Foreign direct investments and ”green” consumers

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Abstract

In this paper, we focus on the relationship between foreign direct investment, environmental norms and consumers' ecological preferences. This empirical study is based on previous theoretical models showing that weak unilateral environmental regulations create pollution havens attracting FDIs, which leads to even more pollution. However, our first non parametrical estimations on data coming from both developed and developing countries show that outward FDIs decrease with local consumers' "greenness". This is further confirmed by a deeper analysis, showing that home and host consumers' "greenness" has a very strong negative impact on outward FDIs. The results also show that consumers' "greenness" may act as a counterweight to the pollution haven effect.

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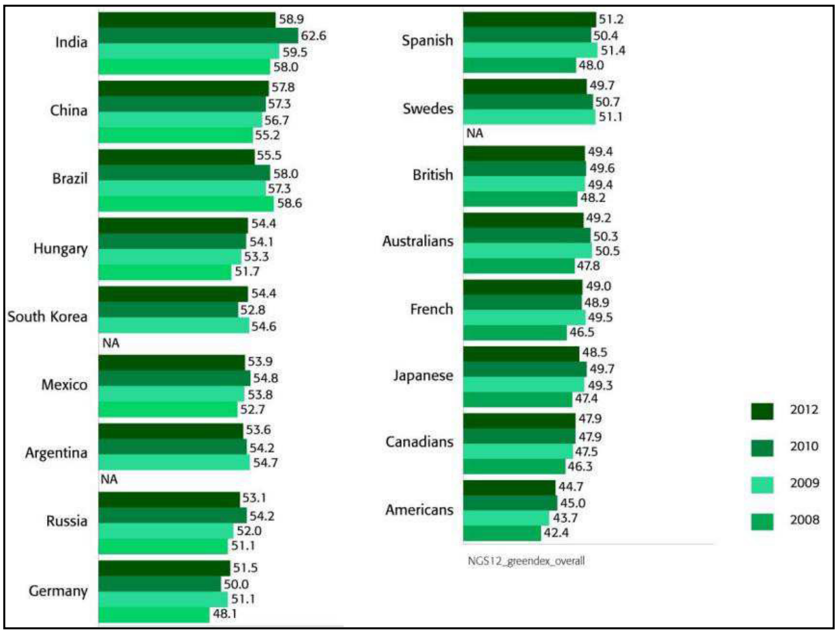
1. Introduction

In 2015, Coca Cola was forced to abandon its plans to build a new bottling facility in Tamil Nadu, a state in southern India. The company finally had to give in to local farmers resistance, who feared water shortage and the dumping of toxic effluents. The same reasons forced the soda giant to stop operating another facility in Kerala. If we go back further in time, in 2000, we find also Mitsubishi who had to give in to protests against its industrial salt project in Mexico, in a World Heritage Site - the Vizcaino Biosphere Reserve, which was threatening a breeding ground for whales and other endangered species. A "Mitsubishi: Don't Buy It" campaign was launched, more than 40 Californian cities passed resolutions condemning the company, and over 700,000 letters of objection were sent. It was a tough fight, but eventually protesters won and the company had to give up.
There aren't many examples like that, but these stories definitely show companies tendencies towards "greening" behaviour, forced either by regulation, society or market forces. So the main idea of this research paper is to disentangle the links between environment, consumers and multinational companies' (MNC) investments overseas, more precisely between "green" consumers, foreign direct investments (FDI) and environmental regulation.

The global market for environmental goods and services was estimated to have reached US$ 866 billion in 2011 (Environmental Business Journal 2012) and is expected to rise to US$ 1.9 trillion by 2020 (Blazejczak *et al.* 2009). Given that "green" consumers are becoming a sizeable market, taking into account consumers' behaviour related to environmental issues is beginning to gain momentum in MNCs' location and organizational decisions. According to Marlow (2007), "green" consumers are particularly present in North America, Western Europe, Japan and Australia. However, National Geographic's Greendex examines environmentally sustainable consumption and behaviour among consumers in 17 countries and shows a global growing environmental concern among consumers in both developed and developing countries (Figure 1)[1]. Also, consumers in developing countries seem to be more concerned with environmental issues than consumers in developed countries. In 2012, Indian, Chinese and Brazilian consumers ranked first in terms of environmental concerns, while Japanese, Canadian and American ones ranked last. Furthermore, "green" consumers typically look for companies that incorporate green practices. So, their concern tends to extend beyond products characteristics, to broader aspects of a company's environmental behaviour, such as financial contributions to environmental causes, support of environmental education programs or the use of natural resources in everyday business operations (Ogle *et al.* 2004). Given the rising power of "green" consumers, this should considerably influence MNCs' location choices and more generally, their adoption of "green" practices. Maersk is a compelling example: through its new strategy focused on sustainable development issues, the company is meant to keep faithful customers and attract new ones.

[1] National Geographic, together with GlobeScan, has built an index quantifying consumers' environmentally friendly behaviour. The index values range between 0 (unsustainable consumption) and 100 (sustainable consumption). For more details, see National Geographic (2008).



Source: National Geographic (2012)

Figure 1. Greendex: trends 2008-2012

Finally, in some countries, despite "green" consumers pressure, it is environmental regulation which doesn't seem to help companies become "greener". On the contrary, weak environmental norms supposedly have led to the emergence of pollution havens, especially in developing countries: MNCs tend to relocate their production facilities to developing countries, where environmental norms are very low or non-existent, leading to higher levels of pollution. A significant contribution on this subject shows that indeed this type of FDI is significantly influenced by local environmental norms (Rezza 2013). This obviously implies a concentration of highly polluting activities and therefore FDIs in countries with poor regulation of pollution. Thus, in countries where consumers feel little concerned with the issue of sustainable development, these capital inflows exacerbate the existing pollution trends.
Consequently, the aim of this paper is to empirically estimate FDI determinants, with a focus on environmental related determinants (regulation and consumers' preferences), without neglecting the traditional ones.

In the light of the above, our paper has two main contributions:

1. The research question: to our knowledge, this paper is the first to analyse empirically the direct impact of consumers' "green" preferences on location decisions of multinational companies (on FDIs) as well as the role they could play in the pollution haven effect.
2. The data: to our knowledge, this paper is the first to use the Greendex developed by the National Geographic as a proxy for "green" consumers preferences. Also, whereas many previous works dealing with FDI determinants use inward FDI as a proxy for the latter, we use outward FDI. This seems a more natural proxy given that the location decision comes from the origin countries not the destination ones. Finally, our proxy for environmental regulation is an index based on how companies' executives perceive enforcement of environmental regulation.

The paper is organized as follows: section 2 reviews previous works related to the links between FDIs, environmental issues (pollution and regulation) and "green" consumers, section 3 presents the empirical analysis (empirical model and data, methodology and results) and section 4 concludes.

2. Literature review

Research on FDI and the environment is rather abundant, with many interesting contributions regarding particularly the impact of FDI inflows on pollution levels as well as the impact of environmental regulation on FDIs. If the impact of FDIs on pollution levels appears quite obvious in the literature, the existence of pollution havens hasn't been clearly established by empirical studies. Problems related to the endogeneity of environmental regulation variables or the omitted variables bias have been highlighted as explaning factors for this lack of consensus regarding the existence of such phenomenon. For instance, Cai *et al.* (2016) and He (2006) find evidence for the pollution haven hypothesis in China, by controlling for the endogeneity of environmental regulation, as well as Cole and Fredriksson (2009), Kellenberg (2009), Ben Kheder and Zugravu (2012) in cross country studies. Candau and Dienesch (2017) as well as Naughton (2014) show the importance of taking into account governance quality and corruption in the host countries and more generally, controlling for comparative advantage factors (e.g. human capital, openness etc. …). However, an important aspect lacks in these studies and this would be consumers' preferences. Most theoretical contributions assume a representative consumer and only take into account consumers' love of variety (NEG models) and the subsequent market size as determinants for companies' location/foreign investment decisions. But what about the type of consumers companies have to deal with? In the context of the location choice literature and the pollution haven effect, to our knowledge there is no notable contribution, except for Darrigues and Montaud (2012), who propose a theoretical model but no empirical validation.

Darrigues and Montaud (2012) use the New Economic Geography (NEG) setting to simulate the impact of environmental norms as well as consumers' ecological preferences on MNCs' location choices under trade liberalization. They show that pollution taxes tend to create pollution havens if globally, consumers do not feel concerned with sustainable development. This triggers even more pollution. On the contrary, more "green" consumers push MNCs to relocate or to adopt cleaner technologies. Consequently, a global ecological awareness might weight down the pollution haven effect. However, companies looking for less stringent environmental regulation do so in order to be able to cut production costs and take higher advantage of scale economies. This is more likely to happen in developing countries with relatively lower production costs, which is common for vertical or efficiency-seeking FDIs trying to exploit the productivity gap between the home and host countries. Without any attempt to model "green" consumer preferences, Rezza (2013) shows evidence of the link between vertical FDIs and the pollution haven effect: Norwegian parent companies invest less in affiliates having vertical motives in countries with more stringent environmental regulations. Thus, a major drawback in Darrigues and Montaud (2102) is that their results are based on identical regions (no difference in production costs or technology). Nevertheless, the pollution haven effect in their model should only be enhanced by the asymmetrical regions hypothesis.

Of course, there is extensive research on the determinants of "green" consumer preferences and choices, as well as customers' pressure on companies' management decisions and supply chain design: Coskun *et al.* (2016), Huang *et al.* (2016), Gualandris and Kalchschmidt (2014), Lin *et al.* (2013), Yalabik and Fairchild (2011), just to name a few, together with the CSR related literature which is beyond the conceptual framework of this paper. For instance, Coskun *et al.* (2016) bring theoretical and pratical evidence on how supply chain could adapt to consumers' "green" expectations. They suggest a goal programming model to optimize the supply chain network for a retailer, which include manufacturers, carriers and distribution centers, based on the "green" expectations of consumer segments (*green* consumers, *red* consumers and *inconsistent* consumers). They also demonstrate the value of their model on a hypothetical real-life-like example. For instance, they show that once the retailer realizes that the "green" consumer segment is enlarging, it can re-design its green supply chain network cooperating with suppliers at the expected greenness level, whereas its suppliers are encouraged to increase their greenness levels. Huang *et al.* (2016) emphasize how customers' pressure push for "green" innovations, by motivating companies to invest in research and development. Their empirical investigation is based on previous theoretical contributions and survey data.

Finally, an interesting contribution comes from Chander and Muthukrishnan (2015) and analyzes the impact of "green" consumption on pollution, but there is no consideration here for companies location decisions or the pollution haven effect. In a vertically differentiated duopoly, they show that collective action by "green" consumers can lead to lower pollution, higher social welfare and at the same time, higher profits for firms. Somehow, they bring evidence (at least theoretically) that policy makers and firms should support "green" consumers' collective action instead of trying to stifle it.

3. Empirical analysis

3.1 The empirical model and data

Our empirical analysis is based mainly on the conclusions of the NEG models (in the spirit of Krugman 1991, Baldwin *et al.* 2003, Venables 1996, Fujita and Thisse 2006), assuming monopolistic competition in the production of industrial goods and capital mobility, as well as on those of the multinational activity literature (Markusen 1995, Markusen and Maskus 2002, Markusen and Venables 1998, Fujita and Thisse 2006). A major result of these models is that in a highly heterogenous world, with an internationally mobile capital looking for the highest reward, multinational companies will seek to take advantage of all the opportunities a country may offer, be it in terms of factors endowments and production costs, institutions and/or market access. Thus, FDI decisions are taken as a function of each possible destination's attributes, but also, in a highly integrated world, as a function of the gap between the home country and the host country (Fujita and Thisse 2006). To this, we add the pollution haven effect and consumers' "green" preferences. Consequently, we have two main research questions:

1. Does consumers' "greenness" have a significant impact on foreign companies' decision to invest in their countries?
2. If so, can "green consumers" contribute to weight down the pollution haven effect in their countries?

Given that our main variable of interest is consumers' "greenness", our sample is rather dictated by the availability of its proxy. We choose the National Geographic Greendex, constructed for 17 developed and developing countries, highly representative for world's population and FDIs. The Greendex rankings reflect the behaviours of the average consumer in each of the countries included in the study, and the environmental sustainability of that behaviour. Selected countries were chosen to reflect the variety of geographies and the different levels of environmental impact and economic development. Today the population of these countries represents more than half of the world population, including 7 of the 11 most populous nations. In 2007, the 14 countries initially included in the study accounted for 75% of the energy consumed in the world (National Geographic 2008). We conduct our study on outward bilateral FDIs, over the 2008-2012 period[2], with FDIs coming from the 17 Greendex countries, which include OECD and BRIC countries[3].

In a preliminary analysis, we proceed to a non-parametric analysis of our main variables of interest: bilateral outward FDIs (*OFDI*), environmental regulation (ER_{WEF}) and consumers' "greenness" (*Greendex*). We choose bilateral outward FDI stocks as our dependent variable rather than inward FDI, given that the location decision comes from origin countries not destination ones. Also, the literature on outward FDI determinants is a lot more scarce than the one on inward FDI determinants. Notable contributions are scarce and they deal especially with cross section data (mostly BRICS countries) rather than panel data (Chou *et al.* 2011, Zhang and Daly 2011, Wang *et al.* 2012, Anwar and Mughal 2012). As a proxy for environmental regulation, we choose the enforcement of environmental regulations index from the World Economic Forum (The Travel and Tourism Competitiveness Report). Given that we work with national aggregates, this index seems the right choice for its comprehensive approach and its availability. In particular, the WEF index is very attractive, because it is based on the companies executives' answers to surveys and FDI decisions ultimately come from executives. Consequently, their view of a country's environmental regulation is highly relevant in FDI decisions analysis. Moreover, this index accounts for how executives perceive enforcement of regulation, not its stringency. Especially, in developing countries, traditionally experiencing significant corruption, enforcement of any regulation appears more relevant to decision making than the stringency of any *de jure* regulation. Regulation stringency should not worry executives too much as long as it remains "on paper" and its enforcement is weak.

The Kendall's rank correlation (Table I) shows us a rather surprising positive correlation between FDIs and environmental regulation in host countries, but an expected negative correlation between FDIs and consumers' "greenness". A positive impact of host country environmental regulation has been found by Javorcik and Wei (2003), for instance, suggesting cleaner industries are actually attracted by more regulated environments.

Table I. Kendall's rank correlation

	$LnOFDI_{ij}$	$LnER_{WEFj}$	$LnGreendex_j$
$LnOFDI_{ij}$	0.9985		
$LnER_{WEFj}$	0.0847*	0.9537	
$LnGreendex_j$	-0.1164*	-0.3846*	0.9810

** denotes statistical significance at 5% level*

But the pollution haven literature suggests that FDI is attracted by *relatively* weaker environmental regulation, so an even more appropriate determinant would be the gap between home and host regulation. Kendall's rank correlation seems to confirm this approach rather than the previous (Table II).

[2] In order to reduce the missing data impact, we have a gap in our panel corresponding to 2011, because the Greendex is not available for that year.

[3] Argentina, Australia, Brazil, Canada, China, France, Germany, Hungary, India, Japan, Korea, Mexico, Russia, Spain, Sweden, United Kingdom, United States.

Table II. Kendall's rank correlation (regulation gap ER_{WEFG})

	$LnOFDI_{ij}$	$LnER_{WEFGj}$	$LnGreendex_j$
$LnOFDI_{ij}$	0.9985		
$LnER_{WEFGj}$	0.1945*	0.9973	
$LnGreendex_j$	-0.1164*	0.3261*	0.9810

** denotes statistical significance at 5% level*

This first attempt to disentangle the link between FDIs, environmental regulation and "green" consumers encourages a further deeper analysis. Consequently, we define a more comprehensive approach and given that our dependent variable is defined in bilateral terms, we work with the following baseline gravity equation:

$$OFDI_{ijt} = MA_{it} + MA_{jt} + ER_{WEFit} + ER_{WEFjt} + Greendex_{it} + Greendex_{jt} + Control_{jt} \quad (1)$$

where subscripts i, j and t define home country, host country and time, respectively and MA stands for the market access[4], a classic determinant for facilities location or FDI, put forward by NEG models. The market access is used here to replace the GDP as a better determinant for FDI stocks, given that it has a broader definition, taking into account countries' market potential as well as their integration into world markets. Appendix 1 summarizes the different steps for its computation. We also introduce various variables, in order to control for different aspects of host countries global competitiveness, such as availability of human capital, governance, macroeconomic environment. Table III below summarizes our main variables and data sources.

Table III. Data and sources

Variable	Data	Source
OFDI	Bilateral outward FDI of home country	UNCTAD (US$ millions, stocks)
MA	Market Access	Author's calculation (index)
ER_{WEF}	Enforcement of environmental regulations	WEF (index)
Greendex	Consumers' "greenness"	National Geographic (index)
Control variables in host countries		
SEC	Secondary enrollment	World Bank (units)
CORRUPT	Corruption Index	Transparency International (index)
UNEMP	Unemployment rate	World Bank (% of total LF)

3.2 Methodology

Summary statistics (Table IV) and density (Figure 2) analysis show two main problems related to our dependent variable: overdispersion and heteroskedasticity. These are current problems related to bilateral FDI data, which require quite specific econometric treatment. As stated by Santos Silva and Tenreyro (2006, 2008), the heteroskedasticity inherent to gravity equations could be dealt with by using the Poisson Pseudo Maximum Likelihood (Poisson PML) estimator. The latter remains consistent even in the presence of overdispersion, when the dependent variable is continuous. Furthermore, Head and Mayer (2014) suggest using OLS, as well as Poisson and Gamma PML as robustness checks. Also, economists are often

[4] The market access is computed by the author following the Redding and Venables (2004) procedure, with improved econometric treatment allowing to take into account the heteroskedasticity of bilateral trade flows, traditionally used for this kind of computation.

concerned with endogeneity coming from *reverse causality* (especially regulation and market access endogeneity here) as well as the *omitted variables bias*. In gravity equations, *reverse causality* should not be a significant problem, given that the dependent variable is bilateral, while the independent ones are not (Naughton 2014, Head and Mayer 2014): FDI coming from *one* particular partner country shouldn't have a significant impact on the environmental policy or the market access of a country. However, as a robustness check allowing to solve the problem of potential endogeneity of the market access and the environmental regulation variable, we also run all our regressions by replacing the variables with their lagged variables (first lag). Results will be reported in Appendix 2. Finally, we tackle the problem of *omitted variables bias* by taking into account several control variables, while our *MA* variable also takes into account origin and destination country fixed effects.

Table IV. Bilateral outward FDIs: summary statistics

Variable	*Obs*	*Mean*	*Std. Dev.*	*Min*	*Max*
OFDI	896	2.46e+07	6.02e+07	0	5.98e+08

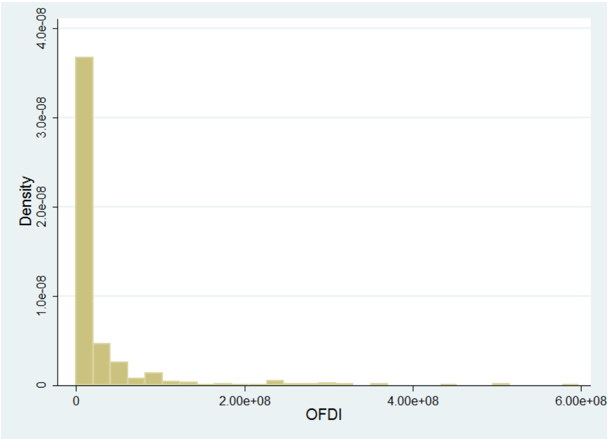


Figure 2. Distribution of bilateral outward FDI data

We follow Head and Mayer (2014) and use the three suggested estimators for comparison and robustness checks.

Finally, given our research questions, our empirical anaylsis is built in 2 stages. Firstly, in order to be able to answer research question n°2, we should verify the existence of the pollution haven effect in our sample. Consequently, we conduct our first stage estimations without taking into account consumers' "greenness". The reason is to avoid any interaction between our variables that might lead us to conclude to a "fake" pollution haven effect. Secondly, we add the Greendex variables to our regressions and follow the interaction with the pollution haven effect.

3.3 Results

Table V reports results for the estimation of (1) without the Greendex, using OLS, PPML and GPML. Secondly, we integrate the Greendex, to test for the robustness of the first stage results and, of course, for the impact of consumers' "greenness" on bilateral outward FDIs and the link with the pollution haven effect. Table VI reports results after integrating the Greendex.

Table V. The pollution haven effect

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*
$LnMA_i$	2.311***	1.445***	1.460***
	(-0.195)	(-0.14)	(-0.092)
$LnMA_j$	1.299***	0.554***	0.505***
	(-0.317)	(-0.136)	(-0.166)
$LnER_{WEFi}$	6.542***	2.112***	2.958***
	(-0.524)	(-0.278)	(-0.257)
$LnER_{WEFj}$	-4.193***	-3.956***	-3.037***
	(-1.437)	(-0.78)	(-0.788)
$LnCORRUPT_j$	3.026***	4.385***	2.550***
	(-1.025)	(-0.624)	(-0.535)
$LnUNEMP_j$	1.722***	0.501***	1.389***
	(-0.321)	(-0.151)	(-0.145)
$LnSEC_j$	0.428**	0.582***	0.426***
	(-0.174)	(-0.08)	(-0.079)
Constant	-4.086	1.272	2.588
	(-3.359)	(-1.779)	(-1.809)
Obs	*653*	*653*	*653*
R^2	*0.485*		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

Our first stage estimates seem to remain rather robust regardless of the estimator used, with OLS estimates globally higher as compared to the PML estimators, a result which has already been highlighted in previous works and put forward by statisticians. All variables are statistically significant and have the expected sign. Especially, focusing on the environmental regulation variables, our estimations confirm the pollution haven effect: the more stringent policies are, the lower the outward FDIs and vice versa. So, strong environmental regulation at home spurs outward FDI towards countries with weaker environmental norms. Also, together with corruption in destination countries, environmental regulation has a relatively higher impact on OFDI decisions as compared to the other variables in our model.

In a second stage, we integrated our consumers' "greenness" variable, the Greendex. Regarding the sign and the statistical significance of coefficients, results are similar to the previous ones, while the impact of consumers' "greenness" appears impressively high as compared to all the other variables. Interestingly, results show that not only the Greendex in destination countries has a strong impact on OFDI decisions, but also that the Greendex in investing countries has a much stronger impact. So, contrary to what one might believe, consumers' "greener" behaviour at home do not make companies invest more overseas. This seems to answer quite nicely to our second research question: "green" consumers do have the power to weight down the pollution haven effect, especially if we think that consumers' behaviour at home counts more than local consumers' behaviour.

Table VI. The pollution haven effect and consumers' "green" behaviour

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*
$LnMA_i$	1.893***	0.747***	0.794***
	(-0.224)	(-0.102)	(-0.096)
$LnMA_j$	1.021***	0.422***	0.27
	(-0.385)	(-0.155)	(-0.178)
$LnER_{WEFi}$	4.763***	1.671***	1.650***
	(-0.672)	(-0.266)	(-0.26)
$LnER_{WEFj}$	-3.276**	-3.292***	-2.828***
	(-1.527)	(-0.868)	(-0.684)
$LnCORRUPT_j$	2.164*	3.571***	2.243***
	(-1.136)	(-0.779)	(-0.447)
$LnUNEMP_j$	1.622***	0.705***	1.395***
	(-0.336)	(-0.144)	(-0.157)
$LnSEC_j$	0.444**	0.588***	0.479***
	(-0.176)	(-0.081)	(-0.08)
$LnGreendex_i$	-9.463***	-8.661***	-10.92***
	(-1.933)	(-0.918)	(-0.871)
$LnGreendex_j$	-4.731*	-2.732*	-3.074***
	(-2.466)	(-1.443)	(-1.029)
Constant	54.48***	46.50***	58.76***
	(-9.999)	(-6.423)	(-5.242)
Obs	*587*	*587*	*587*
R^2	*0.501*		

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

Finally, following our preliminary non parametric analysis, we proceed to a robustness check and replace environmental regulation in home and host countries with the gap of regulation between the two (Table VII). Results remain highly similar and the regulation gap variable has the expected sign, confirming once again the pollution haven effect.

Table VII. The regulation gap effect

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*	*OLS*	*PPML*	*GPML*
$LnMA_i$	2.385***	1.409***	1.456***	1.923***	0.753***	0.751***
	(-0.19)	(-0.136)	(-0.093)	(-0.228)	(-0.105)	(-0.099)
$LnMA_j$	1.325***	0.542***	0.503***	1.062***	0.320**	0.221
	(-0.318)	(-0.139)	(-0.166)	(-0.376)	(-0.144)	(-0.184)
$LnER_{WEFGj}$	6.238***	2.415***	2.971***	4.518***	1.923***	1.859***
	(-0.499)	(-0.232)	(-0.258)	(-0.584)	(-0.242)	(-0.254)
$LnCORRUPT_j$	4.265***	3.478***	2.512***	2.929***	2.622***	1.624***
	(-0.582)	(-0.363)	(-0.319)	(-0.636)	(-0.39)	(-0.304)
$LnUNEMP_j$	1.634***	0.596***	1.391***	1.597***	0.748***	1.399***
	(-0.32)	(-0.14)	(-0.14)	(-0.339)	(-0.143)	(-0.156)
$LnSEC_j$	0.502***	0.543***	0.424***	0.485***	0.555***	0.451***
	(-0.158)	(-0.076)	(-0.076)	(-0.167)	(-0.074)	(-0.077)
$LnGreendex_i$				-9.889***	-8.384***	-10.53***
				(-1.763)	(-0.896)	(-0.906)
$LnGreendex_j$				-4.432*	-3.871***	-3.522***
				(-2.311)	(-1.116)	(-1.076)
Constant	-3.703	0.499	2.559	55.27***	49.53***	58.72***
	(-3.428)	(-1.844	(-1.797)	(-10.17)	(-5.777)	(-5.225)
Obs	653	653	653	587	587	587
R^2	0.482			0.501		

Robust standard errors in parentheses
*** $p<0.01$, ** $p<0.05$, * $p<0.1$

We finally control for the impact of the 2008 crisis and re-run all the above regressions with 2008 and 2009 dummies. We introduce them successively in the regressions and the results do not change significantly. The 2008 dummy is significant in most regressions, whereas the 2009 dummy is not. The only variable which seems to be however affected in some regressions (only those with the 2008 dummy) is the market access of the destination country (*MA* loses its statistical significance). Results are reported in Appendix 3.

4. Conclusions and future research

The pressure of consumers and more precisely, of "green" consumers on companies and the management of their supply chain should be an important decision factor for executives, together with national environmental policies, the ultimate goal being pollution control and eventually, mitigation. In this context, this paper represents a first attempt to determine whether consumers' "greenness" has a significant impact on companies' overseas location decisions (measured by outward FDIs) and if it might also be a counterweight for weak environmental policies which lead to pollution havens emergence. In a first stage, our results confirm the existence of the pollution haven effect in a sample of OECD and BRIC countries. We found a significant positive impact of home regulation and a significant negative impact of host regulation on outward FDIs, as well as a significant positive impact of the regulation gap: companies "run away" from stringent environmental regulation at home and are attracted to relatively weaker environmental regulation abroad. Results remain highly similar when we integrate in our regressions, the Greendex, our proxy for consumers' "greenness", with a very strong significant impact of *all* consumers, in home *and* host countries.

Consequently, it seems like "green" consumers *everywhere* act like an opposing force to FDIs attracted to pollution havens, not only local "green" consumers who are directly impacted by polluting companies coming from abroad. Interestingly, among all the variables used in our regressions, the Greendex appears to have the highest impact on FDIs, regardless of the equation being tested. Also, traditional determinants of FDIs, such as market potential, human capital availability, stability of the macroeconomic environment are also confirmed and estimation results remain robust to the different specifications including our environment related variables.

Of course, this is a first attempt to disentangle the links between "green" consumers, FDIs, environmental regulation and pollution havens. An important future research line would be to account more accurately for the magnitude of the consumers' "greenness" impact on FDIs and ultimately, on pollution. Also, the interaction between environmental regulation and consumers' "greenness" could be analyzed as a potential FDI determinant. Finally, our empirical analysis could be interestingly replicated on a count data model, using the numer of foreign affiliates as a proxy for location decisions abroad rather then FDIs.

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Appendix 1

In order to compute the market access, we follow the method introduced by Redding and Venables (2004), which implies estimating it through the trade equation:

$$X_{rs} = \beta_0 + \beta_1 FX_r + \beta_2 FM_s + \beta_3 \ln dist_{rs} + \beta_4 contig_{rs} + \varepsilon_{rs}, \quad (1)$$

where X_{rs} – exports from country r to country s
FX_r – origin/exporting country fixed effects
FM_s – destination/importing country fixed effects
$dist_{rs}$ – distance between the trade partner countries
$contig_{rs}$ – a dummy taking value 1 if trade partners share a common border, 0 otherwise
ε_{rs} – error term

The destination country fixed effects are used as a proxy for the market potential of each partner of the exporting country, while distance and contiguity are trade costs proxies.
Thus, the market access of country r is defined as the sum of the market potentials of all its partners including its own, weighted by trade costs and is calculated based on the estimation of (1).

$$\hat{MA}_r = \sum_s \exp(FM_s)^{\hat{\beta}_2} dist_{rs}^{\hat{\beta}_3} contig_{rs}^{\hat{\beta}_4} \quad (2)$$

where $\hat{\beta}_i$ represent the coefficients estimated in (1)
Consequently, the market access of a country measures the size of its domestic and foreign markets and how easy it can access them.
The data we use for the estimation of (1) are trade flows from IMF and distance and contiguity from the CEPII gravity database. We also use the PPML estimator instead of OLS as Redding and Venables (2004), in order to take into account the heteroscedasticity of trade flows data. We follow Redding and Venables (2004) and assume internal trade costs depend on its area:

$$dist_{ii} = 0.66(area/\pi)^{1/2} \quad (3)$$

Appendix 2

Table V. Revised with lagged variables

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*	*OLS*	*PPML*	*GPML*
$LnMA_i$	2.311***	1.445***	1.460***			
	(-0.195)	(-0.14)	(-0.092)			
$LnMA_j$	1.299***	0.554***	0.505***			
	(-0.317)	(-0.136)	(-0.166)			
$LnER_{WEFi}$	6.542***	2.112***	2.958***	5.715***	1.947***	2.550***
	(-0.524)	(-0.278)	(-0.257)	(-0.56)	(-0.31)	(-0.276)
$LnER_{WEFj}$	-4.193***	-3.956***	-3.037***			
	(-1.437)	(-0.78)	(-0.788)			
$LnCORRUPT_j$	3.026***	4.385***	2.550***	3.088***	4.169***	2.589***
	(-1.025)	(-0.624)	(-0.535)	(-1.158)	(-0.752)	(-0.606)
$LnUNEMP_j$	1.722***	0.501***	1.389***	1.517***	0.723***	1.525***
	(-0.321)	(-0.151)	(-0.145)	(-0.368)	(-0.169)	(-0.163)
$LnSEC_j$	0.428**	0.582***	0.426***	0.432**	0.639***	0.517***
	(-0.174)	(-0.08)	(-0.079)	(-0.189)	(-0.099)	(-0.090)
$L.LnMA_i$				2.152***	1.448***	1.434***
				(-0.234)	(-0.172)	(-0.115)
$L.LnMA_j$				1.203***	0.407**	0.331*
				(-0.372)	(-0.164)	(-0.188)
$L.LnER_{WEFj}$				-4.599***	-3.623***	-2.942***
				(-1.749)	(-0.969)	(-0.921)
Constant	-4.086	1.272	2.588	-1.748	0.154	1.327
	(-3.359)	(-1.779)	(-1.809)	(-3.704)	(-2.253)	(-2.264)
Obs	*653*	*653*	*653*	*452*	*452*	*452*
R^2	*0.485*			*0.467*		

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table VI. Revised with lagged variables

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*	*OLS*	*PPML*	*GPML*
$LnMA_i$	1.893***	0.747***	0.794***			
	(-0.224)	(-0.102)	(-0.096)			
$LnMA_j$	1.021***	0.422***	0.27			
	(-0.385)	(-0.155)	(-0.178)			
$LnER_{WEFi}$	4.763***	1.671***	1.650***	4.478***	1.524***	1.509***
	(-0.672)	(-0.266)	(-0.26)	(-0.686)	(-0.285)	(-0.265)
$LnER_{WEFj}$	-3.276**	-3.292***	-2.828***			
	(-1.527)	(-0.868)	(-0.684)			
$LnCORRUPT_j$	2.164*	3.571***	2.243***	2.224*	2.677***	2.092***
	(-1.136)	(-0.779)	(-0.447)	(-1.332)	(-0.761)	(-0.525)
$LnUNEMP_j$	1.622***	0.705***	1.395***	1.252***	0.598***	1.227***
	(-0.336)	(-0.144)	(-0.157)	(-0.403)	(-0.189)	(-0.199)
$LnSEC_j$	0.444**	0.588***	0.479***	0.500***	0.639***	0.546***
	(-0.176)	(-0.081)	(-0.08)	(-0.185)	(-0.084)	(-0.085)
$LnGreendex_i$	-9.463***	-8.661***	-10.92***	-9.812***	-9.852***	-11.45***
	(-1.933)	(-0.918)	(-0.871)	(-2.157)	(-1.05)	(-1.066)
$LnGreendex_j$	-4.731*	-2.732*	-3.074***	-6.886**	-5.935***	-4.476***
	(-2.466)	(-1.443)	(-1.029)	(-3.401)	(-1.73)	(-1.417)
$L.LnMA_i$				1.782***	0.684***	0.802***
				(-0.256)	(-0.116)	(-0.107)
$L.LnMA_j$				0.761*	0.0096	0.0261
				(-0.441)	(-0.19)	(-0.201)
$L.LnER_{WEFj}$				-3.875**	-2.297**	-2.692***
				(-1.875)	(-0.991)	(-0.841)
Constant	54.48***	46.50***	58.76***	65.71***	63.61***	66.04***
	(-9.999)	(-6.423)	(-5.242)	(-14.83)	(-7.744)	(-7.501)
Obs	*587*	*587*	*587*	*452*	*452*	*452*
R^2	*0.501*			*0.467*		

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table VII. Revised with lagged variables

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*	*OLS*	*PPML*	*GPML*
$LnMA_i$	1.923***	0.753***	0.751***			
	(-0.228)	(-0.105)	(-0.099)			
$LnMA_j$	1.062***	0.320**	0.221			
	(-0.376)	(-0.144)	(-0.184)			
$LnER_{WEFGj}$	4.518***	1.923***	1.859***			
	(-0.584)	(-0.242)	(-0.254)			
$LnCORRUPT_j$	2.929***	2.622***	1.624***	2.615***	2.346***	1.446***
	(-0.636)	(-0.39)	(-0.304)	(-0.719)	(-0.395)	(-0.347)
$LnUNEMP_j$	1.597***	0.748***	1.399***	1.240***	0.611***	1.231***
	(-0.339)	(-0.143)	(-0.156)	(-0.404)	(-0.187)	(-0.194)
$LnSEC_j$	0.485***	0.555***	0.451***	0.504***	0.639***	0.518***
	(-0.167)	(-0.074)	(-0.077)	(-0.18)	(-0.084)	(-0.086)
$LnGreendex_i$	-9.889***	-8.384***	-10.53***	-10.10***	-9.851***	-11.14***
	(-1.763)	(-0.896)	(-0.906)	(-2.089)	(-1.038)	(-1.143)
$LnGreendex_j$	-4.432*	-3.871***	-3.522***	-6.326**	-6.507***	-5.218***
	(-2.311)	(-1.116)	(-1.076)	(-3.03)	(-1.413)	(-1.514)
$L.LnMA_i$				1.854***	0.686***	0.791***
				(-0.256)	(-0.115)	(-0.11)
$L.LnMA_j$				0.835**	-0.048	-0.033
				(-0.417)	(-0.168)	(-0.205)
$L.LnER_{WEFGj}$				4.525***	1.770***	1.687***
				(-0.701)	(-0.284)	(-0.301)
Constant	55.27***	49.53***	58.72***	64.82***	65.22***	67.51***
	(-10.17)	(-5.777)	(-5.225)	(-14.69)	(-7.382)	(-7.655)
Obs	587	587	587	452	452	452
R^2	0.501			0.491		

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Appendix 3

Table V. Revised with 2008 dummy

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*	*OLS*	*PPML*	*GPML*
$LnMA_i$	2.311***	1.445***	1.460***	2.332***	1.467***	1.494***
	(-0.195)	(-0.14)	(-0.092)	(-0.194)	(-0.14)	(-0.092)
$LnMA_j$	1.299***	0.554***	0.505***	1.330***	0.578***	0.522***
	(-0.317)	(-0.136)	(-0.166)	(-0.324)	(-0.138)	(-0.167)
$LnER_{WEFi}$	6.542***	2.112***	2.958***	6.479***	2.102***	2.784***
	(-0.524)	(-0.278)	(-0.257)	(-0.513)	(-0.278)	(-0.253)
$LnER_{WEFj}$	-4.193***	-3.956***	-3.037***	-4.312***	-3.795***	-3.071***
	(-1.437)	(-0.78)	(-0.788)	(-1.428)	(-0.733)	(-0.784)
$LnCORRUPT_j$	3.026***	4.385***	2.550***	3.074***	4.231***	2.570***
	(-1.025)	(-0.624)	(-0.535)	(-1.015)	(-0.601)	(-0.529)
$LnUNEMP_j$	1.722***	0.501***	1.389***	1.772***	0.634***	1.512***
	(-0.321)	(-0.151)	(-0.145)	(-0.326)	(-0.135)	(-0.139)
$LnSEC_j$	0.428**	0.582***	0.426***	0.431**	0.577***	0.437***
	(-0.174)	(-0.08)	(-0.079)	(-0.173)	(-0.08)	(-0.079)
Dummy2008				0.188	0.300**	0.275*
				(-0.242)	(-0.137)	(-0.148)
Constant	-4.086	1.272	2.588	-4.094	1.044	2.376
	(-3.359)	(-1.779)	(-1.809)	(-3.359)	(-1.769)	(-1.84)
Obs	*653*	*653*	*653*	*653*	*653*	*653*
R^2	*0.485*			0.485		

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table VI. Revised with 2008 dummy

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*	*OLS*	*PPML*	*GPML*
$LnMA_i$	1.893***	0.747***	0.794***	1.854***	0.654***	0.716***
	(-0.224)	(-0.102)	(-0.096)	(-0.224)	(-0.099)	(-0.096)
$LnMA_j$	1.021***	0.422***	0.27	0.827**	0.136	0.11
	(-0.385)	(-0.155)	(-0.178)	(-0.404)	(-0.168)	(-0.192)
$LnER_{WEFi}$	4.763***	1.671***	1.650***	4.737***	1.623***	1.660***
	(-0.672)	(-0.266)	(-0.26)	(-0.673)	(-0.269)	(-0.259)
$LnER_{WEFj}$	-3.276**	-3.292***	-2.828***	-2.890*	-2.542***	-2.486***
	(-1.527)	(-0.868)	(-0.684)	(-1.558)	(-0.857)	(-0.676)
$LnCORRUPT_j$	2.164*	3.571***	2.243***	1.862	2.804***	1.932***
	(-1.136)	(-0.779)	(-0.447)	(-1.153)	(-0.699)	(-0.447)
$LnUNEMP_j$	1.622***	0.705***	1.395***	1.484***	0.495***	1.235***
	(-0.336)	(-0.144)	(-0.157)	(-0.344)	(-0.152)	(-0.165)
$LnSEC_j$	0.444**	0.588***	0.479***	0.481***	0.596***	0.495***
	(-0.176)	(-0.081)	(-0.08)	(-0.178)	(-0.073)	(-0.084)
$LnGreendex_i$	-9.463***	-8.661***	-10.92***	-10.21***	-10.04***	-11.66***
	(-1.933)	(-0.918)	(-0.871)	(-1.978)	(-0.902)	(-0.977)
$LnGreendex_j$	-4.731*	-2.732*	-3.074***	-6.780**	-5.922***	-5.035***
	(-2.466)	(-1.443)	(-1.029)	(-2.703)	(-1.522)	(-1.284)
Dummy2008				-0.495*	-0.508***	-0.458**
				(-0.299)	(-0.164)	(-0.186)
Constant	54.48***	46.50***	58.76***	65.23***	65.11***	69.52***
	(-9.999)	(-6.423)	(-5.242)	(-11.55)	(-6.819)	(-6.736)
Obs	*587*	*587*	*587*	*587*	*587*	*587*
R^2	*0.501*			*0.501*		

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table VII. Revised with 2008 dummy

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*	*OLS*	*PPML*	*GPML*
$LnMA_i$	1.923***	0.753***	0.751***	1.896***	0.650***	0.681***
	(-0.228)	(-0.105)	(-0.099)	(-0.229)	(-0.099)	(-0.098)
$LnMA_j$	1.062***	0.320**	0.221	0.902**	0.0612	0.0712
	(-0.376)	(-0.144)	(-0.184)	(-0.391)	(-0.146)	(-0.197)
$LnER_{WEFGj}$	4.518***	1.923***	1.859***	4.444***	1.758***	1.808***
	(-0.584)	(-0.242)	(-0.254)	(-0.595)	(-0.248)	(-0.256)
$LnCORRUPT_j$	2.929***	2.622***	1.624***	2.828***	2.275***	1.491***
	(-0.636)	(-0.39)	(-0.304)	(-0.64)	(-0.342)	(-0.292)
$LnUNEMP_j$	1.597***	0.748***	1.399***	1.474***	0.508***	1.226***
	(-0.339)	(-0.143)	(-0.156)	(-0.347)	(-0.149)	(-0.164)
$LnSEC_j$	0.485***	0.555***	0.451***	0.526***	0.584***	0.475***
	(-0.167)	(-0.074)	(-0.077)	(-0.171)	(-0.071)	(-0.083)
$LnGreendex_i$	-9.889***	-8.384***	-10.53***	-10.62***	-9.991***	-11.44***
	(-1.763)	(-0.896)	(-0.906)	(-1.846)	(-0.9)	(-0.998)
$LnGreendex_j$	-4.432*	-3.871***	-3.522***	-6.146**	-6.679***	-5.447***
	(-2.311)	(-1.116)	(-1.076)	(-2.465)	(-1.192)	(-1.331)
Dummy2008				-0.429	-0.540***	-0.487***
				(-0.3)	(-0.159)	(-0.186)
Constant	55.27***	49.53***	58.72***	64.76***	67.60***	70.15***
	(-10.17)	(-5.777)	(-5.225)	(-11.51)	(-6.206)	(-6.798)
Obs	587	587	587	587	587	587
R^2	0.501			0.502		

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1*

Table V. Revised with 2009 dummy

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*	*OLS*	*PPML*	*GPML*
$LnMA_i$	2.311***	1.445***	1.460***	2.310***	1.443***	1.468***
	(-0.195)	(-0.14)	(-0.092)	(-0.195)	(-0.14)	(-0.091)
$LnMA_j$	1.299***	0.554***	0.505***	1.297***	0.540***	0.505***
	(-0.317)	(-0.136)	(-0.166)	(-0.317)	(-0.135)	(-0.163)
$LnER_{WEFi}$	6.542***	2.112***	2.958***	6.535***	2.123***	2.918***
	(-0.524)	(-0.278)	(-0.257)	(-0.522)	(-0.277)	(-0.257)
$LnER_{WEFj}$	-4.193***	-3.956***	-3.037***	-4.281***	-3.985***	-3.077***
	(-1.437)	(-0.78)	(-0.788)	(-1.435)	(-0.777)	(-0.78)
$LnCORRUPT_j$	3.026***	4.385***	2.550***	3.078***	4.426***	2.579***
	(-1.025)	(-0.624)	(-0.535)	(-1.023)	(-0.622)	(-0.528)
$LnUNEMP_j$	1.722***	0.501***	1.389***	1.759***	0.529***	1.445***
	(-0.321)	(-0.151)	(-0.145)	(-0.323)	(-0.149)	(-0.144)
$LnSEC_j$	0.428**	0.582***	0.426***	0.437**	0.594***	0.433***
	(-0.174)	(-0.08)	(-0.079)	(-0.173)	(-0.08)	(-0.078)
Dummy2009				-0.222	-0.129	-0.201
				(-0.236)	(-0.137)	(-0.144)
Constant	-4.086	1.272	2.588	-4.163	1.024	2.518
	(-3.359)	(-1.779)	(-1.809)	(-3.354)	(-1.772)	(-1.805)
Obs	*653*	*653*	*653*	*653*	*653*	*653*
R^2	*0.485*			0.485		

Robust standard errors in parentheses

**** p<0.01, ** p<0.05, * p<0.1*

Table VI. Revised with 2009 dummy

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*	*OLS*	*PPML*	*GPML*
$LnMA_i$	1.893***	0.747***	0.794***	1.881***	0.747***	0.793***
	(-0.224)	(-0.102)	(-0.096)	(-0.224)	(-0.102)	(-0.096)
$LnMA_j$	1.021***	0.422***	0.27	1.030***	0.422***	0.271
	(-0.385)	(-0.155)	(-0.178)	(-0.385)	(-0.156)	(-0.178)
$LnER_{WEFi}$	4.763***	1.671***	1.650***	4.776***	1.671***	1.669***
	(-0.672)	(-0.266)	(-0.26)	(-0.674)	(-0.265)	(-0.258)
$LnER_{WEFj}$	-3.276**	-3.292***	-2.828***	-3.362**	-3.296***	-2.849***
	(-1.527)	(-0.868)	(-0.684)	(-1.53)	(-0.883)	(-0.689)
$LnCORRUPT_j$	2.164*	3.571***	2.243***	2.231*	3.576***	2.262***
	(-1.136)	(-0.779)	(-0.447)	(-1.139)	(-0.798)	(-0.451)
$LnUNEMP_j$	1.622***	0.705***	1.395***	1.653***	0.706***	1.411***
	(-0.336)	(-0.144)	(-0.157)	(-0.336)	(-0.148)	(-0.158)
$LnSEC_j$	0.444**	0.588***	0.479***	0.446**	0.588***	0.481***
	(-0.176)	(-0.081)	(-0.08)	(-0.176)	(-0.082)	(-0.08)
$LnGreendex_i$	-9.463***	-8.661***	-10.92***	-9.462***	-8.659***	-10.90***
	(-1.933)	(-0.918)	(-0.871)	(-1.931)	(-0.919)	(-0.863)
$LnGreendex_j$	-4.731*	-2.732*	-3.074***	-4.481*	-2.722*	-2.996***
	(-2.466)	(-1.443)	(-1.029)	(-2.457)	(-1.484)	(-1.047)
Dummy2009				-0.19	-0.00354	-0.0729
				(-0.234)	(-0.123)	(-0.139)
Constant	54.48***	46.50***	58.76***	53.46***	46.44***	58.29***
	(-9.999)	(-6.423)	(-5.242)	(-10.01)	(-6.673)	(-5.288)
Obs	*587*	*587*	*587*	*587*	*587*	*587*
R^2	*0.501*			*0.502*		

Robust standard errors in parentheses
**** p<0.01, ** p<0.05, * p<0.1*

Table VII. Revised with 2009 dummy

Dependent variable $OFDI_{ij}$

	OLS	*PPML*	*GPML*	*OLS*	*PPML*	*GPML*
$LnMA_i$	1.923***	0.753***	0.751***	1.909***	0.753***	0.749***
	(-0.228)	(-0.105)	(-0.099)	(-0.227)	(-0.105)	(-0.1)
$LnMA_j$	1.062***	0.320**	0.221	1.069***	0.319**	0.222
	(-0.376)	(-0.144)	(-0.184)	(-0.376)	(-0.144)	(-0.184)
$LnER_{WEFGj}$	4.518***	1.923***	1.859***	4.545***	1.919***	1.878***
	(-0.584)	(-0.242)	(-0.254)	(-0.588)	(-0.242)	(-0.253)
$LnCORRUPT_j$	2.929***	2.622***	1.624***	2.961***	2.612***	1.641***
	(-0.636)	(-0.39)	(-0.304)	(-0.639)	(-0.391)	(-0.306)
$LnUNEMP_j$	1.597***	0.748***	1.399***	1.633***	0.743***	1.414***
	(-0.339)	(-0.143)	(-0.156)	(-0.339)	(-0.147)	(-0.157)
$LnSEC_j$	0.485***	0.555***	0.451***	0.485***	0.554***	0.453***
	(-0.167)	(-0.074)	(-0.077)	(-0.167)	(-0.075)	(-0.077)
$LnGreendex_i$	-9.889***	-8.384***	-10.53***	-9.865***	-8.399***	-10.51***
	(-1.763)	(-0.896)	(-0.906)	(-1.763)	(-0.901)	(-0.897)
$LnGreendex_j$	-4.432*	-3.871***	-3.522***	-4.180*	-3.909***	-3.448***
	(-2.311)	(-1.116)	(-1.076)	(-2.295)	(-1.128)	(-1.095)
Dummy2009				-0.203	0.0185	-0.0719
				(-0.235)	(-0.124)	(-0.14)
Constant	55.27***	49.53***	58.72***	54.15***	49.78***	58.28***
	(-10.17)	(-5.777)	(-5.225)	(-10.16)	(-5.914)	(-5.289)
Obs	587	587	587	587	587	587
R^2	0.501			0.502		

Robust standard errors in parentheses

**** $p<0.01$, ** $p<0.05$, * $p<0.1$*