579	
Prob > F	0.0066	

Note: T-statistics are shown in parentheses. Significance at the 99%, 95% and 90% confidence Levels are indicated by * , **and ***, respectively.

1- The acceptation of model by the Hausman test.

The results indicate that traditional factor endowments do help determine net exports across countries. Agricultural land (% of land area), is negatively correlated with net exports, and a one percent increase is correlated with a 1.36 percent decrease in for raw materials and agricultural exports.

The number of hectares of forest land (% of land area) raises the net exports of forestry products; a one-percent increase in this variable is associated with a 4.53 percent increase in net exports. Likewise, Energy production is positively correlated with net exports, and a one percent increase is correlated with a 197840.7 percent increase energy-intensive production net exports.

A one-percent increase in capital is correlated with a .1607917 percent decline in the share of capital-intensive exports. But, a one-percent increase in labor force is correlated with a 1156.326 percent increase in the share of labor-intensive exports.

Because of, the developed countries have comparative advantage in capital-intensive production, that is pollutant, but their capital-intensive production activities relocate to countries with less stringent environmental regulations due to developed countries' stricter pollution policy, so in the share of capital-intensive exports decease and labor-intensive exports increase in the region.

Also, the significant and negative coefficient of EPI shows more environmental policy stringency in the region decrease net exports. Because of, environmental policies raise production costs; therefore, the production of polluting outputs reduces in the region.

6- Conclusions

The main question posed by this study is whether traditional endowments are destiny in terms of determining the pattern of comparative advantage across developed countries and over 2000–2013. The evidence presented herein indicates that traditional endowments, namely natural resources, labor, and capital, do play the important role in determining comparative advantage. The results that the forestry and energy-intensive production net exports increase and raw materials and agricultural exports decrease. The share of capital-intensive exports decease and the share of labor-intensive exports increase in the region.

But, with regard to level, efficiency and future developments in regulation, it can be expected that the relationship between environmental protection and economic competitiveness will be stronger negative in developed countries.

References

1- Albrecht, J., (1998), Environmental regulation, comparative advantage and the Porter hypothesis, FEEM Nota di Lavoro, 17.99.

2- Albrecht, J., (1998a), Environmental Policy and Inward Investment Position of U.S. Dirty Industries, Inter-economics, July/August, 186-94.

3- Alpay, S., (2000), Does Trade Always Harm the Global Environment? A Case for Positive Interaction, Oxford Economic Papers, 52, 272-288.

4- Antweiler, W., Copeland, B.R., Taylor, M.S., (1998), Is Free Trade Good for the Environment, NBER Working Paper Series, No: 6707.

5- *Baltagi*, B. H., (*2006*), Estimating an economic model of crime using panel data from North Carolina, Journal of *Applied* Economics, 21: 543–547.

6- Baumert, K.A. and Kate, N., (2002), An architecture for climate protection. Published in building on the Kyoto Protocol: options for protecting the climate, World Resources Institute, available on line at http://climate.wri.org/pubs_pdf.cfm?PubID=3762 (30/10/2005).

7- Bowen, H., (1983), Changes in the International Distribution of Resources and Their Impact on US Comparative Advantage, Review of Economics and Statistics, Vol. 65:402-414.

8- Busse, Matthias, (2004), Trade, environmental regulations and the World Trade Organization: new empirical evidence, Policy Research Working Paper Series 3361, The World Bank.

9- Copeland, B.R. and Taylor, M.S., (2003), Trade, Growth and the Environment, Journal of Economic Literature, 42(1), 7–71.

10- Dessus, S. and Bussolo, M., (1998), Is There a Trade-off between Trade Liberalization and Pollution Abatement? A CGE Assessment Applied to Costa Rica, Journal of Policy Modelling, 20, 11-31.

11- Ekins, P., Folke, C. and Costanza, R., (1994), Trade, Environment and Development: The Issues in Perspective, Ecological Economics, 9, special issue.

12- Frankel, J. and Rose, A., (2002), In Is Trade Good or Bad for the Environment? Sorting out the Causality, NBER Working Paper No. 9021. NBER Research Associates.

13- Frankel, J.A. and Rose, A.K., (2002), Is Trade Good or Bad for the Environment? Sorting Out the Causality, National Bureau of Economic Research Working Paper, N.9201.

14- Jaffe, A. and Palmer, K., (1997), Environmental Regulation and Innovation: A Panel Data Study, Review of Economics and Statistics, 79, 610-619.
15- Jaffe, A. B., Peterson, S. R., Portney, P. R. & Stavins, R. N., (1995), Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tell Us?, Journal of Economic Literature, Vol.23 (March 1995): 132-163.
16- Jaffe, A., Peterson, S., Portney, P. and Stavins, R., (1995), Environmental Regulation and the Competitiveness of U.S. Manufacturing: What does the Evidence tell Us?, Journal of Economic Literature, 33, 132-63.
17- Leamer, E. E., (1984), Sources of International Comparative Advantage: Theory and Evidence. Cambridge: MIT Press.
18- List, John And Co, Catherine (2000), The Effects of Environmental Regulations on Foreign Direct Investment, Journal of Environmental Economics and Management, 40(1), pp. 1-20.
19- Macrory, Patrick F.J. Appleton, Arthur E. and Plummer, Michael G., (2005), The World Trade Organization: Legal, Economic and Political Analysis,vol. 2. New York: Springer, pp. 137-170.
20- McGuire, M., (1982), Regulation, Factor Rewards, and International Trade, Journal of Public Economics, 17: 335-354.
21- Pesaran, M., (2004), General Diagnostic Tests for Cross Section Dependence in Panel, Cambridge Working Papers in Economics No. 0435 Faculty of Economics, University of Cambridge.
22- Pethig, R., (1976), Pollution, Welfare and Environmental Policy in the Theory of Comparative Advantage, Journal of Environmental Economics and Management, 2,160-169.
23- Porter, M. and Linde, C. van der (1995), Toward a new conception of the environment competitiveness relationship, Journal of Economic Perspectives, 9, 97-118.
24- Shortle, J. S. and Abler, D., (2001), Environmental Policies for Agricultural Pollution Control, CAB International Publishing, New York.
25- Siebert, H., (1977), Environmental Quality and the Gains from Trade, Kyklos, 30(4): 657-673.
26- Stewart, R. B., (1993), Environmental Regulation and International Competitiveness, Yale Law Journal, June, 102(8): 2039-2106.

27- Tobey, J., (1990), The Effects of Domestic Environmental Policies on Patterns of World trade: an Empirical Test, Kyklos, 43(2): 191-209.

28- Tobey, J.A., (1993), Effects of Domestic Environmental Policy on Patterns of International Trade, Shane, M.D. and H. van Witzke eds., The Environment, Government Policies, and International Trade: A Proceedings, USDA: Staff Report No. AGES 9314.

29- World Trade Organization (WTO) (1999). Special Studies –Trade and Environment.