

## “The Impact of Environmental Regulations on Competitiveness: An Empirical Multi-Country Analysis”

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### Abstract

*The mastery of the environment has become a major preoccupation in industrialized countries. It must be also one of the concerns of developing countries, which several critics have addressed to globalization in its relationship with the environment and focus on its responsibility for environmental degradation. The world of globalization requires new regulations, but it seems difficult to establish a successful action in the multilateral level. It is therefore important to revive the debate on the reform of the environmental governance in a global context. It turned out that it is necessary to strengthen existing policies. However, stringent regulations have been criticized because they negatively affect trade. It is therefore important to study empirically the impact of draconian regulations on bilateral trade.*

**Key Words:** international trade, environmental governance, bilateral trade, globalization, competitiveness.

**Classification JEL:** 6 F, 17 Q.

### Introduction

The globalization of trade has been the subject of criticism, based on quality of environment. Criticism of globalization in its relationship with the environment show that economic openness in stimulating growth, lead to a worsening of unsustainable emissions and pressure on the natural environment. This will promote the implementation of environmental regulations more stringent.

Supporters of the trade see that in these relatively stringent policies a kind of protectionist measures and they admit that the application of these regulations involve significant costs of compliance. However, these stringent policies have been criticized on the grounds that they encourage companies to reduce their production, which negatively affects export. This assumption is sometimes presented by some as evidence that would not even need to be discussed, while others are afraid that the strictness regulations is the cause of significant deterioration of terms of trade . In fact, the available data are not always easy to interpret, lead to a more nuanced view of the impact of environmental regulations on competitiveness. Given this trend marked by the strengthening of environmental policies, it is important to study empirically the effect of environmental policy on competitiveness especially the effect on export and import.

This will be the subject of this paper. This denier will be divided into two section. The first one will present briefly the main empirical work on the issue prior to expose thereafter the approach to be adopted in the test empirical assessment. The second section will focus on developing an empirical study about the effect of stringent policies on export after having develop a measure of the rigor of the environment policy.

### I. Review of the Literature

Many studies have investigated the effect of environmental regulations on competitiveness, some of which have used the gravity model. In this context, we recall the work of Jaffe et al (1995). These authors, after spending two decades of research, which aims to affirm the negative effect of rigorous regulations on competitiveness, failed to detect a statistically significant effect. By cons, Kot (1998) found a significant result for the period 1967-1977: he confirm the idea that industries supporting higher costs of environmental protection, undergo a loss in export compared to industries that spend less expense. Robison (1988) found that imports of the United States, for all categories of products over the period 1977 to 1982, have increased compared to export. However, in the composition of imports, the share of chemical products, is less than the share of others products such as textiles. For cons, the same author, found no significant change in the terms of trade over the period 1973 to 1977.

However, Grossman and Krueger (1991), which aims to study the impact of the cost of pollution reduction on the import of the United States from Mexico in various sectors in 1987, found a significantly positive relationship otherwise an increase in import when their industries support a very low cost of reducing pollution, which contradicts that was supposed later, but this confirm the Porter hypothesis, which predicts a positive effect on the economy of stringent environmental regulations.

In addition, Sorsa (1994) shows that the adoption of a rigorous policy for the U.S is accompanied by a significant increase in exports for the period 1970-1990, he found a positive relationship between regulation and competitiveness. Tobey (1990), through the Heckscher-Ohlin-Vanek approach, don't found an impact significantly negative of stringent environmental policies on exports in 1975. This study involved 23 countries in five pollution-intensive sectors and was made using a qualitative measure of the rigor policy. Finally, Tobey found no relationship between stringency of regulation and competitiveness.

However, two effects can make not significant the analysis of stringency of environmental regulation and its negative effect on the export and positive effects on import. First, the negative effect of strict policy on export can be influenced by local subsidies for pollution-intensive industries. This may well result from interest groups and lobbies, would depend also on the choice of the indicator of the extent of rigor. Indeed, the rarity and heterogeneity of environmental data make difficult to find an indicator that can directly reflect the economic cost of the strict anti-pollution regulation in the cost of production. Secondly, stringent environmental regulations lead to a government policy that restricts the importation of foreign products that do not obey the criteria of environmental policies. This contradicts the expected positive effect on imports and may be an insignificant effect or even a negative effect on import. This effect is not positive and it can, therefore, be interpreted as an indicator of the adoption of environmental regulation as a barrier to imports.

In addition, the major drawback of the approach Tobey (1990) is that it is based on the multilateral trade. In order to overcome this problem, Van Beers and Deb Van Bergh (1997) used the gravity model, which has long been the model most often used in empirical studies of bilateral trade flows. He is known for his empirical sucked into the explanation of the different types of flows. This empirical success of the model has attracted the attention of economists and led to a series of tests and empirical evaluation. In fact, the empirical evaluation of this paper is part of the list of succession.

## ***II. Empirical Study***

The empirical study is considered necessary to evaluate the impact of environmental regulation on the export and import countries. However, the gravity model will aim to empirically study the effect of a stringency of environmental regulation on bilateral dirty trade flows.

### **II.1. Variables and Indicators of Environmental Policy**

#### **II.1.1. Variables**

Economic theory postulates that bilateral trade is often explained by variables qualified standards. These variables are the gross domestic product, population, area and distance between countries  $i$  and  $j$ . The latter is designed as a proximal transport costs. The series of quantitative variables is extracted from the data base of the World Bank (WB) and the geographic distances from a web site under the following address: [http://www.eiit.org/Resources/Trade data.html](http://www.eiit.org/Resources/Trade%20data.html) Gravity.

In order to highlight the effect of membership in free trade zones, dummy variables are introduced, one that indicates the membership in the European Union (EU) and the other free trade area in the Mediterranean European countries (EMFTA).

In addition,  $X_{ij}^k$  are bilateral exchange partner country in a product  $k$ . The series of bilateral trade is extracted from the data base Chelem.

#### **II.1.2. Indicators of Environmental Policy**

Three types of indicator environmental policy are distinguished:

- 1-indicator that represent the environmental pressure.
- 2-indicator on the quality of the environment.
- 3-indicator on the financial effort allocated by the State for environment protection.

We are interested in the third, which is divided into input indicator and output indicator. The first indicator is based on the input efforts to protect the environment as public spending on research and development and expenses for the control and reduction of pollution. Indeed, a nation that spends expenses, relatively high, to decrease pollution or provides a lot of effort to reduce pollution regarded as a country that adopts a relatively strict environmental regulation. However, a country that spends a considerable amount of financial resources for the reduction of pollution provides subsidies to industries that suffer a loss due to the increase in costs of environmental protection and a decrease in export caused an increase in import. The first attempt to quantify a input indicator was undertaken by the United Nations Conference on Trade and Development (UNCTAD), and discussed by Walter Ugelow in 1979 and used in the empirical study of Tobey (1990).

The second indicator or output indicator reflects the actual result of environmental regulation. It is considered more efficient than the input indicator as revealing of the severity of the environmental regulation. Indeed, it can reveal the effectiveness of environmental regulation ex-post as it takes into account the results of compensation subsidies. However, if the government decides to tax the energy consumption and also to subsidize its use, reducing energy consumption will be less weak in case of subsidy and therefore the strict environmental regulation be less effective. The output indicator is considered relevant because it directly reflects the economic cost of environmental regulation on the basis that the pollutant pay.

To highlight the severity of environmental policies in our study, we used a measure of the efficiency of energy. therefore, a country with a very high energy intensity would be able to reduce it following a strict environmental policy. These variables also come from the database of the World Bank.

## II.2. The choice of Endogenous Variables

Economic openness, stimulating growth, lead to a worsening of unsustainable emissions of pollutants, such as the greenhouse gas emissions, mainly from energy products. However, attempts are made to establish specific regulation to reduce carbon dioxide and energy. Generally developing countries are characterized by a large population and a high energy consumption, generating an energy intensity that is higher than in industrialized countries.

So to rationalize energy intensity, must install modern and efficient energy systems where new equipment is needed. Therefore, high costs of implementation will be supported mainly by developing countries that may affect exports of pollution-intensive products, especially energy products from developing countries to industrialized countries.

This justifies the choice of the following endogenous variables: the bilateral trade from i to j of pollution-intensive products ( $X_{ij}^{PIP}$ ) and bilateral trade from i to j of energy products ( $X_{ij}^{PE}$ ).

## II.3. Structure of the Model

When it comes to a gravity model of bilateral trade a panel estimation is required. However, because of the unavailability of bilateral trade data for more recent years, the study will be made for 2002. The estimate is to study the effect of stringent environmental regulation on bilateral exchange with the following specification:

$$\text{Log } X_{ij}^k = \beta_0 + \beta_1 \log Y_i + \beta_2 \log Y_j + \beta_3 \log \text{pop}_i + \beta_4 \log \text{pop}_j + \beta_5 \log \text{sup}_i + \beta_6 \log \text{sup}_j + \beta_7 \log D_{ij} + \beta_8 \text{UE}_{ij} + \beta_9 \text{EMFTA}_{ij} + \beta_{10} \log \text{MME}_i + \beta_{11} \log \text{MME}_j + U_{ij}$$

The index i represents the countries of the southern Mediterranean, Middle East non-OPEC countries and Gulf countries, the index j include the CEEC and some industrialized countries and k traded products.

- $X_{ij}^k$  = Bilateral exchange of country i to country j in product k
- $Y_i$  and  $Y_j$  are respectively the gross domestic product in constant dollars U.S. (USD2000)
- $\text{Pop}_i$  and  $\text{Pop}_j$  are respectively the total population of countries i and j And  $\text{sup}_i$ - $\text{sup}_j$  are respectively the areas of countries i and j in square kilometers.
- $D_{ij}$ : distance between the capitals of partners country in kilometers.
- $\text{UE}_{ij}$ : dummy variable is equal to 1 if countries i and j belong to the European Union and 0 otherwise.
- $\text{EMFTA}_{ij}$ : dummy variable is equal to 1 if countries i and j are members of the EMFTA and 0 otherwise.
- $\text{MEE}_i$ : measuring the energy efficiency of the exporting country expressed in constant dollars (2000) per kg of oil equivalent

- MEE<sub>j</sub>: measuring the energy efficiency of the importing country expressed in constant dollars (2000) per kg of oil equivalent
- U<sub>ij</sub>: Error term

The study year is 2002, the sample covers 28 countries, including 11 industrialized countries (China, Canada, Denmark, France, Italy, Germany, Spain) and three countries of Central and Eastern Europe (CEE) countries (Poland, Hungary and Romania) and 17 developing countries which are divided into eight countries of the southern Mediterranean (PSM) (Algeria, Cyprus, Egypt, Israel, Malta, Morocco, Tunisia and Turkey) and 3 Middle Eastern non-OPEC countries (Jordan, Yemen, Syria) and six Gulf countries (Saudi Arabia, Kuwait, Bahrain, Emirates, Oman, Iran).

The choice of country and year of study is guided by the overall context of the study on the one hand, and the availability of data on the other. However, the aim of the study was to determine the effect of the adoption of stringent environmental regulation in importing countries, especially developed countries on export from developing countries. However, the stringent environmental standards for products, methods and production processes as well as the rules on free trade international agreements, can affect the competitiveness and international trade. As a result, exporters will face increasing environmental costs to satisfy the conditions for membership of international free trade zones, rules and standards developed by their trading partners. These costs are much heavier that the production will be low which affects the competitiveness of small and medium enterprises that characterize the industrial sector in developing countries.

#### **III.4. Estimation Results and Interpretations**

Examination of the output estimate assumes that the estimated with the two endogenous variables model is globally significant. This is illustrated in the probability values (F-statistic) that is always zero. It is also noted a good quality of adjustment for both regressions that is displayed in the values of coefficients of determination especially in the case of trade in pollution-intensive products ( $R^2 = 0.8$ ).

The estimate is made for two types of trade ie the dirty trade or pollution intensive trade and trade in energy products. For both regressions, the coefficient of geographical distance is significant and has the expected sign. Indeed, when countries are distant, transport costs will be high therefore the bilateral trade will be low.

The area  $i$  and area  $j$  ( $sup_i$ ;  $sup_j$ ) which are supposed to have a negative effect on bilateral trade shows a positive significance. This can be explained as follows: countries with a large area will have more natural resources and since most pollution-intensive products especially energy products are based resources, bilateral trade in these products will intensify.

It is also assumed that bilateral trade is negatively influenced by the population ( $pop_i$ ,  $Pop_j$ ) this is explained by the fact that a country whose population is large can specialize in several product lines and will therefore be less dependent on trade bilateral. This assumption is confirmed in the case of developing countries as the coefficient population ( $pop_i$ ) is significantly negative, it can be enhanced by the following suggestion: the application of environmental standards in developed countries transform development countries, expected to adopt lax policies, home of the most polluting activities and will then depend less pollution intensive bilateral trade. This suggestion has also justify the positive coefficient of the population of developed countries because developed country with a large population will be dependent on pollution intensive trade seen the export of polluting industries to developing countries become pollution haven.

As for the variables  $Y_i$  and  $Y_j$  have sometimes unexpected signs especially for industrialized countries this is explained by the fact that these variables do not necessarily have the same trend of evolution that trade in a particular product category. They generally have the same pattern of evolution with the overall volume of trade, and not in a particular sector.

For dummies  $UE_{ij}$  and  $EMFTA_{ij}$  are expected to have positive signs, this is may explain the fact that trade is increasing in the areas of free trade, however, the estimate shows negative signs. This result is due to the fact that membership or establishing of free trade zone - Mediterranean Free Trade Area covering substantially all trade between the two shores of the Mediterranean as well as the partnership between the environmental standards to restrict trade pollutant. In short, bilateral trade in pollution-intensive products is not stimulated in the free trade zones.

Finally, the examination of the impact estimate of a strict environmental policy on the export and import shows that the coefficient measuring the energy efficiency of exporting countries is significantly negative for both regression that leads to confirm the hypothesis that predicts a severe environmental policy degrades exports. However, the sign of the coefficient measuring energy efficiency of importing countries is positive. This result would mean that the decrease in exports was accompanied by an increase in the level of imports, following a decline in production due to the heavy costs incurred by countries meeting the conditions for membership of areas economic integration an high costs of environmental standards supported by polluting industries.

Tunisia as a country on the southern shores of the Mediterranean, was selected to conduct this empirical study. However, international trade plays an important role in the Tunisian economy and intensified with the gradual liberalization of foreign trade by signing an agreement for a free trade area with the European Union which is its import partner business. This agreement was an important step in the opening of the Tunisian economy to international competition, while it imposes a compliance with multilateral and regional environmental regulations. In this regard, the adoption of these stringent environmental policies will certainly affect the foreign trade of Tunisia as was confirmed in this empirical test of the gravity model.

The following table shows the estimation results:

	Pollution-intensive Product	Energy Product
C	-23.58415 (-3.405909)	-10.75771 (-1.402412)
$Y_i$	0.210586 (3.525297)	0.296618 (2.479294)
$Y_j$	-0.485477 (-5.577949)	-0.404170 (-4.098074)
$Pop_i$	-1.317985 (-6.165817)	-2.375702 (-10.40115)
$Pop_j$	1.941809 (7.794579)	1.873140 (6.565519)
$Sup_i$	0.695707 (5.298676)	1.191183 (10.22678)
$Sup_j$	1.602795 (7.605955)	1.493928 (5.809325)
$D_{ij}$	-1.662677 (-4.576027)	-1.868186 (-5.394699)
$UE_{ij}$	-1.857787 (-4.576027)	-3.376185 (-3.155564)
$EMFTA_{ij}$	-2.014226 (-3.978290)	-1.807191 (-4.022119)
$EMM_i$	-2.730243 (-7.306646)	-5.225618 (-15.91386)
$EMM_j$	6.993857 (8.152711)	6.512484 (6.566240)
$R^2$	0.790624	0.875309
DW	1.505584	1.256726
F-statistic	49.77574	79.13235
Prob (F)	0.000000	0.000000

Source: Own calculations

## II.5. Conclusion

The empirical analysis developed in this paper proves the existence of a degrading on bilateral trade for countries adopting stringent environmental regulation. However, the most significant being the sector of pollution-intensive products, especially energy products sector. In addition, faced with international requirements for the protection of the environment and the rules of free trade agreements, the polluting industries of member countries are obliged to strengthen their policies because adherence to these zones of economic integration became conditioned by respect for the environment and to enact more stringent standards. Now it appears that strengthening policies has hurt competitiveness.

## **Conclusion**

Faced with global warming, the Kyoto Protocol paves the way for the implementation of measures aimed at strengthening the fight against the greenhouse effect. The idea is to make binding commitments to emissions of greenhouse gases reduction. However, the energy sector is the largest emitter of greenhouse gas emissions and make emissions reductions requires the use of policies for efficient use of energy.

The vast majority of environmentalists revive the debate of efficiency of the environmental regulation. However, the issue of efficiency is the degree of severity that should have environmental standards in order to achieve their goals efficiently. This discipline policy was criticized as a threat to the exchange.

From an empirical point of view, the question of the severity of regulations and its impact on exports and imports has been the subject of several studies. Sometimes it appears insignificant results this may be the result of either from poor choice of model or either from poor choice of indicator of the extent of stringent of environmental policy. To overcome this problem, we have used the gravity model which is known by its empirical success in explaining bilateral trade flows. This model was estimated using a measure of energy efficiency that was previously analyzed and interpreted.

The empirical test has confirmed the hypothesis that predicts the degrading effect of stringent policies on pollution intensive bilateral trade including energy products. However, the addition of dummy variables that indicate membership in free trade zones shows that bilateral trade in pollution-intensive products is not stimulated in the areas of economic integration. In short, the deepening of economic integration and strengthening of environmental standards seem to evolve in parallel. Finally, the world can enter a phase of relaxation of environmental regulations motivated by economic considerations.

## **Bibliography**

- Frankel, Jeffrey. A et Andrew. K. Rose,(2002),”Is trade good or bad for the environment? Sorting out the causality”, working paper w 9201.
- Grossman. Gene et Alan. Krueger,(1995),”Economic growth and the environment”. Quarterly Journal of Economics,353-377.
- Grossman. Gene et Alan. Krueger,(1991),”environmental Impacts of North American Free trade agreement”, working paper 3914, Cambridge, mass: national Bureau of economic research in “a new look at environmental protection and competitiveness”. Edited by Goodstein. Eben, (2003).Washington.D.C.Juin.8775-8810.Economic Policy Institute.
- Jaffe. Adam, S. Peterson, Paul Port Neyand Robert Stevens, (1995), « Environmental Regulation and the competitiveness of US. Manufacturing: what does the evidence tells? Journal of economic literature.
- Kot. Joseph (1998), « the impact of domestic regulatory policies on us. International competitiveness.” In Goodstein. Eben, (2003), “a new look environmental protection on competitiveness”. Washington, D.C Juin 8775 8810: Economic Policy institute Kimboll (2000)
- Larson. Bruce A, Eric Nicol, basher el Zubi, Nabil Sukker, karim Haraki, Mohamed Salah Matoussi, Kotatin Zain and card chouchani, (2002), “the impact of environmental regulations on exports.
- Larson. Bruce A, (2000), « evaluation the impact of specific environmental regulations on exports “land economics 76 (4): 534 – 549
- Porter. Michael (1998), “the competitive advent age of nations”, the free press, in Frenkel and rose (2002)
- Porte. Michael and class van der land, (1995), “Journal of Economic Perspectives vol 9, no.4, pp. 119 – 32 in Frenkel. J and Rose K (2002)
- Robison. H. David, (1988), “industrial pollution abatement the impact on the balance of trade “connection journal of economic. Vol 21, no1, pp. 187 – PP In good stein. Eben (2003), “A New look et environmental protection...” ...
- Rodrick. Denict J. Rodriguez, (2002), “trade policy and economic growth: a sceptic guide to the cross national evidence”
- Sorsa. Pirri to, (1994), “competitiveness and environmental standards some exploratory results”. Policy research paper 1248. Washington, doc: word ben K. In Goodstein, Eben, (2003),” A new look et environmental...
- Tobey. James. A, (1990), “the effects of domestic environmental policies on patterns of world trade: An empirical test, “Kyklos, Vd 43, fox2 191 – 209.
- Van Beers. Cees and Van Den Begh. Jerom C.J.M, (1997),an empirical multi-country analysis of the impact of environmental regulations on foreign trade flows”, Kyklos. Vol 50 fascicule 1,29 – 46