

## **LLEE Working Paper Series**

# **Impact of environmental regulations on trade in the main EU countries: conflict or synergy?**

*Roberta De Santis*

Working Paper No. 93  
April 2011

**Luiss Lab of European Economics**  
Department of Economics and Business  
LUISS Guido Carli  
Viale Romania 32, 00197, Rome -- Italy  
Centre Web page

© Roberta De Santis. The aim of the series is to diffuse the research conducted by Luiss Lab Fellows. The series accepts external contributions whose topics is related to the research fields of the Center. The views expressed in the articles are those of the authors and cannot be attributed to Luiss Lab.

# Impact of environmental regulations on trade in the main EU countries: conflict or synergy?

R. De Santis\*

## Abstract

In an increasingly integrated world with declining trade barriers, environmental regulations can have a decisive role in shaping countries' comparative advantages. The conventional wisdom about environmental protection is that it comes at an additional cost on firms imposed by the government, which may erode their global competitiveness. However, this paradigm has been challenged by some analysts. In particular, Porter (1991) argues that pollution is often associated with a waste of resources and that more stringent environmental policies can stimulate innovations that may over-compensate for the costs of complying with these policies. This is known as the Porter hypothesis.

While there is a broad empirical literature on the impact of trade on environment the empirical literature on the impact of environmental regulations on trade flows is relatively scarce, very heterogeneous and presents mixed results. The innovative feature of this paper is its attempts to estimate, in a gravity setting, the overall impact on 15 EU countries bilateral exports of three major Multilateral Environmental Agreements (MEAs).

According to our estimates, to be member of MEAs in 1988-2008 had a positive impact on EU15 exports ranging between 22 and 35%. Furthermore, it seems that the jointed membership of WTO/EU and MEAs had a further positive "interaction effect" on EU15 exports. These results show the presence of a synergy, at least for EU members, between environmental regulations and trade flows. It can be partly explained by a possible trade diversion effect with respect to countries that did not sign MEAs, and a corresponding trade creation effect among members of the environmental agreements.

This explanation seems consistent with the fact that the relevance of the relationship between MEAs, EU and WTO rules for enhancing mutual supportiveness of environment and trade has been clearly reflected in the international negotiations in the past twenty years.

LUISS Guido Carli and ISTAT , [rdesantis@istat.it](mailto:rdesantis@istat.it), [rdesantis@luiss.it](mailto:rdesantis@luiss.it),  
[http://works.bepress.com/roberta\\_de\\_santis/](http://works.bepress.com/roberta_de_santis/)

The views expressed in this paper are those of the author and do not necessarily represent the institutions with which the author is affiliated. Any error or mistake remains authors' sole responsibility. Thanks are due to Claudio Vicarelli for many useful comments.

KEY WORDS: Comparative advantage, environmental regulation, trade

JEL N°: F10, F18, F34

## **Introduction**

Growing global interdependence, both economic and environmental, increases the need for coherence and coordination in trade and environmental policies. The European Union has been the central proponent of including environmental issues in trade discussions at the multilateral level and has made increasing efforts to integrate its trade strategy with the principles of sustainable development (and vice versa). This aspect is particularly evident in the recent Europe 2020 strategy.

At present, there are over 250 multilateral environmental agreements (MEAs) dealing with various environmental issues which are currently in force. About 20 of these include provisions that can affect trade. For instance, they may contain measures that prohibit trade in certain species or products, or that allow countries to restrict trade in certain circumstances.

A question that may arise is whether measures under a MEA are compatible with WTO rules. For example, a multilateral agreement could authorize trade in a specific product between its parties, but ban trade in the same product with countries that have not signed the agreement. This could be found to be incompatible with WTO's non-discrimination principle known as "most favoured nation treatment", which requires countries to grant equivalent treatment to the same (or "like") products imported from any WTO member country. On the other hand, WTO rules do allow members to derogate from their obligations in some cases, for instance where a measure is aimed at the conservation of natural resources, provided certain conditions are met.

The conventional wisdom about environmental protection is that it comes at an additional cost on firms imposed by the government, which may erode their global competitiveness. However, this paradigm has been challenged by some analysts. In particular, Porter (1991) argues that pollution is often associated with a waste of resources and that more stringent environmental policies can stimulate innovations that may compensate for the costs of complying with these policies. This is known as the Porter hypothesis. It is worth to underline that empirical studies present mixed results.

The innovative feature of this paper is its attempts to estimate, in a gravity setting, the overall impact on 15 EU countries bilateral exports of three major Multilateral Environmental Agreements (MEAs).

This paper is organized as follows. The first section conducts a critical survey of the most recent empirical literature, the second, the third and the fourth sections describe the empirical strategy, the equation and the dataset and the estimates results. Conclusions follow.

### **1. A SURVEY OF THE LITERATURE: CONFLICTS OR SYNERGIES?**

According to economic theory, the environmental regulations is not neutral with respect to trade flows. In fact, the environmental rules modifying the production cost curve, would determine a change in the comparative advantages. It is worth to underline, however, that the interaction between international trade and environmental policies could determine opposite effects on trade flows.

In the theoretical literature, most widely discussed is the “pollution haven - race to the bottom” hypothesis, which says that countries that are open to international trade will adopt looser standards of environmental regulation, out of fear of a loss in international competitiveness. This hypothesis was initially formulated in the context of local competition for investments and jobs within Federal States, where the decentralized environmental responsibilities gave each state independence in setting their environmental standards in line with their priorities. Most critics argue that increased competition for trade and foreign direct investment could lead to lowering of environmental standards and regulations.

Less widely recognized, is the Porter hypothesis<sup>1</sup> stating that stringent environmental regulation does not necessarily deteriorate the industrial competitiveness of a country. Rather, stringent environmental policies – under the condition that they are efficiently designed and employed – can further a nation’s international competitiveness.

While there is a broad empirical literature on the impact of trade on environment the empirical literature on the impact of environmental regulations on trade flows is relatively scarce, very heterogeneous and presents mixed results. One of the main problem is that most studies are incomparable to other ones with the consequence that results do not lead to a uniform conclusion. Mainly due to differences in model assumptions, methods employed and data used a comparison of results across studies is extremely difficult.

The differences in study outcomes are mainly related to three factors<sup>2</sup>: i) different studies use different policy stringency indicators. These comprise input versus output-oriented indicators, costs versus physical measures, objective (observed) versus subjective (self reported, expert judgemental) measures. ii) studies use different types of temporal data, iii), different methods are employed: simple statistical indicators or econometric studies; cross-section, time series or panel data econometric studies; and studies at country, State, firm or plant level.

Among the papers comparable, using a gravity setting with OECD data<sup>3</sup>, the most significant studies are Van Beers and Van den Bergh (1997) that test the impact of environmental stringency on bilateral exports. They construct indicators of environmental stringency based mainly on energy intensities and recycling rates and

---

<sup>1</sup> Porter & van der Linde 1995. For a survey on empirical paper assessing Porter hypothesis see Ambec S. ; Lanoie P. (2007)

<sup>2</sup> The following categorization of empirical studies illustrates the wide diversity of approaches: i) trade-in-goods (Tobey 1990, van Beers and van den Bergh 1997) versus factor content of trade (Xu and Song 2000); ii) simple statistical indicators (Low 1992) versus (multivariate) regression models (Tobey 1990, van Beers and van den Bergh 1997) or applied equilibrium modelling (Steininger 1999); iii) multilateral trade flows (Tobey) versus bilateral trade flows (van Beers and van den Bergh); iv) single country (Low and Yeats 1992, studies in Fredriksson 1999) versus multi-country or multiregion (Tobey, van Beers and van den Bergh, Xu and Song 2000); v) static (Tobey, van Beers and van den Bergh) versus dynamic (Bjørn et al. 1997, Xu and Song); vi) analysis at the individual firm level (Bjørn et al.) versus sector level (all of the other studies mentioned in this list).

<sup>3</sup> For an extensive survey see Jug and Mirza (2005).

rank OECD countries according to their stringency into a 0-1 index. Their main result confirms in a way the pollution haven hypothesis, since they come to the finding that the OECD countries' exports are negatively and significantly affected by more stringent regulations. They also show that imports are negatively correlated with the importing country's stringency, which does not support the pollution haven hypothesis.

Harris et al. (2002) slightly modify Van Beers and Van den Bergh's tests by adding-up exporters and importers' fixed effects as well as time effects to show that the stringency variable does not confirm anymore the first findings. Grether and De Melo (2003) represent in a gravity setting stringency by a regulatory gap between countries, measured by difference in GDP per capita. However, when they control for different factors in their trade equation they conclude that the relationship between the regulatory gap and trade flows is not robust.

## 2. EMPIRICAL STRATEGY

The aim of our empirical analysis is to estimate whether and how the interaction between WTO, EU and MEAs memberships exerted a significant impact on EU15 exports in a gravity setting.

In line with recent works, we augmented the gravity equation with a multilateral trade resistance index. Starting from Anderson and Van Wincoop (2003), the inclusion of "multilateral trade resistance index" in empirical papers has been widely used to obtain a specification of a gravity equation that can be interpreted as a reduced form of a model of trade with micro foundations<sup>4</sup>. As for the empirical strategy, we use a panel data technique. A major motivation for this choice is the possibility to control for the correlated time invariant heterogeneity<sup>5</sup>. We perform an Hausman specification test to check the presence of correlation between explanatory variables and individual effects. Results are reported in table 1: the null hypothesis of zero correlation is rejected,

---

<sup>4</sup> Anderson and van Wincoop (2003) developed a theoretical gravity equation by using a CES utility function. Their basic gravity model is subject to:

$$x_{ij} = \frac{y_i y_j}{y^w} \left( \frac{t_{ij}}{P_i P_j} \right)^{1-\sigma} \quad P_j^{1-\sigma} = \sum_i P_i^{\sigma-1} \theta_i t_{ij}^{1-\sigma} \forall j$$

where  $y^w$  is the world income, country  $i$ 's world income share  $\theta_i = y_i / y^w$ , and trade cost  $t_{ij}$  is a function of border effect  $b_{ij}$  and distance  $d_{ij}$ .  $b_{ij} = 1$  if there is no border barriers between country  $i$  and  $j$ , otherwise equals one plus the tariff equivalent of the border barrier between the two countries. The model says that the trade between country  $i$  and  $j$  is determined by the share of the multiplier of both countries' income to the world income, as well as trade cost adjusted for the price indexes in both countries. The price index in country  $j$  is a function of the price indexes, income shares, and the trade costs of all countries.

<sup>5</sup> OLS suffer from heterogeneity bias in a gravity setting. The two most widely used panel data models are the random effect model (REM) and fixed effect model (FEM): both can control for heterogeneity. Their assumptions are different. REM models require that unobserved bilateral effects are  $\sim$  n.i.i. and orthogonal to the remaining part of the error term. regressors have to be uncorrelated to individual effects and error term for all cross sections and time periods. If the orthogonality conditions hold, the REM provides more efficient estimates than FE estimators. If explanatory variables are correlated with unobserved individual effects FEM is consistent.

showing that for our purposes FEM seems more reliable than REM<sup>6</sup>. However, FEM suffers from the major shortcoming of not being able to provide estimates of time invariant regressors.

In order to overcome this problem we decided to use an Hausman and Taylor estimator (HT). HT method is a 2SLS random effect model that allows to deal with correlation between regressors and unobserved individual effects. Using an HT estimator it is possible to estimate parameters of time invariant regressors.

The HT model in a bilateral form follows:

$$Y_{ijt} = \alpha_0 + \beta_1 X_{1ijt} + \beta_2 X_{2ijt} + \delta_1 Z_{1ij} + \delta_2 Z_{2ij} + e_{ijt} \quad (1)$$

$$e_{ijt} = \mu_{ij} + v_{ijt} \quad (2)$$

where  $\alpha_0$  is the constant term,  $\mu_{ij}$  is the unobserved individual effect,  $v_{ijt}$  is the white noise error term,  $X_1$  are the time-varying variables uncorrelated with  $\mu_{ij}$ ;  $X_2$  are the time-varying variables correlated with  $\mu_{ij}$ ;  $Z_1$  are time-invariant variables, uncorrelated with  $\mu_{ij}$ ;  $Z_2$  are time invariant variables correlated with  $\mu_{ij}$ .

$\mu_{ij}$  is the part of  $e_{ijt}$  including all the bilateral characteristic not specifically modelled in  $X_1$ ,  $X_2$ ,  $Z_1$  and  $Z_2$ . It includes also the unobserved trade resistance variables, both bilateral and country specific:

$$\mu_{ij} = \eta_{ij} + k_i + \lambda_j + \omega_t \quad (3)$$

where  $\eta_{ij}$  are the bilateral specific effects,  $k_i$  and  $\lambda_j$  are importer and exporter country characteristics,  $\omega$  are time effects.

The presence of  $X_2$  and  $Z_2$  causes correlation with unobserved individual effect. HT model uses variables already included in the model to instrument  $X_2$  and  $Z_2$ <sup>7</sup>.

In the empirical literature there are different selection procedures to select the variables correlated with  $\mu_{ij}$ . It is possible to select instruments on the base of economic intuition (Hausman and Taylor (1981)) or following different procedures<sup>8</sup>.

---

<sup>6</sup> The test statistic of 128.87 is greater than the chi-squared critical value with 11 degrees of freedom therefore the null hypothesis that the REM is consistent is rejected.

<sup>7</sup> In details,  $X_2$  can be instrumented by deviation from the group means of  $X_2$ ;  $Z_2$  can be instrumented by deviation from the group means of  $X_1$ . The model is identified as long as the number of variables in  $X_1$  is greater than the number of variables in  $Z_2$ .

### 3. EQUATION AND DATASET

The dependent variables in the estimates are the EU15 bilateral export flows. The equation is estimated for the EU15 countries as exporting countries and 25 countries (15EU members + 10 OECD) as trading partners; the time span is 1988-2008<sup>9</sup>.

We introduce three sets of variables into the gravity equation: i) standard gravity variables, ii) variables proxing multilateral trade resistance index iii) dummy variables for trade and environmental agreements<sup>10</sup>,

i) Standard gravity variables. Bilateral distance, as a proxy of transport costs, and the product of the importer's and exporter's GDP as proxies of the "mass".

ii) Multilateral trade resistance index. To built a multilateral resistance index, price indexes are needed. However, price variables are not available for all the countries, especially for developing ones. Therefore, in the empirical literature, several methods have been implemented to proxy these trade resistance terms. The most widely used seems to be the inclusion of country specific dummies<sup>11</sup>. This method has the advantage to capture unobserved price effect producing consistent estimates of parameters. Feenstra (2004) shows that the inclusion of these dummies generates about the same results of Anderson and Van Wincoop (2003). Our empirical strategy follows these suggestions.

In HT models country specific dummies appear in the error term. At the same time, the remaining components of  $\mu_{ij}$  (equation 3) proxies the unobserved trade resistance variables, both bilateral and country specific. We adopt a broad interpretation assuming that  $t_{ij}$  is a log-linear function of observable variables<sup>12</sup>.

iii) Trade and environmental agreements;

The estimated equation form is the following:

$$\ln EXP_{ijt} = b1 \ln Mass_{ijt} + b2 \ln Dist_{ij} + b3 Simil_{ijt} + b4 Fact_{ijt} + b5 Z + b6 Kyoto_{ijt} + b7 UNFCCC_{ijt} + b8 Montreal_{ijt} + b9 WTO_{ijt} + b10 EU_{ijt} + e_{ijt} \quad (4)$$

---

8 See for instance Walsh (2006)

9 The dataset is taken by OECD (STAN DTB) for bilateral exports in value terms and environmental stringency indicators, World Bank WDI for GDP in US \$ and population, WTO and MEAs membership are taken by WTO and OECD websites, distance is taken from <http://www.cepii.fr/anglaisgraph/bdd/distances.htm>.

<sup>10</sup> We selected three major MEAs : Montreal Protocol on Substances that Deplete the Ozone Layer, United Nations Framework Convention on Climate Change and the Kyoto Protocol, since they include many trade related measures (see appendix) and have been signed by the EU. The dataset is available on request.

<sup>11</sup> Rose and van Wincoop (2001).

<sup>12</sup> Dummies for common language, shared borders, currency, islands countries, land area of exporter and importer, See Marques H, and J. Spies (2006), Melitz (2005), Subramanian and Wei (2003), Rose (2002).

where:

- i)  $\ln$  is the natural logarithm,  $i$  is the exporting country,  $j$  is the importing country and  $t$  is the year
- ii)  $EXP_{ijt}$  is exports in value from country  $i$  to country  $j$ ;
- iii)  $MASS_{ijt}$  is the product of the gross domestic product of the exporting and importing countries, a proxy of the “mass”, i.e. the size of the countries involved in bilateral trade;
- iv)  $Dist_{ij}$  is the great circle distance between  $i$  and  $j$ <sup>13</sup>; this formula approximates the shape of the earth as a sphere and calculates the minimum distance along the surface.
- v)  $Simil_{ijt}$  is the similarity index of the two trading partners’ GDP as a measure of relative country size; it is built as:

$$\ln \left[ 1 - \left( \frac{GDP_{it}}{GDP_{it} + GDP_{jt}} \right)^2 - \left( \frac{GDP_{jt}}{GDP_{it} + GDP_{jt}} \right)^2 \right]$$

- vi)  $Fact_{ijt}$ : it is the absolute difference in relative factor endowments between country-pairs; it is built as:

$$\left| \ln \left( \frac{GDP_{it}}{POP_{it}} \right) - \ln \left( \frac{GDP_{jt}}{POP_{jt}} \right) \right|$$

where POP is the population.

- vii)  $Z$  is a vector of dummy variables capturing bilateral characteristics i.e. dummies for common language, shared borders, currency, islands countries, land area of exporter and importer.
- viii)  $WTO_{ijt}$  is a *dummy* that assumes value 1 if the importing country  $j$  liberalizes its imports under the WTO and at the same time the exporting country  $i$  is a WTO member.
- ix)  $Kyoto_{ijt}$ ,  $UNFCCC_{ijt}$  and  $Montreal_{ijt}$  are dummies that assumes value 1 if the exporting and importing countries have signed respectively the Kyoto, UNFCCC and Montreal agreements and 0 otherwise.
- x)  $EU_{ijt}$  is a dummy that proxies the EU internal market integration process. Therefore, EU membership has been a dynamic process, with European countries joining the EU in different years, this dummy assumes value 1 when both countries were members .

We expect that bilateral export flows are positively influenced by: i) the product of importing and exporting countries’ GDP. In gravity models trade flows are positively influenced by the “mass” proxied by the product of GDP. ii) The WTO and the “EU

---

<sup>13</sup> To calculate great circle distances you need the longitude and latitude of the capitol or “economic center” of each economy in the study. The apply the following formula to obtain the distance measure in miles:  $D_{ij} = 3962.6 \arccos([\sin(Y_i) \cdot \sin(Y_j)] (6) + [\cos(Y_i) \cdot \cos(Y_j) \cdot \cos(X_i - X_j)])$ , where  $X$  is longitude in degrees multiplied by 57.3 to convert it to radians and  $Y$  is latitude multiplied by  $-57.3$  (assuming it is measured in degrees West).

membership”: countries joining EU and WTO should have benefited from declining trade barriers.

.We expect that bilateral export flows are negatively influenced by: i) distance. According to the standard gravity model, bilateral distance is a proxy for transport costs and cultural proximity between two countries.

We have no a priori on: i) the signs of the MEAs: a negative sign of the index favours the pollution haven hypothesis. On the contrary, a positive sign supports Porters’s hypothesis; ii) the signs of the relative country size index (*Simil*). A negative sign of the index favours the classical Heckscher- Ohlin- Samuelson trade theory view that trade rises with relative factor endowment differences. On the contrary, a positive sign supports Linder’s hypothesis, which states that trade volumes are smaller the more dissimilar two countries are in terms of relative factors.

#### 4. ESTIMATES RESULTS: IS ENVIRONMENTAL REGULATION A SECONDARY TRADE BARRIER?

We estimated our equation (4) through an HT estimator. As we have stressed in section 2, in this kind of model the choice of variables correlated with residuals is crucial. We tested in the estimates several variables potentially correlated with unobserved individual effects. The choice of the feasible set of instruments depended on the deviation of the estimates from FEM estimates.<sup>14</sup> The basic idea was that the lower the gap with FE estimates, the lower the correlation of the independent variables with residuals.

To test the appropriateness of the choice of variables correlated with unobserved individual effect, we performed a Hausman-Taylor over-identification test based on comparison between the HT and Within estimators.

We identified HT1<sup>15</sup> as our preferred version: the mass, bilateral distance, the similarity index and the borders were the most important sources of correlation between explanatory variables and unobserved specific effects. The HT over-identification test did not reject the hypothesis of legitimacy of our choice of instruments.

The estimates results are summarised in Table 1. As regards “gravity standard” variables, a positive export relationship with the mass and a negative one with distance is confirmed, in line with the findings in the empirical literature. The control variables, not reported in the table, are statistically significant and with the expected signs.

---

<sup>14</sup> FEM results were taken as benchmarks: the within estimator is a consistent estimator of parameters, controlling for any source of correlation between regressors and unobserved individual effects.

<sup>15</sup> Several HT specifications were implemented in order to select the appropriate instrumental variables we selected HT1 with the following: instruments (Simil, Indist, Inmassa, border) .

As in Baltagi, Egger and Pfaffermeier (2003), the signs and statistical significance of  $Simil_{ijt}$  and  $Fact_{ijt}$  seem to support the Linder hypothesis: bilateral trade is higher the more similar two countries are in terms of factor endowments and country size.<sup>16</sup>

Table 1. The impact of trade agreements and MEAs on EU15 import flows

N. of obs: 5698 N. of bilat. relat. 286	Hausman-Taylor		
	Time sample 1988-2008		
	within	GLS	HT1
$\ln Mass_{ijt}$	0.40***	0.29***	0.41***
$\ln DIST_{ij}$		-0.75***	0.11
$Simil_{ijt}$	1.11***	0.20	1.11***
$Fact_{ijt}$	-0.13***	-0.05*	-0.13***
$EU_{ijt}$	0.15***	0.20***	0.15***
$WTO_{ijt}$	0.23***	0.25***	0.27***
$UNFCCC_{ijt}$	0.20***	0.17***	0.20***
$Montreal_{ijt}$	0.30***	0.31***	0.30***
$Kyoto_{ijt}$	0.27***	0.36***	0.28***
Costant	10.4***	19.13***	8.6***
Hausman test $\chi^2(11)$		1128.87***	
F test	F(11, 5339)= 551.02***		
Over-Identification Test: $\chi^2(3)$			2.94**

Regressors in  $Z_{ij}$  included but with unrecorded coefficients:  
\*\*\* significant at 1% , \*\* significant at 5%, \* significant at 10%.

The three MEAs dummies have positive and significant coefficients, rejecting the hypothesis of pollution haven<sup>17</sup>. In fact, according to our estimates the average positive variations of exports (of EU 15 towards OECD countries) induced by signing UNFCCC, Kyoto and Montreal agreements are respectively 22, 32 and 35%, over the period 1988-2008. It can be partly explained by a possible trade diversion effect with respect to countries that did not sign MEAs, and a corresponding trade creation effect among members of the environmental agreements.

We also find a positive and significant relationship between EU and WTO memberships and bilateral exports. Similarly to the related empirical literature<sup>18</sup>, our results show that

<sup>16</sup> This hypothesis was resumed by Helpman and Krugman (1985). They asserted - using a model derived from a standard monopolistic competition framework- that the theory behind comparative advantages (i.e. the Heckscher-Ohlin model) does not predict the relationships in the gravity model. Deardoff (1998) suggested that the basic gravity model can be derived from H-O, and so too can the Linder, Helpman-Krugman hypothesis. Reconciliation is provided by Evenett and Keller (2002) who find that “factor endowments and increasing returns explain different components of the international variation of production patterns and trade volumes”.

<sup>17</sup> Since the coefficient of the dummy UNFCCC is 0.20, the variation of exports induced by signing this agreement (UNFCCC=1) with respect to the case of not signing (UNFCCC=0), is given, other things being equal, by  $[(\exp 0.20 - 1) / \exp 0.20] * 100 = 22\%$ .

<sup>18</sup> Rose (2002), Subramanian and Wei (2003), De Santis and Vicarelli (2007).

the WTO membership dummy is positive and statistically significant. EU countries exported about 31% more towards WTO members than towards other countries. As for the EU membership, the impact is more limited (16%) than that for WTO membership. Nevertheless, this result is consistent with the tight trade links characterizing the EU members also before the creation of the European Union <sup>19</sup>.

We included in our regression interaction terms between our trade and environmental agreements dummies (table2). With the inclusion of these terms, the estimated coefficients indicated the difference in effects of the regressors (EU or WTO membership) on the dependent variable (EU15 bilateral exports) between countries that had signed MEAs and those that had not.

Table 2. Interaction effects

	Coeff.		Coeff.
UNFCCC*EU	0.01	UNFCCC*WTO	0.25***
Montreal* EU	0.06	Montreal* WTO	0.98
Kyoto* EU	0.14***	Kyoto* WTO	0.32***

Interestingly, with respect to the interaction with the EU membership, we found a positive and significant coefficient only between the EU membership and the Kyoto agreement. This shows that, for EU members, the effect of having signed the Kyoto agreement on bilateral trade was higher (by the amount of the estimated coefficient). As for the WTO membership we found positive and significant coefficient for the UNFCCC and Kyoto agreements.

## CONCLUSIONS

Estimates show that EU15 bilateral export flows were positively influenced by the presence of both trade and environmental agreements in the period 1988-2008. This evidence seems to show that, at least for EU members, on average, the environmental regulations did not constitute a secondary trade barriers in the past twenty years.

According to our estimates, to be member of MEAs in the period 1988-2008 had a positive impact on EU15 exports ranging between 22 and 35%. Furthermore, it seems that the jointed membership of WTO/EU and MEAs had a further positive “interaction effect” on exports.

These results reject the pollution haven hypothesis in favour of a view à la Porter, at least for EU members. This is in line with the fact that the relevance of the relationships between MEAs, EU and WTO rules for enhancing mutual supportiveness of environment and trade has been clearly reflected in the international negotiations in the past twenty years.

---

<sup>19</sup> Trade relationships within Europe have always been intense because of cultural and neighbourhood factors and they have been reinforced over the past decades by several partially overlapping policy decisions.

We also find a positive and significant relationship, in line with the existing literature, between EU and WTO membership and bilateral exports: EU countries exported about 31% more towards WTO countries and 16% more towards EU members. The lower impact of EU membership is consistent with the historically tight trade links characterizing the economies in Europe also before the creation of the European Union.

## References

- Ambec S., Barla P. (2006) Can environmental regulations be good for business? An assessment of the Porter hypothesis. *Energy Studies Review*, Vol. 14, No. 2, pp.42-62.
- Ambec, Stefan & Cohen, Mark A. & Elgie, Stewart & Lanoie, Paul, 2011. "The Porter Hypothesis at 20: Can Environmental Regulation Enhance Innovation and Competitiveness?," Discussion Papers dp-11-01, Resources For the Future
- Anderson J.E. and E. Van Wincoop (2003) "Gravity with Gravitas: a Solution to the Border Puzzle", *American Economic Review*, 93, 1, pp.170-192.
- Bjørn, E., R. Golombek and A. Raknerud, 1997. Environmental regulation and plant exit: a logit analysis based on establishment panel data. *Environmental and Resource Economics* 11: 35-59.
- Cagatay, S. & Mihci, H. (2006). "Degree of environmental stringency and the impact on trade patterns", *Journal of Economic Studies*, Vol. 33 No. 1, 2006, pp. 30-51
- Deardoff A.V. (1998), "Determinants of Bilateral Trade: Does Gravity Work in a Neoclassical World?" in Jeffrey A. Frankel (ED) *The Regionalisation of the World Economy*, Chicago, University of Chicago Press for NBER, pp.7-22.
- De Benedictis L., De Santis R: and Vicarelli C: (2005), "Hub and Spoke or Else? Free Trade Agreements in the "Enlarged" EU", in *European Journal of Comparative Economics*, vol.2, issue.2 .
- De Santis R. Vicarelli C. (2007) "The "Deeper" and the "Wider" EU Strategies of Trade Integration. An Empirical Evaluation of Common Commercial Policy Effects", *Global Economy Journal*, vol.7, issue 4, ,art.4, 2007
- Egger P. (2005), Estimating Regional Trading Bloc Effects with Panel Data' *Weltwirtschaftliches Archiv/Review of World Economics*, 140, 151-156.
- Egger P. and M. Pfaffermayr (2002), 'The pure effects of European Integration on intra-EU core and Periphery trade', University of Innsbruck Working Paper No. 1.
- Egger, P. and M. Pfaffermayr (2004). Distance, Trade and FDI: A Hausman-Taylor SUR Approach. *Journal of Applied Econometrics*, Vol. 19, pp. 227-246.
- Evenett S.J. and W. Keller (2002), "On Theories Explaining the Success of Gravity Models", *Journal of Political Economy*, vol.110, pp.281-316.
- Feenstra, R. (2004). *Advanced International Trade: Theory and Evidence*. Oxford: Princeton University Press
- Fredriksson, P.G. (ed.), 1999. *Trade, Global Policy, and the Environment*. World Bank Discussion Paper, No. 402, The World Bank, Washington D.C.
- Helpman, E. and P. Krugman, 1986, *Market Structure and Foreign Trade*, MIT Press, Cambridge, Massachusetts

- Jaffe, A.B., S.R. Peterson, R.R. Portney and R. Stavins, 1995. Environmental regulation and the competitiveness of US manufacturing. *Journal of Economic Literature* 33: 132-163.
- Jug J. and Mirza D., (2005), Environmental Regulations in Gravity Equations: Evidence from Europe. *The World Economy*, Vol. 28, No. 11, pp. 1591-1615, November .
- Levinson A, 2009. "Pollution and International Trade in Services," NBER Working Papers 14936, National Bureau of Economic Research, Inc
- Linnemann, H., 1966. *An Econometric Study of International Trade Flows*. Amsterdam: North-Holland.
- Low, P. and A. Yeats, 1992. Do "dirty" industries migrate? In: P. Low (ed.), *International Trade and the Environment*, Washington D.C., World Bank Discussion Papers, 159, 89-103.
- Marques H, and J. Spies (2006). "Trade Effects of the Europe Agreements," Discussion Paper 274/2006, Department of Economics, University of Hohenheim, Germany.
- Markusen, J.R., 1999. Location choice, environmental quality and public policy. In: J.C.J.M. van den Bergh (ed.), *Handbook of Environmental and Resource Economics*. Cheltenham: Edward Elgar.
- Melitz J. (2005), North, South and Distance in the Gravity Model, CEPR Discussion Paper N. 5136.
- Porter, M.E. and C. van der Linde, 1995. Green and competitive: ending the stalemate, *Harvard Business Review*, September-October: 120-134.
- Tinbergen, J., 1962. *Shaping the World Economy. Suggestions for an International Economic Policy*, New York: The Twentieth Century Fund.
- Rose A.K. (2002), Do we really know that the WTO increases trade?, NBER Working Paper n. 9273, October.
- Steininger, K.W., 1999 General models of environmental policy and foreign trade. In: J.C.J.M. van den Bergh (ed.), *Handbook of Environmental and Resource Economics*. Cheltenham: Edward Elgar.
- Subramanian A. and S. Wei (2003), The WTO Promotes Trade but Unevenly, NBER Working Paper n. 10024, October.
- Tobey, J. A., 1990. The effects of domestic environmental policies on patterns of world trade: an empirical test, *Kyklos* 43: 191-209.
- Tobey, J. A., 1993. The impact of domestic environmental policy on international trade. In: H. Giersch (ed.), *Economic Progress and Environmental Concerns*, Berlin: Springer-Verlag.
- Ulph, A. 1999. Strategic environmental policy and foreign trade. In: J.C.J.M. van den Bergh (ed.), *Handbook of Environmental and Resource Economics*. Cheltenham: Edward Elgar.

UNCTAD, 1976. Implications for the Trade and Investment of Developing Countries of United States Environmental Controls, New York: United Nations.

Van Beers, C. and J.C.J.M. van den Bergh, 1997. An empirical multi-country analysis of the impact of environmental regulations on foreign trade flows. *Kyklos* 50: 29-46.

Xu, X., and L. Song, 2000. Regional cooperation and the environment: do “dirty” industries migrate? *Weltwirtschaftliches Archiv* 136(1): 137-157.

APPENDIX

MATRIX ON TRADE MEASURES PURSUANT TO SELECTED MEAs

Montreal Protocol on Substances that Deplete the Ozone Layer

Name of MEA, date of adoption and objective	Information on MEA/WTO membership	Trade-related measures	Supportive measures	Non-compliance mechanism	Disputes	Provisions for non-parties
<p>Montreal Protocol on Substances that Deplete the Ozone Layer, 1987, and its Amendments.</p> <p>The Montreal Protocol develops a regime that limits the release of ozone-depleting substances (ODS) into the atmosphere.</p>	<p>There are 175 Parties to the Montreal Protocol.</p> <p>There are 3 WTO Members that are not party to the Protocol:</p> <p>Guinea Bissau Rwanda Sierra Leone</p> <p>The Parties to the Amendments to the Protocol are:</p> <p>London Amendment (1990): 145</p> <p>Copenhagen Amendment (1992): 120</p> <p>Montreal Amendment (1997): 56</p>	<p><b>Article 4</b></p> <p>The measures are directed against non-parties. These measures are as follows:</p> <p>(a) Control of trade in ODS with non-parties:</p> <p>(i) Annex A substances: import from non-parties banned from January 1990, export banned from January 1993;</p> <p>(ii) Annex B substances: import and export banned from August 1993 for non-parties to the London Amendment;</p> <p>(iii) Annex C – Group II - HBFCs: import and export banned from June 1995 for non-parties to the Copenhagen Amendment.</p> <p>(iv) Annex C Group I hydrochlorofluorocarbons (HCFCs): import and export ban with non-parties to the Beijing Amendment from 1 January 2004.</p> <p>(v) Annex C Group III: Import and export ban with non-parties to the Beijing</p>	<p><b>The London Amendment under Article 10</b></p> <p>Established a Multilateral Fund for incremental costs. The Fund has disbursed nearly US\$1 billion to 120 developing countries for the purpose of institutional strengthening, training, project preparation, and implementation of investment projects. The Fund has the obligation to meet all the agreed incremental costs of developing countries for implementing the control measures. An indicative list of agreed incremental costs approved by the MOP IV was established in 1991 (permanent in 1992). The three-year initial budget for 1991-93 was US\$240 million and the budget was replenished in 1993, 1996 and 1999.</p> <p>As of 2000, the fund has financed more than 2,000 projects in developing countries to meet the costs of changing from CFC technologies to more</p>	<p><b>Article 8</b></p> <p>In 1990 MOP II adopted non-compliance procedures and established an Implementation Committee. The functions of the Committee are to receive, consider and report on any submission made by one or more Parties and any information or observations forwarded by the Secretariat in connection with the preparation of a report referred to in Article 12 of the Protocol. After receiving a report by the Committee, the Meeting of the Parties may, taking into consideration the circumstances of the case, decide upon and call for steps to bring about full compliance with the Protocol, including measures to assist a Party's compliance and to further the Protocol's objectives.</p> <p>The Multilateral Fund, contributed to by the developed countries, meets all the agreed incremental costs of all developing countries to implement the control measures. Parties having difficulties meeting their obligations under the Protocol have notified the</p>	<p><b>Article 11 of the Vienna Convention for the Protection of the Ozone Layer</b></p> <p>applies to the Montreal Protocol and its amendments for dispute settlement. In the event of a dispute, Parties are:</p> <ol style="list-style-type: none"> <li>1. To first seek a solution by negotiation;</li> <li>2. if an agreement is not reached by negotiation, they may jointly seek the good offices of, or request mediation by a third party;</li> <li>3. for those disputes not resolved in accordance with negotiation or mediation, a Party</li> </ol>	<p><b>Article 4 (8)</b></p> <p>Trade restrictions do <u>not</u> apply if a non-party is in compliance with the Protocol.</p> <p>Article 4 (8) states: "Notwithstanding the provisions of this Article, imports and exports referred to in paragraphs 1 to 4 <i>ter</i> of this Article may be permitted from, or to, any State not Party to this Protocol, if that State is determined, by a meeting of the Parties, to be in full compliance with Article 2, Articles 2A to 2E, Articles 2G <u>and</u> 2H and this Article, and have submitted data to that effect as specified in Article 7".</p>

Name of MEA, date of adoption and objective	Information on MEA/WTO membership	Trade-related measures	Supportive measures	Non-compliance mechanism	Disputes	Provisions for non-parties
	Beijing Amendment (1999): 6	<p>Amendment within one year from the date of entry into force of the Beijing Amendment.</p> <p>(b) Control of trade in ODS products with non-parties:</p> <p>Import of products (listed in Annex D) containing Annex A substances banned from May 1992;</p> <p>It was decided at MOP V that it was not feasible to ban or restrict trade in products made with, but not containing Annex A substances.</p> <p>Parties also decided that products containing Annex B and Annex C, Group II, substances or products made with, but not containing the Annex C, Group II substances will not be listed.</p> <p>(c) Exports of ODS-technologies: Parties to discourage "to the fullest practicable extent", export of technology for producing of ODS; however, there are exceptions for HCFCs and for equipment or technology to recycle ODS.</p> <p>MOP IX introduced, through the Montreal Amendment (not yet in force), <i>inter alia</i>, trade controls for methyl bromide (Annex E) with non parties:</p>	<p>ozone-friendly technologies. Also, developing countries have received assistance for institutional strengthening and technical advice to help them reduce their use of ODS.</p> <p>The allocations so far have been as follows: Period Amount (US\$ in Millions):</p> <p>1991 to 1993: \$240 1994 to 1996: \$455 1997 to 1999: \$465 2000 to 2002: \$440</p> <p>The GEF also provides funds to countries with economies in transition. There are a number of GEF-eligible countries that are Parties to the Protocol, where the production or consumption of ODS is too high to qualify for support under the Multilateral Fund. These are mainly countries in Central and Eastern Europe, and the former Soviet Union. The same criteria apply for the funding of ozone projects under the GEF as under the Multilateral Fund. The GEF has allocated US\$148 million for 14 such countries.</p> <p>Technology Transfer under</p>	<p>MOP under self-reporting provision of the procedure. In 1995, five countries with economies in transition jointly self-reported their foreseeable failure to comply with the Protocol's control measures.</p>	<p>may declare that it accepts one or both of the following means of dispute settlement as compulsory:</p> <p>(a) Arbitration in accordance with procedures adopted by the COP at its first meeting; or</p> <p>(b) submission of the dispute to the ICJ</p> <p>If the Parties have not accepted the same or any procedure, the dispute shall be submitted to a conciliation commission which is created upon the request of one of the Parties to the dispute. This commission shall be composed of an equal number of members appointed by each Party concerned and a chair chosen jointly by the members appointed by each Party. It shall render a final and</p>	

Name of MEA, date of adoption and objective	Information on MEA/WTO membership	Trade-related measures	Supportive measures	Non-compliance mechanism	Disputes	Provisions for non-parties
		<p>- From November 2000, each Party shall ban the import, and after November 2000, the export, of methyl bromide from any State not Party to the Montreal Amendment.</p> <p>- Parties are to discourage the export of technology for producing or for utilizing methyl bromide to non-parties.</p> <p>- Each Party shall refrain from providing any assistance for the export to non-parties of any equipment or technology that would facilitate production of methyl bromide.</p> <ul style="list-style-type: none"> <li>Recent trade-related decisions from MOP XI include:</li> </ul> <p>Three further adjustments, relating to control and gradual phase-out of production by developed countries of CFCs, (chlorofluorocarbons), halons, other fully halogenated CFCs and methyl-bromide (Annex A, B and E substances) for basic domestic needs of developing countries</p> <p>The Beijing Amendment to the Montreal Protocol shall enter into force on 1 January 2001, provided that at least 20 instruments of ratification of the Amendment have been deposited, or on the 90th day following the date on which the required number of ratifications have been reached. Under the</p>	<p>Article 10A occurs under fair and most favourable conditions.</p> <p>Nearly 2500 projects are being implemented in developing countries to shift their use to non-ODS substances.</p>		<p>recommendatory award, which the Parties shall consider in good faith.</p> <p>There have been no disputes to date. Decisions are reached by consensus.</p>	

Name of MEA, date of adoption and objective	Information on MEA/WTO membership	Trade-related measures	Supportive measures	Non-compliance mechanism	Disputes	Provisions for non-parties
		<p>Protocol, HCFCs are to be phased out in developed countries by 2030 and in developing countries by 2040.</p> <p>The Beijing Amendment to the Protocol will also ban trade in HCFCs with countries that have not yet ratified the Copenhagen Amendment (1992), which introduced the HCFC phase out. The Beijing Amendment also requires developed countries to freeze the production of HCFCs in 2004 at 1989 levels (measured as the average of consumption and production levels) and developing countries to do so in 2016 with a similar baseline of 2015. Production of 15 per cent above baseline will be permitted to meet the "basic domestic needs" of developing countries. In addition, the production of a recently developed ozone-depleting chemical, (bromochloromethane, which is a controlled substance in a newly created Group III of Annex C) is to be completely phased out in all countries by 1 January 2002.</p>				

**United Nations Framework Convention on Climate Change**

Name of MEA, date of adoption and objective	Information on MEA/WTO relationship	Trade-related measures	Supportive measures	Non-compliance mechanism	Disputes	Provisions for non-parties
<p>United Nations Framework Convention on Climate Change (UNFCCC), 1992.</p> <p>The objective of the Convention is stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system (Article 2).</p>	<p>There are 186 Parties to the UNFCCC.</p> <p>There are 3 WTO Members that are not party to the UNFCCC:</p> <p>Brunei, Darussalam Tanzania Turkey</p>	<p>The UNFCCC does not directly restrict trade, but actions of countries implementing the UNFCCC could have significant trade implications. The requirement to adopt National policies and corresponding measures to mitigate climate change by developed country Parties is set up in Article 4.2 (a.)</p> <p><b>Article 3.5</b> International trade is specifically mentioned in this article " ... measures taken to combat climate change, including unilateral ones, should not constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade."</p> <p>According to the UNFCCC Secretariat, the policies and measures adopted by Parties have not had any adverse impacts on international trade.</p>	<p><b>Article 11</b> Establishes a financial mechanism (which is the GEF) to provide financial resources, including for the transfer of technology.</p> <p>GEF covers the difference (or "increment") between the costs of a project undertaken with global environmental objectives in mind, and the costs of an alternative project that the country would have implemented in the absence of global environmental concerns.</p>	<p>Pursuant to <b>Article 13</b> of the UNFCCC, COP 4 considered the establishment of a Multilateral Consultative Committee (MCC) for the resolution of questions regarding the implementation of the UNFCCC.</p> <p>The proposed MCC is to provide advice to Parties and to prevent disputes. The nature of the MCC is to be facilitative, non-judicial, transparent, and co-operative. The outcome of the MCC may include recommendations and any measures that the MCC deems suitable for the effective implementation of the Convention.</p>	<p><b>Article 14</b> The Parties concerned shall seek a settlement of the dispute through negotiation or any other peaceful means of their own choice. Parties may make a written submission at any time as to whether they recognize as compulsory the submission of the dispute to the ICJ, and/or arbitration. If Parties are unable to settle their dispute through the above means, the dispute is to be submitted, at the request of any of the Parties concerned to conciliation.</p> <p>A conciliation commission is to be created upon the request of one of the Parties to the dispute, composed of an equal number of members appointed by each</p>	<p>No provisions.</p>

Name of MEA, date of adoption and objective	Information on MEA/WTO relationship	Trade-related measures	Supportive measures	Non-compliance mechanism	Disputes	Provisions for non-parties
					<p>Party concerned who in turn jointly chooses a chair. The commission is to render a recommendatory award, which the Parties shall consider in good faith. Additional procedures relating to conciliation shall be adopted by the COP.</p> <p>No disputes to date.</p>	

## Kyoto Protocol

Name of MEA, date of adoption and objective	Information on MEA/WTO membership	Trade-related measures	Supportive measures	Non-compliance mechanism	Disputes	Rights of non-parties
<p>Kyoto Protocol, 1997.</p> <p>A protocol to the UNFCCC which is a step towards achieving the objective of the Convention by reducing emissions from Annex I Parties.</p>	<p>The Protocol has 84 signatures and 34 ratifications.</p> <p>According to Article 25, to come into force, the Protocol requires at least 55 ratifications, and the Annex I Parties that ratify must account for 55 per cent of carbon dioxide emissions for 1990.</p> <p>The 14 WTO Members that are Parties to the Protocol are:</p> <p>Antigua &amp; Barbuda Bolivia Cyprus Ecuador El Salvador Fiji Guatemala Jamaica Maldives Nicaragua Panama Paraguay</p>	<p><b>Article 2.1(a)</b> Annex I Parties shall, in order to promote sustainable development, implement and/or further elaborate policies and measures in accordance with national circumstances, such as enhancement of energy efficiency in relevant sectors of the national economy and progressive reduction or phasing out of market imperfections, fiscal incentives, tax and duty exemptions and subsidies in all greenhouse gas-emitting sectors that run counter to the objective of the Convention and application of market instruments.</p> <p><b>Article 2.3</b> Annex I Parties will strive to implement policies and measures in such a way as to minimize adverse effects, on other Parties, including effects on international trade.</p> <p>The Kyoto Protocol sets out three flexibility mechanisms:</p> <p><b>Article 6</b> Joint Implementation (projects between Annex I countries to help meet a Party's commitments.)</p> <p><b>Article 12</b> Clean Development Mechanism (The CDM allows Annex I Parties to invest in projects in developing</p>	<p><b>Article 11 of the UNFCC</b> Adopts the financial mechanism of the Convention, which is the GEF.</p>	<p><b>Article 16</b> Provides that the COP can consider and modify as appropriate the Multilateral Consultative Process that is referred to in Article 13 of the UNFCCC. The MCP applied to the Kyoto Protocol shall operate without prejudice to the procedures and mechanisms established under Article 18 of the Protocol.</p> <p><b>Article 18</b> The COP serving as the meeting of the Parties shall, at its first session, approve appropriate and effective procedures and mechanisms to determine and to address cases of non-compliance with the provisions of the Protocol. This includes the development of an initiative list of consequences, taking into account the cause, type, degree and frequency of non-compliance. Any such procedures and mechanisms that entail binding consequences shall be adopted by means of an amendment to the Protocol.</p> <p>Such procedures and mechanisms are being developed.</p>	<p><b>Article 14 of the UNFCCC</b> Governs dispute settlement for the Kyoto Protocol.</p>	<p>No provisions.</p>

Name of MEA, date of adoption and objective	Information on MEA/WTO membership	Trade-related measures	Supportive measures	Non-compliance mechanism	Disputes	Rights of non-parties
	Trinidad & Tobago Uruguay	countries to achieve sustainable development, contribute to the objective of the Convention and assist Annex 1 Parties to comply with reduction commitments).  <b>Article 17</b> Emissions Trading (undefined).				

