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LIBERALIZATION AND GREENHOUSE GASES EMISSIONS IN THE EU-10

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Abstract

Purpose: This paper is an attempt to analyze the relationship between liberalization and Greenhouse Gases emissions in Central and East European Countries. After their accession to the EU, most of the CEECs have already committed to reducing their GHGs emissions. Although emissions have decreased on average, there is a substantial heterogeneity among the countries in terms of both the direction and the magnitude of the changes. Moreover, within the liberalization and integration efforts, increasingly huge amount of Foreign Direct Investment has flown to the region, rendering it almost a magnet of inward FDI over the past two decades. Therefore the question is whether or not this increase in foreign investment to CEECs is related to the polluting industries. The coincidence of increased FDI and GHGs emission has led us to study the relationship between them.

Design/methodology/approach: We exploited cross-sectional and time series variation of the data.

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Originality/value: Few previous studies have taken into account FDI and environmental performance together, so our analysis represents a notable contribution to the pollution haven literature.
Findings: We found that the polluting FDI is positively associated with GHGs emissions in CEECs.

Keywords: CEECs, Liberalization, Foreign Direct Investment, Greenhouse Gas Emissions, Environment, EU

Paper type: Research paper

INTRODUCTION

Economic integration with the European Union (EU) provides a significant contribution to international trade and also to Foreign Direct Investment (FDI) in Central and Eastern European Countries (CEECs) now that they are new members of the EU. FDI in particular has become a major channel of economic transformation in these countries. According to many studies (Meyer, 1995; Lankes and Venables, 1996; Hunya, 1997, 2000; Borensztein *et al.*, 1998; Brenton and Di Mauro, 1999; Resmini, 2000; Carstensen and Toubal, 2004; Ryszard and Prochniak, 2009; Varamini and Kalash, 2010) GDP growth, productivity growth, structural change and profit rates were higher in these countries with the help of FDI inflow. The ten new member countries (EU-10: Bulgaria, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia and Slovenia) which joined the EU can be characterized by the magnet of inward FDI over the past two decades; almost all new members' FDI inflows as a share of GDP have increased during this period. Within the region, Hungary recorded the largest FDI inflows relative to GDP; in 1993 FDI inflows as a share of GDP in Hungary[4] increased from 5.97 per cent to 6.88 per cent in 2011. For the Czech Republic, the same figure increased from 1.67 to 2.38 and for Poland it increased from 1.83 to 2.97 (Table 1).

These are the members of the Vizegrad countries. The FDI sectors of these countries, which accounted for more than 70% of total FDI inflows to the EU-10, are mostly in traditional sectors, scale intensive and science based sectors. Some Baltic countries such as Latvia and

[4] Hungary is the most attractive country, together with the Czech Republic and Poland. We call them the Vizegrad countries.

Table 1. FDI inflows to EU-10 as a Share of GDP

	1993	1998	2000	2005	2008	2011
Bulgaria	0.37	4.11	7.76	14.18	19.87	4.84
Czech Rep.	1.67	5.79	8.48	8.92	2.92	2.48
Estonia	-	10.38	6.82	22.49	7.88	1.97
Hungary	5.97	6.97	5.97	7.71	48.62	6.88
Latvia	1.01	5.39	5.7	5.06	4.26	5.32
Lithuania	0.41	8.22	3.31	4.58	4.04	3.38
Poland	1.83	3.68	5.45	3.64	2.84	2.97
Romania	0.36	4.82	2.80	6.94	6.92	1.42
Slovakia	1.23	1.92	7.15	4.89	4.16	3.81
Slovenia	0.89	0.99	0.68	2.72	3.34	1.65

Source: World Bank, http://search.worldbank.org/data?qterm=FDI & language=EN (02.03.2013)

Lithuania also have high FDI inflows as a share of GDP. In terms of investment perception, the EU-10 have continued to become one of the most attractive destinations around the world. Some of them have remained among the most popular countries, including Poland. In spite of the global crisis in 2011, Poland received nearly 19 billion FDI inflows, which accounted for 47.3% of the total for the EU-10.

When we look at the determinants of FDI for these countries, we observe a wide range of conditions, including host-country and home-country factors such as the characteristics of local markets, cheapness and availability of skilled labour, the stability and effectiveness of government, incentives and promotion of investments and rules regarding investments.[5] Among these factors, the large market size and educated and/or low-wage labour force are particularly prominent. As shown, the mentioned group of FDI determinants includes almost everything except environmental factors. Generally, environmental concerns are considered as a part of the legal and administrative system that shapes the functioning of markets, but environmental standards and/or conditions are not spelled out in this system. However, even without clarification, there is some justification for the relationship between weak or strict environmental regulations and FDI inflows, which suggests the pollution haven hypothesis.

[5] For detailed determinants of FDI, see UNCTAD (1998) World Investment Report, trends and determinants, Geneva, UN.

The pollution haven hypothesis (PHH) depends on the relationship between FDI in pollution-intensive industries (dirty industries) and environmental regulations/legislations/rules or standards in host countries. It is argued that polluting industries try to find locations (countries) with weak rather than stringent environmental standards. These countries then become pollution havens. Since the developed world encourages more migration of dirty industries to the developing countries, developing countries are concerned about their environment. On the other hand, it is also well-known that trade liberalization of these countries makes this migration easier.

This paper is an attempt to analyze the relationship between GHGs emissions and the integration of CEECs within the EU. Within the liberalization and integration efforts, an increasingly huge amount of FDI has flown to the region and the region has become almost a magnet for inward FDI over the past two decades. Therefore the question is whether or not this increase in foreign investment in CEECs is related to the polluting industries. We make use of EU membership to analyze the joint effect of environmental regulations and integration. The membership is expected to have negative impact on GHGs emission thanks to the stringent environmental regulations. On the other hand, integration might have a positive impact on pollution if polluting FDI inflows increase after integration. Thus our analysis sheds some light on the net effect of EU membership.

Note that the set of developing countries in our sample excludes some of the CEECs due to lack of data. Our countries are therefore the Czech Republic, Estonia, Hungary, Poland and Slovakia, with relatively higher FDI figures. In the literature, few previous studies have taken into account FDI and environmental performance together. In that sense, our analysis represents a notable contribution to the pollution haven literature. For this purpose, after this introduction, in the next section we explain the relationship between FDI and pollution haven analysis before describing the methodology and the data employed.

ENVIRONMENTAL IMPACT OF FOREIGN DIRECT INVESTMENT

FDIs are still one of the most important sources for developing countries; they bring financial resources, technology, know-how, human capital and in-service training to host developing countries.

On the other hand, foreign direct investments are looking for cheap labour, large market opportunities, strategic locations for other close markets and lax environmental rules and regulations in these countries. In terms of FDI and environment nexus, the last factor becomes controversial in the literature. While it is argued that the relationship between FDI and the environment is an empirical issue, there is a theoretical presumption that includes three components of what Grossman and Krueger were the first to explicitly put forth as the notions of scale, technique and composition effects. The scale effect refers to the positive relationship between economic activity and pollution (such as GHGs). FDI may easily expand the scale of existing and/or new industries, and this brings an increase in pollution. The composition effect explains the impact of changing industrial structure on emissions. Finally, the technical effect posits that lower GHGs emissions come from technological improvements.

The above issues are discussed in connection with some empirical literature. On one side of the argument, some studies (Xing and Kolstad, 2002; Wenhua, 2007; Dean *et al.*, 2003) have provided empirical evidence which shows that FDI in polluting industries is attracted by lax environmental regulations. On the other hand, some studies (Dasgupta *et al.*, 1997; Eskeland and Harrison, 2003) have found little evidence to support the pollution haven hypothesis. For example, in their analysis of foreign investment in Mexico, Venezuela, Morocco and Cote d'Ivoire, Eskeland and Harrison (1997: 27) wrote that they found no evidence that foreign investors are concentrated in dirty sectors. Sometimes the objection to the pollution haven hypothesis comes from hierarchical ranking of the main determinants of FDI; Gray (2002: 313) argued that environmental regulations are not included as a substantial factor by foreign investors. However, Xing and Kolstad (2002) found the opposite result and their empirical study supported the effect of the laxity of environmental regulation on FDI. They emphasized that "lax environmental policy tends to attract more capital inflow from the US for pollution-intensive industries" (Xing and Kolstad, 2002: 15). Again, the study of Smarzynska and Wei (2001) found "some" support for the pollution haven hypothesis using the countries' participation in international environmental treaties; they found that the share of FDI in polluting industries in total inward FDI is lower for host developing countries with more stringent environmental regulations. On the other hand,

there are some studies based on both results; for example, in the study of Dean *et al.* (2003), "relatively weak environmental levies in India are found a significant attraction for joint ventures with partners from Hong Kong, Macao, Taiwan and other Southeast Asian developing countries, but in contrast, joint ventures with partners from developed countries are attracted by stringent environmental levies" (Dean *et al.*, 2003: 23-24). In a similar way, Jenkins (2003) examined the effect of liberalization on polluting activities in three Latin American countries: Argentina, Brazil and Mexico. He concluded that following the beginning period of liberalization, all three countries have increased their comparative advantage in "dirty" industries, and only Mexico has started to specialize in relatively low-pollution industries due to the stricter enforcement of environmental regulations (Jenkins, 2003: 93).

METHODOLOGY AND DATA

In order to analyze the impacts of polluting FDI on the environment, this paper employs an unbalanced panel data set which consists of yearly observations for five CEECs (Czech Republic, Estonia, Hungary, Poland and Slovakia) during the period 1993–2010. The common feature of these countries is that they became European Union members in 2004. We excluded Latvia, Lithuania and Slovenia for data-availability reasons. Bulgaria and Romania are eliminated because there were not enough observations after they became members in 2007. The data set includes GHGs emission, real GDP per capita, polluting FDI and other important determinants of pollution, such as human capital, institutional quality and macroeconomic stability.

For air pollution and polluting FDI, this paper utilizes the rich database of EUROSTAT. The air pollution variable is the total greenhouse gas emissions (1.000 tonnes of CO2 equivalent). We define the polluting FDI variable as the share of manufacturing and construction FDI in total FDI inflows. Real GDP per capita (in PPP) and institutional quality series are collected from Penn World Tables and Polity IV Project respectively (See Teorell *et al.*, 2011). We employ the polity2 variable to measure the institutional quality. This variable ranges from 0–10, where 0 is the least democratic and 10 the most democratic country. Finally, macroeconomic stability (current account balance of GDP) and human capital (primary school enrolment) data is derived from World Development Indicators.

Following the literature, we estimated Environmental Kuznets Curve with our variable of interest (polluting FDI) and several control variables[6] mentioned above. We began by defining the following model:

$$\ln(P_{it}) = \alpha_i + \beta_1(\ln rgpdch_{it}) + \beta_2(\ln rgpdch_{it})^2 + \beta_3(\ln rgpdch_{it})^3 + \beta_4 PFDI_{it} + \beta_5 EU\_04_{it} + \beta_6 PFDI_{it} * EU\_04_{it} + \sum_{i=7}^{k} \beta_i Z_{it} + \varepsilon_{it} \quad (1)$$

where P is the GHGs emission, *rgdpch* is the real GDP per capita (in PPP), *PFDI* is the polluting FDI, *EU_04* is the dummy which takes 0 until 2004 and takes 1 afterwards, and finally, Z is the vector of control variables. Since a short panel data set was employed, we did not use any time series techniques such as panel unit root and cointegration tests. In the above equation (1), α_i is the country fixed effect that captures the effects specific to each country that do not change over time, such as culture and climate, and ε_{it} is the idiosyncratic error term, which is allowed to be heteroscedastic and autocorrelated. Subscripts i and t represent country and year, respectively.

It is worth noting several points. Firstly, we did not include time fixed effects as the most relevant common shock is EU membership, which is captured by our dummy in the sample period. Moreover, the statistical tests can not reject the fact that the time dummies are jointly equal to zero when our model includes the EU dummy. Secondly, our identification assumption is that being a member of the European Union is an exogenous policy change. Hence, we can analyze whether the effects of polluting FDI change after CEECs countries join the EU.

The share of polluting FDI in total FDI inflows will test for the pollution haven effect. We expect to estimate $\beta_4 > 0$, meaning that the higher the amount of polluting FDI, the higher the pollution. However, in order to determine the overall impact of polluting FDI, we carry out the following derivation:

$$\frac{\partial P_{it}}{\partial PFDI_{it}} = \beta_4 + \beta_6 EU\_04_{it} \quad (2)$$

If we find an insignificant β_6, this means that being a member of the EU did not have any impact on the positive relationship between

[6] We also estimated the model with other control variables (trade openness, agriculture value added as a share of GDP, financial market development) but we have not reported these results, since they are statistically insignificant.

polluting FDI and GHGs emission. If joining the EU did not have any favourable impact in terms of regulations and polluting FDI inflows increased owing to the integration, we will estimate a positive and significant β_6. In contrast, if we find a negative and significant β_6 and $\beta_6 > \beta_4$ in absolute terms, we will conclude that the EU helped these countries decrease the negative impacts of polluting FDI, possibly via environmental regulations.

Regarding the relationship between income and pollution, we employed a cubic form to test the existence of EKC (Environmental Kuznets Curve). The cubic form represents N-shaped EKC, meaning per capita pollution first increases at low levels of income and then decreases with rising income, but after a certain level of income it increases again. Therefore the expected signs are $\beta_1 > 0, \beta_2 < 0$, and $\beta_3 > 0$. Finally, we expect to obtain a negative and significant relationship between our control variables (institutional quality, macroeconomic stability and human capital) and GHGs emission.

EMPIRICAL RESULTS

Table 2 reports the results of the benchmark model: air pollution equation without any control variable. Focusing on the income variables, we found that the coefficients of real GDP per capita, its square and cube, had their expected signs. The coefficients indicate an N-shaped relationship, which is consistent with the previous literature[7]. This means that as per capita output grows, air pollution increases at low level of income, then the relations become negative and pollution falls with rising output. Finally, the relation becomes positive after a certain level of income again.

Our variable of interest, polluting FDI, is positively and significantly associated with the GHGs emission, as expected. A one percentage point increase in polluting FDI leads to 0.05 per cent increase in GHGs emission. Although this result confirms the previous studies, the central issue of our paper is not this. We are interested in whether being a member of the European Union has a significant effect on this relationship. Therefore we carry out the following analysis:

$$\frac{\partial P_{it}}{\partial PFDI_{it}} = 0.000512 - 0.000523 EU\_04_{it} \qquad (3)$$

[7] See Grossman and Krueger (1995) among others. For the opposite result, see Cole (2004) and Atici (2012).

	(1)	(2)
lnrgdpch	2.938	2.337
	(0.515)***	(0.458)***
lnrgdpch ^{2}	-1.281	-1.025
	(0.222)***	(0.196)***
lnrgdpch ^{3}	.0186	0.015
	(0.003)***	(0.002)***
Polluting FDI	0.00051	0.00035
	(0.00023)*	(0.00015)*
EU_04	0.02	0.0310
	(0.022)	(0.016)
Polluting FDI*EU_04	-0.00052	-0.00036
	(0.00025)*	(0.00015)*
CURB/GDP		-0.008 (0.002)*
HC		-0.005 (0.001)**
Institutional Quality		-0.06 (0.006)***
R-square	0.28	0.54
Observations	68	60

Table 2. Polluting FDI and GHGs Emission

Notes: Robust standard errors are given in parentheses under parameter estimates. Significance at the 90%, 95% and 99% confidence levels are indicated by *, **, *** respectively. Dependent variable is logarithm of GHGs emissions (1,000 tonnes per capita).

Notice that the positive relationship between polluting FDI and GHGs emission vanishes after CEECs become members of the European Union. Being a member of the European Union makes the effect of polluting FDI on GHGs emission negative. If a country becomes a member of the EU, GHGs emission decreases almost 0.001 per cent. This result tells us that thanks to the environmental regulations, CEECs improved their environmental quality after membership. This behaviour

is also encountered in developing countries, as we observed in Jenkins (2003) or Eskeland and Harrison (2003), who argued that MNCs use and comply with advanced pollution and other environmental standards.

In the second column, we added control variables in order to check whether the aforementioned relationship between EU membership and pollution is robust to the inclusion of other important determinants of pollution. We found that CEECs decrease environmental pollution if: they are economically more stable; they have better institutions; and they have more human capital. Despite the fact that all control variables are significant and they have expected signs, our main result still holds. Notice that in both of the estimations, β_6 is negative and larger than β_4 in absolute terms.

Although all the countries in our sample became members of the EU in 2004, the negotiations started earlier and CEECs joined the EU after closing all the chapters. Therefore, CEECs started to change their environmental regulations before 2004. Despite the fact that implementation of new regulations takes time, it might be the case that the impact of the EU via environmental regulations materialized earlier. For this reason, we examined whether our main results would persist when we assumed that the effect of regulations started before 2004. In Table 3, we created another dummy variable (EU_01) which takes 0 until 2001 and 1 afterwards, and allows it to interact with the polluting FDI variable[8].

In column 1 of Table 3, we ran our benchmark regression. According to the results, a one percentage point increase in polluting FDI is associated with an estimated increase of GHGs emission by 0.23 per cent. Performing the previous calculation, we get:

$$\frac{\partial P_{it}}{\partial PFDI_{it}} = 0.00234 - 0.00235 EU\_01_{it} \qquad (4)$$

As in the previous case, joining the EU increases environmental quality. After becoming members of the EU, GHGs emission decreases by 0.001 per cent.

In the second column, we add control variables. All the variables have the same signs and significance levels except the institutional quality

[8] The same story is also meaningful for FDI inflows. If FDI increased in advance because it was expected that CEECs would join the EU, we would need to use lag level of FDI inflows as well. However, the data show that it is exactly the opposite: FDI inflows increased after 2004.

	(1)	(2)
lnrgdpch	2.7 (1.09)**	1.425 (0.67)*
lnrgdpch ^{2}	-1.17 (0.47)**	-0.629 (0.288)*
lnrgdpch ^{3}	.017 (0.006)**	0.015 (0.009)**
Polluting FDI	0.00234 (0.0005)**	0.0026 (0.0002)***
EU_01	0.082 0.031**	0.075 (0.012)***
Polluting FDI*EU_01	-0.00235 (0.0005)*	-0.0026 (0.0002)***
CURB/GDP		-0.009 (0.001)***
HC		-0.08 (0.001)***
Institutional Quality		-0.028 (0.15)
R-square	0.33	0.65
Observations	68	60

Notes: See notes under Table 2.

Table 3. Polluting FDI and GHGs emission with new dummy variable

variable. Although it has a negative effect on pollution, it is marginally insignificant. Regarding our variables of interest, the interaction term is negative and larger than the coefficient of polluting FDI variable. Therefore, we obtain the same negative relationship between EU membership and GHGs emission.

CONCLUSION

There is a serious debate on the behaviour of private FDI in developing countries; it is argued that facilitating environmental regulations is an attractive and important factor when private investors decide on the locations of their investments. So the FDI-environment nexus is a decisive component. This paper investigated the evidence for the pollution haven hypothesis for CEECs and assessed the extent to which

FDIs, through polluting intensive industries and integration with the EU, have brought about environmental pollution.

Our findings verify the previous results related with the Environmental Kuznets Curve (EKC) and the pollution haven hypothesis. First of all, during the period covering 1993–2010, as per capita output grows, air pollution increases at low levels of income, then the relations become negative and pollution falls with rising output. Finally, the relation again becomes positive after a certain level of income. This result obviously verifies the observation of EKC in EU-10 members. Meanwhile, due to the lack of suitable data, the study examined only five of ten new EU members (Czech Republic, Estonia, Hungary, Poland and Slovakia).

The econometric results presented in this study show that at first glance, polluting FDI is positively and significantly associated with the GHGs emissions in these countries, confirming the pollution haven hypothesis. Regarding the integration of CEECs with the EU, we found that the new members have benefited from the integration via stricter environmental regulations. Joining the EU alleviates the negative impacts of polluting FDI on GHGs emissions. Furthermore, having controlled for human capital, macroeconomic stability and institutional quality, polluting FDI still exhibits a positive, statistically significant relationship with pollution. Our main result: the favourable impacts of integration with the EU also survives inclusion of the control variables.

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