THE TWO-WAY LINKAGE BETWEEN FOREIGN DIRECT INVESTMENT AND ENVIRONMENTAL POLLUTION IN VIETNAM - FROM SECTORAL PERSPECTIVES

Cao Thi Hong Vinh[*]

Abstract

Two-way linkage between foreign direct investment (FDI) and environmental pollution is a topic that has attracted a great deal of attention of economists. Nevertheless, there are few quantitative studies which indentify the relationship between FDI and environmental pollution using sectoral data. Utilizing that kind of data with the General Methods of Moments (GMM) regression method, this paper affirms the existence of two-way linkage between FDI and environmental pollution. Specifically, FDI is found to cause an increase in the level of pollution, which is measured by the emission of greenhouse gases (GHG) for each economic sector, while the higher degree of pollution also boosts up the amount of FDI flows into Vietnam. Besides, the paper finds that: (i) There is a Kuznets Curve's inverted U-shaped relationship between pollution level and economic growth in general but not for the sector of energy; (ii) Energy sector experiences a rise in the degree of pollution while attracting a large amount of FDI;(iii) Within the energy sector, the sub-sector of production & distribution of electricity, gas and water has received a limited value of FDI. Based on these results, some policy recommendations will be made for Vietnamese government to attract more FDI but still reduce pollution levels..

Key words: *Foreign Direct Investment (FDI), Environmental pollution, Economic sector.*

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1. Introduction

FDI inflows have been considered one of the important capital flows that has made considerable economic contributions to the development process of host countries, especially developing countries like Vietnam. However, in addition to those economic aspects, more and more attentions have been paid towards another pillar of the development (especially sustainable one) called environmental perspective. The first question about what the actual effect of FDI on environmental pollution of capital recipients is attracted a great deal of attentions. Given that question, the answers are different. One point of view is that with modern technologies that could produce environment-friendly and clean products to serve host countries' markets, FDI inflows do facilitate pollution reduction, thus making a positive effect on the environmental quality. In reverse, the other way of thinking is that FDI inflows which are just profit-

[*] PhD candidate, Foreign Trade University; Email: caovinhftu@yahoo.com.

targeted, not concerned with the processing dumped water, toxic gases, industrial waste, etc will cause a heavy threat of environmental degradation.

In addition to the impact of FDI on the environmental pollution mentioned above, the environment itself, as well as its elements, constitutes the key factors affecting the investment decisions of FDI investors. High environmental pollution on one side perturbs investors because of its influencing their health and safety, on the other side promotes their investment process due to the fact that the countries with high environmental pollution is more likely to have loose environmental management policies which impose less costs to process dumped water, toxic gases, etc. Hence, the answers to the second question about the impact of environmental pollution on the FDI inflows are inconsistent. From the two questions, what I am concerned is about *how is the two-way linkage between FDI and environmental pollution, especially for such a developing country as Vietnam?*

The two-way linkage between FDI and environmental pollution has been attracted a plenty of attentions from researchers. Hoffman et. al. (2005) using Granger causality analysis has found that a two-way linkage between FDI flows and CO_2 emissions (proxy for environmental pollution) does not exist consistently in all countries. Specifically, for low-income countries, the research supports the impact of CO_2 emissions on FDI flows to these countries (ones with high pollution that are more capable of attracting FDI than others). For middle-income countries, the paper has just found the significant effect the opposite direction, i.e. FDI flows will result in an increase in CO_2 emissions. As for the group of high-income countries, there is not any linkage between FDI flows and CO_2 emissions. Lee (2009) also applies Granger causality methods to test bidirectional relationship in Malaysia during the period 1970-2000. The study indicated that between these two factors, there has only one-dimensional existence of FDI impact on CO_2 emissions of Malaysia. In their research paper, Pao and Tsai (2011) have looked into the effect of FDI on CO_2 emissions as well as the opposite impact by using Panel data from Russia, Brazil, India and China in the period from 1980 to 2007. The authors have pointed out the existence of a two-way linkage and suggested that when attracting FDI, developing countries should strictly control the pollution of this FDI inflow, while promoting environmental protection activities through the transfer of technology and technical know - how with foreign companies in order to reduce negative impacts on the environmental pollution. A recent study of Hassaballa (2013) has clarified that in the long term, two-way linkage exists only in three out of all the developing countries in the research sample. However, if both short and long terms are considered, that linkage between two variables does exist.

For the case of Vietnam, in my perception, the study of the two-way linkage between FDI and the environmental pollution in this country is rather limited. The only research I'm aware of is of Dinh Hong Linh and Lin (2014). In this study, the authors looked into the mutual relationship of CO_2 emissions, energy consumption, economic growth and FDI in Vietnam. Using data for the period from 1980 to 2010 based on different techniques, they have found a mutual impact between FDI flows into Vietnam and energy consumption,

as well as a direct impact of CO_2 emissions on the level of FDI flows. From these results, according to Dinh Hong Linh and Lin (2014), while FDI into Vietnam increased, energy consumption also rose. Moreover, the lax regulations on environmental pollution will help Vietnam attract more FDI more, thereby increasing the level of environmental pollution. However, the study by Dinh Hong Linh and Lin (2014) just used data only at the yearly national level and not about economic sectors of Vietnam.

Stemming from this situation, I will look into the two-way linkage between FDI and the environmental pollution (proxy by the emission of greenhouse gases (GHG)) by economic sectors. In this research, GHG is measured in Metric Tons (MT) of CO2 emissions equivalent. My two main hypotheses are as follows:

$H0_1$: FDI inflows into Vietnam lead to the increase in the pollution level of the country

$H0_2$: The rise in pollution of Vietnam make it more attractive for FDI inflows to the country

The next section of the paper has the structure as follows: Section 2 refers to the database and research methods, Section 3 focuses on the study results and the content described in Section 4 is the conclusion of the whole research.

2. Data and methodology

2.1 Data

From official and trustworthy data sources, a sample has been constructed to cover a time range of 1993 and 2012. Details for those sources for variables are as follows:

About GHG emissions by sector in Vietnam, the data is taken from CAIT database (Climate Data Explorer) of the World Resources Institute (http://cait.wri.org). This is an environmental pollution-related database used very widely and reliably from mainstream sources like Center for Analysis of Carbon Dioxide Information, Organization for Food and Agriculture of the United Nations, International Energy Agency, the World Bank, the Administration of the US Energy Information Administration, and the Environmental Protection Agency of USA.

About foreign direct investment (FDI) inflows and gross domestic product (GDP) by industry in Vietnam, data is collected from the Statistical Yearbook across years published by the General Statistics Office of Vietnam. I do some adjustments to have a consistent set of sectors (including 3 main sectors) and sub-sectors (3 main subsectors belonging to the sector of energy) between CAIT and GSO data (sectors and subsectors from GSO are adjusted to those mentioned in CAIT)..

2.2. Methodology

To learn about the relationship between FDI and the environmental pollution, I deployed a system of two equations. *The first equati*on is to help determine the impact of FDI flows on GHG emissions (measured in metric tons of CO_2) by sectors. This equation is based on the theory of the Environmental Kuznets curve (EKC) which shows the inverted U-shape relation between the income of the country and the amount of CO2 emission, hence the squared value of logarithm of Vietnam's income (proxy by GDP) is included in the equation (The content of Environmental Kuznets curve is mentioned in Annex A1). *The second equation* helps clarify the

reciprocal impact of GHG emissions on FDI flows into Vietnam by sector (The squared value of logarithm of GDP isn't included due to unclear U-shape relationship between FDI and GDP).[1] These simultaneous regression equations are as follows:

$$LogCO2_{it} = \alpha_1 LogFDI_{it} + \alpha_2 LogGDP_{it} + \alpha_3 (LogGDP)sqt_{it} + \alpha_4 D_{it} + \epsilon_{it} \quad 1$$

$$LogFDI_{it} = \beta_1 LogCO2_{it} + \beta_2 LogGDP_{it} + \beta_3 D_{it} + u_{it} \quad 2$$

Where: i denotes sector i (sector i is one out of three major sectors: (1) Agriculture, forestry and fisheries; (2) Mining; (3) Energy (including Production & distribution of electricity, fuels and water; Processing and manufacturing industries & construction; Transportation, storage and communications) and finally t denotes year t.

- ***LogCO2***$_{it}$ is the logarithm of total GHG emissions (measured in metric tons of CO_2) of sector i in Vietnam during year t
- ***LogFDI***$_{it}$ is the logarithm of the value of FDI flows in sector i of Vietnam during year t
- ***LogGDP***$_{it}$ is the logarithm of the Gross Domestic Product (GDP) by industry i in Vietnam during year t;
- ***(LogGDP)sqt***$_{it}$ is the squared value of the logarithm of Gross Domestic Product (GDP) by industry i in Vietnam during year t(To avoid multi-collinearity with variable LogGDP, I applied the technique of standardized average value of LogGDP before taking square to achieve the value of (LogGDP)sqt);
- ***D***$_{it}$ is the dummy variable controlling industries over the years, by which the variable receives a value of 1 if the sector is the one being considered at year t and 0 otherwise;

Coefficients of interest in the model shown above are and . measures the impact of FDI flows on GHG emissions by sector in Vietnam. If FDI actually makes the pollution level (measured by GHG emission) increase, the coefficient will be positive. Meanwhile, measures the impact of the increase in pollution levels on attracting FDI. If investors direct their investment decisions towards industries with high pollution levels, this coefficient will also have a positive sign.

In addition to the above simultaneous equations by sector, I also study the two-way linkage between FDI and environmental pollution under the sub-sectors of energy in accordance with CAIT's sector classification. The energy sector is a sector that includes such important sub-sectors as (1) Production & distribution of electricity, fuels and water, (2) Processing and manufacturing industries & construction, (3) Transportation, storage and communications. These are the sub-sectors that have many environmental issues under consideration. Thus, the simultaneous regression equations are as follows:

$$LogCO2_{jt} = \alpha_1 LogFDI_{jt} + \alpha_2 LogGDP_{jt} + \alpha_3 (LogGDP)sqt_{jt} + \alpha_4 D_{jt} + \epsilon_{jt} \quad 3$$

$$LogFDI_{jt} = \beta_1 LogCO2_{jt} + \beta_2 LogGDP_{jt} + \beta_3 D_{it} + u_{jt} \quad 4$$

Where: j denotes sub-sector j and t denotes year t (Other similar denotations are as shown for equations (1) and (2)).

Summary statistics about the variables in the form of sectors and the sub-sectors of energy are described in Table 1 and 2 below:

[1] GDP is included in both equations (1) and (2) because it does significantly affect our two main dependent variables of CO2 and FDI. The effect of GDP on environmental pollution (measured by CO2 emission in this paper) is supported by the Environmental Kuznets Curve theory. The other impact of GDP on FDI inflows has been much considered in the researches regarding FDI and economic growth. See Table 6 in Appendix for more information about the correlation among GDP, FDI and CO2..

Table 1: Summary statistics about sectoral variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Logfdi	30	6.077185	2.447792	.7419373	10.35074
Logco2	30	3.892799	.8038934	2.505526	5.167582
Loggdp	30	12.36092	1.018541	10.091	13.80518
(Loggdp)sqt	30	1.002844	1.349966	.0000153	5.15253

Table 2: Summary statistics about sub-sectoral variables from the Energy sector

Variable	Obs	Mean	Std. Dev.	Min	Max
Logfdi	29	6.344009	2.516924	1.308333	10.28856
Logco2	30	3.340898	.3325389	2.740195	3.923358
Loggdp	30	11.81723	.7836274	10.24042	13.52299
(Loggdp)sqt	30	.5936028	.8631225	.0003197	2.909621

3. Research results

On the basis of constructing database (especially the collection and calculation of FDI and GDP by sector and sub-sector from Statistical Yearbook of GSO in accordance with CAIT classification of sectors and sub-sectors), by applying Generalized Methods of Moments[2], I have obtained various results related to the mutual impact between FDI and the environmental pollution presented in the following sections:

3.1 Basic results

Table 3 shows the estimation results of the mutual impact between FDI flows and GHG emissions (measured in metric tons of CO_2) for the equations (1) and (2) above. The estimation results are determined based on the application of Generalized Methods of Moments in two ways: first is to estimate two equations simultaneously and second is to estimate them independently. Through Table 3, it could be seen that whether estimated simultaneously or independently, the results obtained are relatively consistent.

For the impact of FDI on GHG emissions measured in CO_2, equations (1) and (3) show results which are quite consistent for all studied variables. In terms of the variable ***LogFDI***, the estimated coefficient is statistically significant at 1% and has a positive sign, reflecting that while FDI into Vietnam increases by 1%, the GHG emissions would rise by 0.199%. As can be concluded, the flows of FDI into Vietnam, thus leading to investors' building production facilities and conducting their business activities, have increased the amount of CO_2 emissions into the environment.

Regarding ***logGDP*** and ***logGDPsqt***, the fact that they are statistically significant at 1% together with signs of the estimated coefficients of these two variables reflects very clearly the relationship between economic growth and environmental pollution as mentioned in Environmental Kuznets Curve theory. Specifically, the logarithm of GDP has a positive sign and squared logarithm of GDP (LogGDPsqt) has a negative one, meaning the inverted-U relationship between economic

[2] Generalized Methods of Moments (GMM) is quite good in dealing with the endogeneity problem which exits due to the mutual correlation among LogFDI, LogCO2 and LogGDP.

growth and the level of emissions into the environment. For ***LogGDP***, the value of the coefficient is 0.233, showing that when GDP increases by 1% then the rise in emissions would be 0.233%. The magnitude of this coefficient for LogGDP is higher than that for FDI, reflecting that the overall operation of the economy has a greater impact on the environmental pollution. This is consistent with the reality.

Table 3: The estimation results of the two-way impact between FDI flows and GHG emissions (measured in CO_2)

	Simultaneously estimation of the two equations		Independent estimation of the two equations	
Dependent var.	**LogCO2**	**LogFDI**	**LogCO2**	**LogFDI**
	(1)	**(2)**	**(3)**	**(**
LogFDI	**0.199*****		0.199***	
	(0.0273)		(0.0273)	
LogGDP	**0.233*****		0.233***	
	(0.0151)		(0.0151	
LogGDPsqt	-0.148***		-0.148***	
	(0.0294)		(0.029	
LogCO2		3.053***		2.300***
		(0.440)		(0.739
LogGDP		-0.483***		-0.255
		(0.153)		(0.2

(Estimation obtained by using Generalized Methods of Moments (GMM). *** / ** / * denote the significance level of 1% / 5% / 10% of the t-statistic.)

For the impact of GHG emissions measured in CO_2 on FDI, equ ation (2) and (4) have expressed a strong influence of emissions on FDI flows into Vietnam. Results of the estimated coefficients for the two methods are actually different. In my point of view, the simultaneously estimated results are considered more efficiently because the two-way effect often takes place at the same time. Therefore, in the following sections, I will only focus on analyzing and researching the simultaneously estimated results.

For ***logCO2***, equation (2) with simultaneous estimation indicates that 1% increase in the amount of GHG emission (measured by CO_2) leads to the rise in FDI flows into Vietnam by 3.053%. This implies the fact that FDI flows into Vietnam have actually been strengthened when pollution levels in Vietnam increase. For ***logGDP***, the negative value of the coefficient reflects that the rapid economic growth would reduce the inflow of FDI into Vietnam. This could be explained in the way that when Vietnam experiences growth in economy, wages of workers increase correspondingly, thus making production costs escalate, thereby reducing the inflow of FDI.

Table 7 in the Appendix compares the results

estimated using various methods such as Ordinary Least Squares estimation (OLS), Generalized Methods of Moments (GMM), Fixed Effects (FE), Random Effects (RE) in each direction of the two-way impact (independently estimating two equations). From the results, we can see that signs and magnitudes of the corresponding key variables are quite consistent across estimations. However, due to the peculiar characteristics of Generalized Methods of Moments, which helps deal with the problem of endogeneity (stemming from the mutual impact between LogFDI and GHG emissions measured in CO_2, as well as possible impacts between LogFDI and LogGDP or GHG emissions and LogGDP), I will only focus on the GMM method.

3.2. Results for specific economic sectors

Table 4 reveals the results using Generalized Methods of Moments to estimate the simultaneous equations with dummy variables controlling sectoral effects.

Table 4: The estimation results of two-way linkage between FDI flows and GHG emissions (measured in CO_2) with dummy variables controlling sector[(a)]

Dependent var.	$LogCO_2$	LogFDI	$LogCO_2$	LogFDI	$LogCO_2$	LogFDI	$LogCO_2$	LogFDI
	(1)	(2)	(3)	(4)	(5)	(6)	(7	
LogFDI	0.199***		0.228***		0.150***		0.00136	
	(0.0273)		(0.0472)		(0.0196)		(0.0270	
LogGDP	0.233***		0.210***		0.260***		0.296***	
	(0.0151)		(0.0317)		(0.0103)		(0.0107)	
LogGDPsqt	-0.148***		-0.126***		-0.0248		-0.0909***	
	(0.0294)		(0.0380)		(0.0300)		(0.0174)	
LogCO2		2.300***		2.444***		4.824**		-4.570*
		(0.739)		(0.432)		(1.988)		(2.398)
LogGDP		-0.255		-0.239		-1.109*		1.704**
		(0.235)		(0.149)		(0.673)		(0.695)
Agriculture…			0.216	**-1.904****				
			(0.200)	(0.				
Mining…					**-0.645****	3.083		
					(0.127)	(2.087)		
Energy							**1.015****	**8.766****
							(0.140)	(
Ob.	30	30	30	30	30	30	30	30

[(a)] denotes the sector classified based on CAIT database. Three sectors we are researching on are: (1) Agriculture, forestry and fisheries; (2) Mining; (3): Energy (including Production & distribution of electricity, fuels and water; processing and manufacturing industries & construction; Transportation, storage and communications. (Estimation made by using Generalized Methods of Moments (GMM). *** / ** / * denote the significance level of 1% / 5% / 10% of the t-statistic.)

Regarding the emissions, based on the magnitude of the coefficient it could be seen that ***energy sector*** is the sector with the potential to increase the level of environmental pollution quickly, the ***agriculture, forestry and fisheries*** doesn't significantly affect pollution, while ***mining*** sector is the one, the growth rate of pollution of which decreases. The first explanation for such quite interesting result for mining could be originated from the fact that pollution levels are measured by greenhouse gas (GHG) emissions which do not really well reflect the pollution situation of the sector. The second reason is the usage of dummy variables which consider mining -sector together with the other two sectors. Hence as compared with the effect of the other two, the pollution level for mining doesn't rise.

Regarding FDI flows into sectors, signs and magnitudes of the coefficients reflect fairly accurately the situation of FDI inflows to Vietnam. While the ***energy sector*** (including many sub-sectors) attracts huge amounts of FDI, the ***mining sector*** hasn't significantly attracted FDI level while the ***agriculture, forestry and fisheries*** witnesses even lower FDI level than that with its FDI growth rate diminishing over the years.

3.3. Results for specific sub-sector of the Energy sector

Table 5: The estimation results of the two-way impact between FDI flows and GHG emissions with controlling dummy variables for sub-sectors of the Energy Sector[(b)]

Dependent var.	$LogCO_2$	LogFDI	$LogCO_2$	LogFDI	$LogCO_2$	LogFDI	$LogCO_2$	LogFDI
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
LogFDI	0.0836***		0.0876***		0.0805***		0.0826***	
	(0.0180)		(0.0228)		(0.0260)		(0.0182)	
LogGDP	0.235***		0.231***		0.236***		0.234***	
	(0.00914)		(0.0129)		(0.0104)		(0.00967)	
LogGDPsqt	0.0502		0.0572		0.0526		0.0577	
	(0.0356)		(0.0394)		(0.0366)		(0.0368)	
LogCO2		11.21***		-8.347		9.375***		10.55***
		(2.404)		(12.11)		(2.656)		(1.977)
LogGDP		-2.639***		3.037		-2.157***		-2.453***
		(0.672)		(3.495)		(0.731)		(0.557)
Elec…			0.0302	-6.337**				
			(0.116)	(2.79				
Manu…					0.0222	1070		
					(0.146)	(1.18		
Trans...							0.0130	0.182
							(0.0803)	(0
Ob.	29	29	29	29	29	29	29	29

[(b)] Sub-sectors include: (1) Production & distribution of electricity, fuels and water; (2) Processing and manufacturing industries & construction; (3) Transportation, storage and communications (Estimation made by using Generalized Methods of Moments (GMM). (*** / ** / * denote the significance level of 1% / 5% / 10% of the t-statistic.)

From Table 5, estimating two equations (3) and (4) simultaneously with the usage of Generalized Methods of Moments (GMM) and the inclusion of dummy variables controlling the three sub-sectors of the energy sector - one of the main economic sectors that releases huge GHG emissions while attracting a great deal of FDI, we can see that:

Firstly, in terms of the impact on GHG emissions, all three sub-sectors have no significant influence on the growth rate of greenhouse gas emissions (measured in metric tons of CO2). As sub-sectors are controlled, the consistent and significant coefficients of LogFDI and LogGDP affirm the lifting up pollution level of FDI and economic growth. However, the insignificant coefficients of (LogGDP)sqt present the evidence of no existence of inverted U-shape of CO2 emission and GDP in the sector of energy in Vietnam.

Secondly, in terms of the impact on FDI flows, compared with the other two, the sub-sector ***Production & distribution of electricity, fuels and water*** is not attracting FDI and even FDI flows into the sub-sector fall, while the other two sub-sectors don't affect the FDI. This result is in line with actual FDI acquisition in practice, since this sub-sector of ***Production & distribution of electricity, fuels and water*** has not been open enough to foreign investors, especially the production of electricity and water which is still under the monopoly of state companies.

In summary, from the above information, the findings could be briefly shown as follows:

Firstly, there exists a significant two-way relationship between the increase in FDI flows and the growth rate of GHG emissions. This means that FDI flows into Vietnam increase environmental pollution and vice versa, the rise in the pollution level is associated with an increase in FDI flows into Vietnam.

Secondly, there possibly exists an inverted U-shaped relationship between pollution level and economic growth in general but not in the sector of energy (as mentioned in the Environmental Kuznets Curve theory).

Thirdly, the ***energy sector*** is the sector that has an increased pollution level, although it is attracting a huge amount of FDI.

Fourthly, in the energy sector, the sub-sector ***Production & distribution of electricity, fuels and water*** has received very small value of FDI.

4. Conclusion

Through theoretical analysis as well as sectoral quantitative research, I have found results clearly demonstrating the existence of the two-way linkage between FDI and the environmental pollution. Particularly, FDI increases pollution levels (measured by the amount of GHG emissions), and the growth of pollution raises FDI flows into Vietnam. In addition, the study also points out other results such as: (i) There is an inverted U-shaped relationship (as mentioned earlier in the Environmental Kuznets Curve) between pollution level and economic growth in general, but not in the sector of energy; (ii) Energy sector experiences a rise in the degree of pollution despite attracting a huge amount of FDI; (iii) Within the energy sector alone, the sub-sector of Production & distribution of electricity, fuels and water has obtained a limited amount of FDI inflows.

From these above findings, some policy recommendations could be made as follows:

At first, ***more specific incentives*** (in addition to general regulations and rules) from the government for FDI investors' environment protection activities. This is very important to create a strong motivation for investors to apply costly technologies to minimize pollution levels. Such incentives could be supports for product distribution, image building or even financial aids.

In addition, ***more environment protection spreading activities*** should be implemented to raise Vietnamese people' awareness about the role of pollution reduction as Vietnam achieves higher economic growth and its people obtain more income. This is to avoid the opinion of the inherent increasing pollution level as the country is still on the process of modernization and industrialization (the left-hand-side inverted U shape of the Environmental Kuznets Curve). This is also essential for Vietnam to get to the point of the right-hand-side of the curve to increase further its growth rate, its people' income but decrease the pollution level.

Moreover, ***higher requirements for the process of FDI projects' approval and appraisal*** especially in the sectors that could highly increase pollution level such as Energy should be applied.

Lastly, ***gradual openness*** for FDI investors to invest in the subsector such as ***Production & distribution of electricity, gas and water*** should also be carried out to exploit the modern pollution-reducing technologies from FDI.❑

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APPENDIX

Table 6: The correlation between main variables of the sector sample

	Logfdi	Logco2	Loggdp
Logfdi	1.0000		
Logco2	0.7104	1.0000	
Loggdp	0.4470	0.8522	1.0000

Table 7: The estimation results of the two-way impact between FDI flows and GHG emissions (measured in CO_2) using different techniques of OLS, GMM, FE and RE

Dependent var.	LogCO2				LogFDI			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(
LogFDI	0.142***	0.199***	0.0215	0.142***				
	(0.0294)	(0.0273)	(0.0201)	(0.0294)				
LogGDP	0.496***	0.233***	0.261***	0.496***				
	(0.0883)	(0.0151)	(0.0449)	(0.0883				
LogGDPsqt	-0.0309	-0.148***	-0.0202	-0.0309				
	(0.0597)	(0.0294)	(0.0265)	(0.0597)				
LogCO2					3.665***	3.053***	1.860	3.665***
					(0.712)	(0.440)	(1.977)	(0.
LogGDP					-1.391**	-0.483***	-0.542	-1.391**
					(0.562)	(0.153)	(0.666)	(0.562)
Ob.	30	30	30	30	30	30	30	30
Method	OLS	GMM	FE	RE	OLS	GMM	FE	RE

(*** / ** / * denote the significance level of 1% / 5% / 10% of the t-statistic.)