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The Relationship between Foreign Direct Investment and The Air Pollution in Developing Countries

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Abstract

The relationship between foreign direct investment and the environmental pollution is controversial in the field of economics. Using the dataset of 20 developing countries collected in the period 1995- 2012, the research provides an estimation of the impact of inflows of FDI to developing countries on the air pollution. A time series- cross section data with a fixed effect and heterogeneous slopes is implemented to identify the variation between countries by Error Correction Model (ECM). It was evident based on the results that the air pollution was not affected by FDI inflows. Moreover, the assessed results indicated the non-existence of an efficient policy that works on controlling pollution emissions in most of the countries. Furthermore, most of the countries lack technological methods and did not adopt efficient policies to regulate the pollution emissions. Finally, the coefficient of manufacturing value added in Lebanon was positive and significant, thus suggesting that the techniques of production utilized in domestic industry cause air pollution.

Keywords: FDI, Air Pollution, Developing countries, pollution havens, pollution haloes.

1- Introduction

Foreign direct investment (FDI) is an investment made by an individual or a company in a business located in abroad. FDI can be done either through founding business operations in a foreign country or by purchasing business assets (such as ownership or controlling interest) of companies that are located abroad. Foreign direct investment is different from portfolio investment. Portfolio investment involves the acquisition of equity of foreign-based companies, FDI goes beyond that and refers to an investment made which results in the effective control or substantial influence over the decision-making process of a foreign business. United Nation, (2009).

Although, the rate of FDI has witnessed a rapid increase between 1980- 2000 and nominal FDI inflows worldwide had increased by 18% per year during 1987-1997.Fredriksson (2003), global FDI decelerated lately and reached to 15% per year during the period 2000- 2012(OECD 2014) due to the slow economic growth, the lack of stock markets and impediment on institutional basis. FDI helped rescuing many developing countries from low rates of economic growth. (Aliyu, 2005). Through filling the saving gap, improving managerial abilities, increasing foreign exchange and boosting the balance of payment of developing countries.

The link between foreign direct investment (FDI) and environment merits investigation. The reciprocal relationship between foreign direct investment (FDI) and environment may have a negative or positive impact on welfare, as FDI stimulates environmental awareness and therefore refrain resources expending. Developed countries work on preserving the environment more than the developing countries. Whereas there is a view to impose a carbon tax in developed countries, developing countries still fall far behind. Both reducing pollution and achieving fiscal sustainability are addressed in this research.

Thus, the economy is working on the services sector which is relatively less resources intensive sector. To further reduce the stress on the environment, we should take into consideration problems like poverty and overpopulation. In addition to spreading environmental awareness.

Due to the controversial relationship of FDI and environment, interaction there-between cannot be neglected. FDI may affect the environment negatively or positively. On the negative side, we shed the light on the polluting FDI transmitted from the developed countries to the developing ones where implementing environmental laws are neglected, which further worsens pollution in the developing countries. As for the positive side, it appears when developed countries apply their environmentally friendly techniques of production in the developing countries through the flows of FDI.

The environment is being strongly affected by the greenhouse gases made by human such as CO2, methane, nitrous oxide, etc. In addition to climate change, deforestation and natural resources depletion. FDI is also one of the main reasons of this negative impact. For the moment, we believe shedding light on the environment has an impact on FDI. For instance, when a country with a high environmental awareness, implementing strict laws, administrates industries in countries with indefinite environmental laws per FDI forms. This fact emphasizes the interconnection between FDI and the environment.

This relation can be theoretically explained through discussing FDI theory first, which is explained by the move of the capital from countries with low rates of return to relatively higher marginal rates of return ones adjusted by risk. The location of FDI is driven by different conditions Carius (2002). By way of example, not exhaustive enumeration, First the economic conditions, that can be explained through, GDP growth rate, trade policies, macroeconomic stability, infrastructure, production in terms of cost and types; second the political conditions, we can include political stability, laws governing the environment and abilities on administrative basis.

Thereof, taxes are a good example to incite to action FDI. They can exempt foreign firms from abiding by the strict environmental laws or regulations. Therefore, the FDI inflow to developing countries may increase the pollution. Thus, the question addressed in this research is, what is the effect of FDI inflows to developing countries on air pollution?

This work is organized as follows: section 1 consists of a review of literature along with a discussion of the existing results on the FDI-environment relationship in the light of these hypotheses. This is carried out on both the theoretical and empirical levels. Section 2 includes econometric analysis of the FDI-environment relationship based on the economic work of Michi et al. (2005), Aliyu (2005), and Merican et al. (2007). the dynamic panel model is used within this analysis. The model studies the effect of FDI inflows that developing countries receive on the level of pollution emissions**.** Section 3 involves deductions and policy conclusions for developing countries with Lebanon as an example. The chapter includes a summary of empirical outcomes. Policy implications for developing countries are presented on two levels. The first level shows a general view, while the second level specifies certain countries. The discussion is extended to the case of Lebanon, followed by implications for effective environmental policies.

2- Literature review

2.1 Theoretical Literature reviews of the FDI-Environment relationship

The literature concerning the relationship between FDI and the environment, can be divided to two theoretical lines. The first is based on the traditional view of the trade comparative advantage. Whereby, the environment is treated simply as another production factor, thus, strict environmental laws end up increasing production costs. While the second, is based on the technology-gap approach, also known as the neo-technology trade perspective. It questions if the concentration of polluting industries in nations with less strict environmental code, is caused by the strict laws implemented in other nations (Mihci et al, 2005). This perspective defends the fact that FDI is beneficial to the environment since it allows environment-friendly production techniques to be transferred as FDI flows from developed into developing nations.

2.1.1 The Classical Trade Perspective of Comparative Advantage

The classical trade perspective of comparative advantage deals with the environment as a factor of production in which strict laws lead to increasing production costs. This view is derived from Ricardo's comparative advantage trade theory. Ricardo conducted this theory to show that mutual gains are achieved by both countries engaging in the trade, if each country specializes in goods, it means it has comparative advantage, however, these are realized under the condition that capital is immobile between the two countries Holland, (2007). If not, then capitalists of country A can invest in country B in wine production and at the same time export clothes to it, hence dominating both industries. This theory departs from what Ricardo meant by mutual gains. Heckscher and Ohlin (1933) modified Ricardo's theory by stating that these mutual gains will be achieved when each country specializes in the production of goods that use the most plentiful factors of production in this country. Accordingly, rich countries will specialize in goods requiring intensive capital, while poor countries go in for goods requiring intensive labor having comparative advantage, as labor is the most available resource there. These theories of international trade focus on capital, labor and sometimes on land as the main factors of production. In addition, both highlight that the proportion of factors of production is what causes comparative advantage in a country. Even when Heckscher-Ohlin (H-O) theory was further studied by Samuelson to H-S-0 model to show the effect of an increase in relative price of a good on inputs prices, the situation was not that different (Audretsch, 2006).

The picture started to change when Leontief proved by empirical evidences that H-S-O model is not always right. This was called in literature Leontief paradox. Leontief showed statistical evidence that the US has comparative advantage in unskilled labor intensive goods and not in

capital as suggested by H-O model. Many economists worked hard to resolve this matter. Accordingly, economists started to focus not only be on capital and labor but rather knowledge. At the beginning this included human capital, skilled labor and technology. The human skills hypothesis extended from See Posner, (1961) and Lucas, (1990) for more information on human capital models.

H-O theory showed on the one hand, after including human capital as a factor of production besides labor, land and capital, that a country should export skill-intensive goods if there is abundance in skilled labor. On the other hand, if a country has a relative abundance in labor force with high level of human capital, then it should focus on human capital intensive goods.

The last modification made to the production function is the main focus of this study, which is the inclusion of environment as a production factor. Severe environmental laws do increase production cost. Per the classical trade perspective on comparative advantage this would automatically mean that nations with strict environmental codes will have higher production costs and, therefore, would neither develop a comparative advantage nor specialize in polluting goods production. Contrarily, countries with indefinite environmental laws would have smaller production costs and, therefore would have the possibility to go for the polluting industries having a comparative advantage.

It is important to point out that sometimes the source of looseness of environmental laws can be derived from difficulties in regulations enforcement and compliances or it costs. Per Cohen (1998), this idea evolved from the optimal penalty literature of Becker (1968). Becker showed that the criminal's response is affected by the probability of detection and the extent of punishment if convicted. Hence, regulations enforcement and compliance can be maintained if the penalty or monitoring are high. This is to raise the probability detection. In addition, Becker proved that implementing rigid legal rules may also help increasing the probability of conviction. Accordingly, loose environmental laws may lead to the deficiency of enforcement and compliances.

2.1.2 The Neo-Technology Trade Perspective

The Neo-Technology Trade perspective is another approach to describe the FDI-environment relationship. This view derives from the technology-gap approach and defends the fact that strict environmental laws are the reason behind the inflation of industrial pollution in nations having indefinite laws concerning the environment (Mihci et al., 2005). As clarified by Meliciani (2001) while studying the growth aspect, the technology-gap approach shed light on

the fact that the variation in technology between nations is the main source of contrast in per capita income.

From a theoretical point of view, the primary distinction between the technology-gap theory and that of the neoclassical exogenous growth is their views regarding technology. This is on account of, in the neoclassical approach, technology is viewed as a public good that is that is available to everyone. Accordingly, it cannot be the reason for variation in development across countries. On the other hand, the technology-gap approach although agrees partially that technology has to some extent some feature of a public good, still stresses on each country a particular level of technology and the difficulty of transmitting full technological capabilities between countries. The source of difficulty emerges from the accumulation of knowledge that is discovered embedded in specific firms or organizations.

This approach, explained by the Neo-technology theories, was reflected in the FDI-environment relationship per Porter hypothesis. It was at first developed by Porter (1991) and later modified by Porter and Van der Linde (1995) and Esty and Porter (1998). As indicated by Mihci et al. (2005), "Porter hypothesis" suggests that harsh laws concerning the environment inspire producers to become creative and exporters of new technologies that are friendly to the environment. In other words: harsh environmental code does not necessarily mean loss of competitiveness Wagner (2003).

The argument is that strict environmental laws will persuade producers to enhance more than a scenario where less severe laws are in place. The higher costs required with strict environmental codes can be counterbalanced by the benefits generated as innovations using environment-friendly techniques are developed. In other words, net compliance costs may diminish as strictness increase and may even become a beneficial factor. This debate concerning the FDI-environment relationship does not appear to be settled and has given space to the creation of several hypotheses, among which we can point out the pollution havens hypothesis. that defends the idea that more prominent the level to which trade and capital movement are free, the greater is the likelihood that pollution intensive industries will transfer from nations that have strict environmental laws to nations that have looser ones. As pointed out by Aliyu (2005), this theory has three dimensions:

1. From a comparative advantage point of view, developing countries provides less severe environmental laws and creates a comparative advantage in polluting industries;
2. Developed countries with strict environmental codes lead to the transfer hazardous wastes (via FDI) to developing nations;

3. The resources in developing nations, especially non-renewable ones (oil, timber and resources of forests) are substantially drained by multinational organizations. Thus, pollution havens hypothesis has two empirical consequences: 1) a positive relationship that emerges between outflows of FDI from developed nations and the environmental code strictness of their nation; and 2) pollution in developing nations and FDI are positively related. However, many, like Copeland and Taylor (2003) believe that there is no speculation, but only a pollution heaven effect and do not give much support to this theory.

On the other side, we have the pollution haloes hypothesis which suggests that FDI may influence the environment positively and benefits it due to the allocation of production technology that is environment-friendly, from developed to developing nations who practice harmful environmental procedures. There are two possible ways through which the transfer of environment-friendly technology may occur, as described by the OECD (2001): via the allocation of enhanced technology with higher environmental standards or via the transfer of management practices within big organizations and multinational firms. It is important to point out that most of the organizations investing in non-OECD nations are private corporations who are generally very efficient from the management and accountability perspectives, therefore, end up lessening pollution and waste (OECD, 2001).

2 . 2 The Empirical Literature Review on the FDI-Environment Relationship

Numerous empirical studies were conducted to better comprehend=d the interrelation amongst FDI and the environment. For instance, Levinson (1996) performed an empirical literature survey to inquire about the sensitivity of FDI to environmental laws in the United States (on national and international levels). It took him over 20 years of empirical research to discover that there was no significant proof to suggest that strict laws related to the environment drove polluting FDI back from developed countries. He also was not able to discover any evidence that suggested that weak environmental codes attracted FDI inflows. In consent to this, Copeland and Taylor (2003) believed that a severe code of environment had no impact on the direction of FDI inflows. What played a critical role was the kind of instrument utilized. In addition, they defended the presence of a pollution heaven effect and not hypothesis.

OECD (1997) also concluded that most the industrial pollution in developed nations are transmitted in the form of FDI to other developed countries, and not developing ones. In fact, the FDI inflows, deemed polluting, which targeted developing nations were considered low compared to the FDI received in the year 1992 compared to 1972. This argument was also supported by Letchumanan and Kodama (2000) who demonstrated that "there is no current

interconnection between FDI flows and pollution defining an industry content... for developing countries" (Mihci et al, 2005). They also demonstrated the negative correlation that existed in the cases of Singapore and Thailand where FDI inflows were mostly clean industries. On the other hand, Germany and the US played a significant role in polluting industries than developing nations. While FDI inflows transferred to the United States caused relatively more pollution than its outflows, in Germany these inflows were more present in cleaner industries than the German FDI outflows. In Japan's case, FDI outflows were present in less polluting intensive industries.

The findings presented by Eskeland and Harrison in the year 1997 point out that pollution in developing countries is lessened by FDI by executing environment-friendly strategies that are "significantly more energy efficient and use cleaner types of energy than local firms"(Aliyu,2005). They do not agree with the pollution haven hypothesis. In Latin America, for instance, free trade and FDI was not followed by the concentration of polluting intensive industries. They concluded that the pollution haven hypothesis could be true in the case of closed economies, but in free economies FDI is followed by less polluting and depleting environment techniques.

Contrarily, an empirical analysis was performed by Kolstad and Xing (1998) to better comprehend the relationship between the strictness of the environmental laws in destination nations and their choice as the destiny for polluting FDI industries. they observed per statistics, there was an extensive negative relation between the chemical FDI outflows of industries in the United States and the strictness of the environmental code of the countries receiving these industries. For cleaner FDI industries, this relationship is not that clear.

Co. et Al. (2003) also concluded that usually there is strong proof suggesting that indefinite laws of environment is a factor that attracts polluting inflows of FDI. They studied the US FDI outflow to developed and developing nations from 1982 to 1992 in two manufacturing industries. Their result demonstrated that the rigor of environmental standards impacted investment decisions since they saw an inverse relation governing environmental standards and FDI flows in the average developing countries (few exceptions to this rule were noticed).

Smarzynska and Wei (2001) Supported the pollution haven hypothesis, upon measuring the environment of a nation standards in accordance with international environment agreements. Studies were conducted on 543 major multinational organizations located in 24 nations in Central/Eastern Europe and the former Soviet Republics through considering the investment database in firms rather than in countries or industries.

Furthermore, a model based on Dunning's integrated approach over the period 1981 and 1988 to identify the interrelated relation between FDI and the environment was introduced by Mihci et al (2005) in which they distinguished a series of equations to assess the impact of several factors influencing FDI inflows and outflows. Several samples were used to test the consistency of the explanatory variables, such as: FDI amongst developed and developing OECD countries, FDI in bilateral agreements involving all OECD countries, and total inflows to OECD nations. Surprisingly, it was detected that, in most the samples, the environment variable played an influence on FDI. Furthermore, (IESP) which is the index of environmental sensitivity performance in the reporter country, representing harsh laws related to the environment, has a positive and critical relationship with FDI outflows.

Last, but not least, Aliyu's (2005) econometric model managed to verify the impact of environmental laws on FDI outflows in 11 developed countries under the Organization for Economic Cooperation and Development from 1999 to 2000 and the effects of FDI inflows on pollution discharges in14 non-OECD developing countries. These discharges can be described as: carbon dioxide total emissions per year, known particulate matters emissions, rising temperature, and total energy use.

The results founded by Aliyu, who used disaggregated database related to foreign direct investment in panel data followed by regressions, pointed out that FDI outflows from polluting industries have a positive relation with the thoroughness of environmental standards in a developed country. Moreover, the results also showed that FDI inflows in developing nations do not play a role in pollution emission and use of energy (except the case of CO2 emissions that were found pertinent in the 14 developing countries considered in the study).

After reviewing the empirical studies on FDI-environment relationship, it is evident to see how this matter is polemic and disputable. There will always be arguments in favor or against each line of thought which points out the need to carry out deeper empirical studies. Thus, this research work has made a significant effort to better understand the nature of this relationship.

3. The empirical study

3.1 Data and methodology

This work is based on a cross section –time series data (panel data) of 20 developing countries over the period 1990-2012. We estimate the panel regression models with fixed effect methods, to clarify the differences among individuals, heterogeneity slopes are used, Haque et al. (2000). The developing countries include (Argentina, Albania, Bolivia, Brazil, Cameroon, Chile, China, ElSalvador, Egypt, Guyana, India, Indonesia, Lebanon, Mexico, Morocco, Nepal,

Pakistan, Philippines, South Africa, and Venezuela). The data used are from World Bank database.

3.2 The variables of model:

The variables of the empirical model are as the follows:

- **The Dependent Variable:**

The model use carbon dioxide emissions (**CO2**) as proxy for the air pollution, because CO2 is the primary source of Global warming and is highly correlated with other gases which increases earth's temperature in the atmosphere like, methane, and Sulphur dioxide, the correlation coefficient of CO2 and Sulphur dioxide located in 111 countries in 1995 is 0.9529 (Hoffmann et al, 2005).In addition, CO2 is used by many studies as a measurement for the air pollution Yaung, (2001) &Holtz-Eakinand Selden, (1995).

- **The Independent Variables:**

  There are 3 independent variables:

  FDI: foreign direct investment inflows to developing countries.

  MAN: manufacturing value added in developing countries that industrialization is a main contributor to the increase of carbon dioxide emissions worldwide. Accordingly, manufacturing value added is a key determinant of pollution (Merican et al, 2007).

  T: is time trend to reflect the effect of new technological program in developing countries.

  The basic equation (1) is specified as follow:

$$CO_{2i,t} = b_i + b1i\, CO_{2\,i,t-1} + b_{b\,2i}\, FDI_{i,t-1} + b_{b\,3i}\, MANU_{i,t-1} + b_{b\,4i}\, T_i + u_{1i,t} \qquad (1)$$

Where: (i)refers to the country and (t) refers to the time

- ***3-3 The Model Estimation***

To evaluate inflows of FDI, manufacturing value added and lagged CO2 variables on CO2 emissions, with fixed effect method, error correction model (ECM)is used, the stationarity of the variables is examined through the Augmented Dicky Fuller (ADF) and Phillips-Perron(PP) unit-root tests. ADF and PP results are shown in tables1.1 (A, B) and1.2 (A, B).

Table 1: The Result of Unit Root Tests

Table 1.1 (A) Results of the (ADF) Unit Root Tests in Heterogeneous Panel
(ADF)-Fisher Chi-Square Test

	Level		First Difference	
Statistic		Prob.	Statistic	Prob.
Co2	153.613	0	986.349	0
FDI Inflow	176.113	0.001	698.598	0
Manufacturing	52.5921	0.143	501.494	0

Table 1.1 (B) Results of the (ADF) Unit Root Tests in Heterogeneous Panel
(ADF)-Fisher Chi-Square Test
Choi Z-stat Test with Trend

	Level		First Difference	
Statistic		Prob.	Statistic	Prob.
Co2	-1.998	0.0214	-19.098	0
FDI Inflow	-7.968	0	-24.584	0
Manufacturing	-0.536	0.299	-18.798	0

Table 1.2 (A) Results of the (pp)Unit Root Tests in Heterogeneous Panel
PP-Fisher Chi-Square Test

	Level		First Difference	
	Statistic	Prob.	Statistic	Prob.
Co2	101.847	0	1745.5 0	0
FDI inflow	157.321	0	3145.21	0
Manufacturing	57.365	0.325	119.35	0

Table 1.2 (B) Results of the(PP) Unit Root Tests in Heterogeneous Panel
PP-Choi Z-stat Test with Trend

	Level		First Difference	
Statistic		Prob.	Statistic	Prob.
Co2	-2.981	0.096	-43.581	0
FDI Inflow	-5.986	0	-51.851	0
Manufacturing	-0.981	0.324	-22.392	0

Another approach that supports this theory is the ECM per Pesaran et al. (1999). although all variables are not considered to be I (1) under ECM specifications, the relationship will certainly appear on the long-run. Disequilibrium term is part of the ECM approach; therefore, the latter is a suitable method that contains all the required information. two variables are involved, for example ECM is found as follows**:**

$$\Delta yti = bti\ \Delta x\ ti - \lambda i\ (y\ ti\text{-}1 - \beta 0 - \beta x\ ti\text{-}1) + \varepsilon\ ti$$

where y is the dependent variable and x is the independent variable at time t for country $I\ and$ $(y\ ti\text{-}1 - \beta 0 - \beta x\ ti\text{-}1)$ is the disequilibrium error from period t-1, β_{1i} long run elasticity of y with respect to x, and b_{1i} constitute the short-run effect of x on y (short-run elasticities)

As a result, this equation shows that for country i, the current change in y (dependent variable) relies on the change in x (independent variables) and the level of disequilibrium in the previous period. Following the ECM approach allows any disequilibrium in the x (independent variables) and y (dependent variable) levels. In addition, ECM studies short' run/long run relationship,

diminish spurious results and allows the use of general-to-specific technique. Following ECM approach, the long run relationship is expected first to use its residual in estimating the short run relationship. In addition, ECM allows the use of OLS estimation, which is another advantage of ECM, H. Hoda (2013).

Correspondingly, in order to study the long run relationship, carbon dioxide emissions are reverted on FDI inflows, producing value added and a time 'trend. A trend term is used to reflect technological advances which are crucial for decreasing pollution. The lagged residual from the OLS estimation of the long run relation e_{it_1} is used in measuring the short run relationship. The coefficient of the lagged residual λ measures the speed of adaptation to long- run equilibrium, as the residual constitute deflection from the long run relationship. To be able to measure the short run relation, examine the following equation:

$$\Delta \text{ CO2it} = (\text{Ti, lagged } (\Delta\text{CO2it-1, } \Delta\text{FDIit, } \Delta\text{MANit}) - \lambda \text{eit-1} + \boldsymbol{\varepsilon_{i,t}}$$

where T_i is the trend term, for country i

CO2it-1:is carbon dioxide emissions at time t-1 for country i,

FDI $_{I,t}$:is FDI Inflows at time t for country i,

MAN$_{i,t:}$ manufacturing value added at time t for country i, λ is the coefficient of the disequilibrium error term, $e_{i,t-1}$ is the lagged residual obtained from estimation of the long-run relationship and it constitute the disequilibrium error term , $\boldsymbol{\varepsilon_{i,t}}$ the error term for this OLS estimation at time t for country i. The equation shows us that taking country i, we recognized that the change in (CO2) in period we studied relies on several factors:

The change in (CO2) in the last period, the change in FDI in current period and the value

the number of lags is two to save freedom levels in statistics. The level of availability is at 5%. added of manufacture sector (MAN) and the disequilibrium level during the last period along with a trend term.

It was obvious that, the results of experimental study based on the Evaluation of basic equation (1) stipulates the following results:

1- FDI Inflows into developing countries are not the reason of environmental pollution except in Bolivia, Cameroon, and Mexico.

2- Most of the countries suffer from the lack of advanced techniques and the absence of efficient policies that usually works on regulating CO2 emissions.

3- Only Guyana proved that pollution was diminishing over time as indicated by the negative significant coefficients regarding the technology progress as illustrated by the trend term, inflows of FDI and added value of manufacturing. Thus, it is clear from the sample that Guyana is following an overall policy that works on reducing pollution. In fact, Guyana is characterized by having about 85% of its land as rainforests with huge bio diversity per World

Bank (2004). The real source of pollution in Guyana is mainly due to water pollution because of mining activities and solid waste sewage. In addition, in Guyana FDI is mainly in telecommunications which is not considered as a polluting industry and mining production which pollutes the water. Accordingly, carbon dioxide emissions are not the only threat there. In Guyana, carbon dioxide emissions per capita were lower than other countries in the lower middle-income group from 1960-2000 (World Bank, 2004). In addition, the government stated in the set national development objectives, that the basic conditions for development process should be environmentally, fiscally and institutionally sustainable which indicates how important the environment is to the government of Guyana.

4- Table (2) indicates the results of the OLS evaluation of equation (1). In most of the countries, the trend term was low which shows that there is no technological progress effect possibly due to the absence of effective policy on this matter. The coefficient of the trend term was extremely negative in Guyana only, shedding light on a cutback in CO2 emissions levels throughout time. With respect to lagged change in carbon dioxide, in most of the countries the coefficient was insignificant suggesting that there is no efficient policy that acts for controlling emissions of carbon dioxide. However, it was significantly and positively affecting current change in carbon dioxide emissions in China and Iran in case of a one period lag. But it was significantly negative in Lebanon in a two periods lag. This stipulates persistence of carbon dioxide emissions in both China and Iran while there is a reduction of the above mentioned in Lebanon.

5- The coefficient of current change of FDI inflows variable is insignificant in all countries except for, Bolivia, Cameroon, and Mexico. where it was significant and negative for Guyana, for a one period lag, it is significantly positive in Cameroon and Mexico too, but only Cameroon had it significant positive with two periods lag. This suggests that FDI inflows increase pollution in the form of carbon dioxide emissions in, Bolivia, Cameroon, and Mexico. This goes in line with the classical trade perspective of comparative advantage suggesting that adopting slackened environmental laws, developing countries will have comparative advantage in industrial pollution thanks to the comparably lower costs. This encourages polluting FDI inflows in developing countries (pollution haven hypothesis).

6- But in the case of Guyana, there is a negative relationship between FDI inflows and carbon dioxide emissions, which fits with the neo-technology perspective; This negative relationship can be attributed to using environmentally friendly technology transmitted to developing countries through FDI (pollution haloes hypothesis).

7- The coefficient of current change of manufacturing value added was found in most of the countries insignificant. Nevertheless, it was significantly positive in Bolivia, China, Lebanon, and Mexico and significantly negative In Guyana only.

8- For countries that have significantly positive coefficients, an increase in manufacturing activity leads to more pollution as expected, since industrialization is always accused of polluting the environment. However, in countries like Guyana where the coefficient was found significantly negative, the higher the manufacturing activity the lower is the carbon dioxide emissions. The use of environmental friendly techniques in production which leads to a decline in pollution levels. This is like the result reached from the trend term for Guyana.

9- Finally, it was expected that the coefficient of the lagged error term of short-run disequilibrium was significantly negative in most of the countries, yet it was negative in only 8 countries. This shows that there is an adjustment towards the long run relationship in these countries. The coefficient was insignificant in all the rest there was no sign of adjustment, suggesting the lack of an active environmental policy or weak enforceability of the laws.

Table 2: **Results of Error Correction Model of Co_2 Equation**

Table 2.1Error Correction Model Results for Heterogeneous Panel with Trend
Dependent Variable Co_2 (Sampling Period: 1995-2012)
Cross-sections 20
Total balanced observatlons:330

	Countries					
	Bolivia	**Cameroon**	**China**	**Lebanon**	**Guyana**	**Mexico**
Variables:						
Co_2(-1)	0.105373	0.01564	**0.89732**	0.13985	0.25632	**0.39874**
	(0.73425) *	(0.16528)	**(6.35813)**	(0,58471)	(2.36847)	**(1.36571)**
Co_2(-2)	0.13869	-0,09529	-0.19594	**0. 19502**	-0.2 3637	0.09374
	(1.85631)	(-0.54213)	(-2.3684)	**(3.24891)**	(-1.54369)	(0.45328)
FDI inflow	0.19 863	**0,01581**	-0,00301	-0.02135	**-0.01254**	**0.12671**
	(2.36571)	(1.96584)	(-0.65871)	(-0.85463)	**(-3.12584)**	**(3.02547)**
FDI inflow (-1)	0,06432	0.03342	0.03251	0.02571	0.00132	**0.19732**
	(0.96854)	(3.25488)	(0.98564)	(2.01257)	(0.95871)	**(2.89701)**
FDI inflow (-2)	0,02391	0.06422	0.05643	0.00093	-0,00634	0.05361
	(1.98421)	**(2.56841)**	(2.09657)	(0.00758)	(-0.85421)	(2.00874)
Manu	0.03296	0.01938	**0.1256**	0.00561	**-0.06431**	**0.16851**
	(2.99651)	(0.85312)	**(3.8954)**	(0.25684)	**(-3.65874)**	**(4.36581)**
Manu (-1)	0.01112	0.018793	-0.03251	**0.02551**	**-0.04652**	-0.01132
	(0.78541)	(2.03251)	(-2.00689)	**(3.05247)**	**(-2.96571)**	(-1.23854)
Manu (-2)	0.05491	0.03246	-0.00531	**0.06329**	**-0.10873**	-0.00021
	(1.00368)	**(4.23581)**	(-0.188547)	**(-4.00589)**	**(-4.35894)**	(-0.00472)
Trend	-0.00854	-0.00113	-0.00223	-0.00441	**-0.00342**	-0.000521
	(-2.00541)	(-2.00358)	(-0.856421)	(-2.00145.)	**(-2.01258)**	(-0,54872)
γ	**-0.76439**	-0.56923	**-0.78631**	**-0.23451**	**-0.25431**	**-0.87341**
	(-4.25892)	(-3.00957)	(-5.00364)	**(-3.00524)**	**(-7.25684)**	**(-5.35874)**
R-squared	**0.701**					

***t-statistics are put in Brackets**

After discussing the general results, few points are worth mentioning on some specific countries.

First: Although the effect of FDI on air pollution was insignificant in Lebanon, MAN had significantly positive effect. Accordingly, the act of manufacturing and not inflows of FDI, is deemed the efficient factor of pollution in Lebanon.

In addition, there is a decreasing trend of FDI inflow to Lebanon FDI inflow decrease from 2.9 in 2014 to 2.34$ billions of in 2015 and this is less than trend of FDI inflow to Lebanon during the period (2009 -2013) and concentrated at real estate sector.

In addition, no efforts are exerted to minimize pollution, particularly when we view the strong existence of CO2 emissions in accordance with the considerably positive coefficient of the emissions of lagged carbon dioxide.

Second: Other nations like (Cameroon, Bolivia and Mexico), had positive significant FDI inflows and manufacturing impact on emissions of CO2, thus, more efforts are required to minimize pollution in such countries, given the two forces jointly correlated to increase its levels, FDI and manufacturing activity. One of the polluting industries in Bolivia is the cement industry, in addition, textiles production and the production of hydrocarbons.

As for Cameroon, one source of pollution with respect to FDI is the French aluminum production which pollutes the air with a wide variety of toxins. Manufacturing also contributes to pollution through sugar refineries and food transformation, industrial chemicals, in addition to vehicles emissions. The case of Mexico is more clarified as per the United Nation Environmental Program, Mexico is among the top 20 countries considered to be greenhouse gas emitters (including land use and forestry). Polluting industries such as cement and textiles intensify the status, in addition to oil, natural gas, chemicals and textiles in the form of FDI and automobile exhausts.

Finally, certain countries like Mexico, Bolivia and Cameroon showed proof of the pollution haven hypothesis, contrary to the case of Guyana that showed evidence for the pollution haloes hypothesis. Therefore, the debate on the FDI inflows effect on environment is unsettled however, there is more evidence in favor of the pollution haven hypothesis. Further empirical evidence on the competing pollution hypothesis are considered next by looking at the effect of FDI inflows on other pollutants.

4- Conclusion

Theoretically, there are two opposing views governing the relationship between FDI-environmental pollution. When talking about the pollution haven hypothesis, it claims that a positive relation exists between FDI and pollution. This results from the harsh laws concerning the environment in developed countries sending polluting FDI to developing countries which has loose environmental laws. Developing countries gain comparative advantage in industrial pollution considering the comparably lower costs due to the loose environmental laws. Empirically this area of research is controversial which puts more emphasis on conducting more experimental research to get a clearer image. The research uses the dynamic panel data model to evaluate how FDI affects (CO2) emissions in a sample of developing countries over the period 1995- 2012.

The results show that FDI Inflows did not affect on the air pollution in most of the cases which showed evidence for the pollution haloes hypothesis. Some countries showed evidence for the pollution haven hypothesis (positive relationship between FDI and CO2) whole most the countries had no technological achievement. There are several policies could be applied by developing countries to benefit from the FDI and control pollution, at the same time. Nevertheless, regardless of which policy they choose to follow, they should rest of the following four pillars:

1- The implementation of effective policies to stimulate technological progress effect.

2- The adoption policies that aim at minimizing polluting emissions and ensuring their compliance and implementation.

3- The regulation of FDI-environment relationship.

4- The encouragement of the use of environment-friendly techniques in industrial facilities.

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