The impact of pollution control enforcements on FDI inflow to Thailand

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Pollution Heaven Hypothesis, Foreign Direct Investment (FDI), environment, pollution control enforcement, laxity.

Abstract

This article reexamines the pollution heaven hypothesis, using measureable environmental indicators to quantify the laxity of pollution control enforcements. The article examines the impact of pollution control enforcements on FDI inflow in industries across the spectrum as well as individual industries. The study was done on a global platform with separate groups of ASEAN countries and domestically within Thailand. Data from the World Bank, UNCTAD and Thailand's Board of Investment between years 2008 to 2013 were used with panel data regression. Mixed results were obtained; low levels of pollution control enforcements significantly attract FDI inflow to ASEAN countries and East Asia Pacific Region, while in the cases of Europe, Central Asia and Latin America no significant result was found. For Thailand, as a host country, firm-level evaluation procedures using pollution intensity value together with laxity of pollution control enforcements were evaluated. Foreign investors from various countries consider that low levels of pollution control enforcements in Thailand reflected significantly and attracted their investment decisions.

Introduction

Foreign Direct Investment (FDI) inflows benefit each host country's economy but at the same time increases pollution caused by industrial activities. Economists have been discussing the pollution heaven hypothesis since 1970s. It appears that poorer countries needing FDI inflows from richer countries will relax their environmental regulations. Since environmental protection and increasing quality of life and wellbeing has become more and more of a global concern, the argument of the pollution heaven has been challenged.

Many empirical studies found evidence in certain countries at certain periods which was consistent with the pollution heaven hypothesis however, some of them found different results. Smarzynska and Wei (2001) from NBER used firm-level data from multinational firms which invested in 24 countries and found supportive evidence that there was lower FDI inflow in countries with higher environmental standard. Dean, Lovely and Wang (2009) found different results in their study of FDI inflows to China during 1993 – 1996 with provincial - level data. The results suggest that investors from developed counties (implying higher environment standard countries) were not attracted by weak environmental regulation provinces; contrasting with investors from weaker environmental standard countries, such as Taiwan and Hong Kong. Sunhoon Chung (2014) from the Korea Development Institute examined patterns of South Korea's FDI outflows during year 2000 – 2007, using industrial – level data. He found significant evidence that Korea investors, especially those from the high polluting industries, tend to invest in the countries having laxer environmental regulations.

Quantity and level of enforcement of environmental laws and regulations that the countries promulgated and participated in would had a direct effect on pollution levels and consequently impacted their FDI. The number of regulations alone however, could not forecast how stringent the environmental body of that country focused on their implementation. The argument then came to the forefront about what would or should be changed if countries had weak enforcements on their environmental regulations. Low levels of pollution control enforcements could be investigated from the measured pollution indicators like dust content in ambient, carbon dioxide (CO2) emission and Biological Oxygen Demand (BOD) in water. Foreign investors can use such data to anticipate how the host countries pay attention to and evaluate the pollution control in future and their behavior following the pollution heaven hypothesis. Enforcements on promulgated environment regulations require serious effort from government institutions and cost of implementation would be one of the barriers, moreover high pollution control enforcements would cost the investors as well. Either stringent or lax enforcement, both pose challenges to government policy, therefore the impact of pollution control enforcements on FDI inflows is the first economic problem to be solved. Because Thailand is one of developing country that confronts with aforementioned problem and has no previous specific studies about the impact of pollution control enforcement and FDI inflows, therefore this study will provide initial policy recommendations to the Thai government on the subject of environmental standards and FDI.

2. FDI and the Environment

2.1 FDI inflow and Pollution Indicators

The amount of FDI inflow to countries would be affected by two distinct fundamentals, 'Horizontal' and 'Vertical' motivations. The horizontal FDI model introduced by Markusen (1984) described investments by multinational enterprises in host countries (other countries) as a way to serve the local market. Therefore, factors affecting horizontal FDI would consist of local market size, industrial network, similarity between home and host countries, plant or industrial level scale of economies and host country tariffs.

The vertical FDI model initiated by Helpman (1984) argued that multinational enterprises invested in host countries because of their business fragmentation to produce in the lower cost locations. Therefore, factors that affect vertical FDI would consist of the abundance of labor, labor price, capital abundance, capital price, and pollution abatement costs related to environmental laxity in host countries.

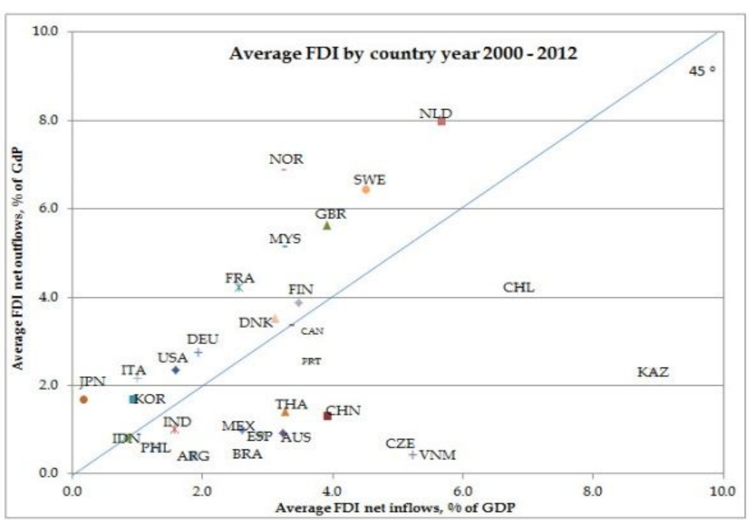

Figure.1. Comparison FDI inflow versus Outflow

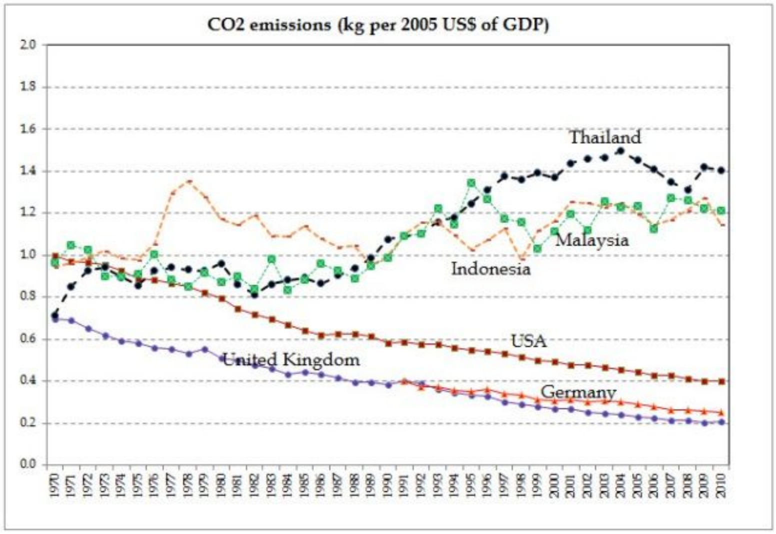

Fig.2. Comparison of CO2 emission between some of developed and developing countries

Following vertical FDI; when host countries enforce their pollution control it would result in a higher cost of production and reduce investment attractiveness.
This vertical concept probably has a right prediction for countries that need foreign investments to grow their economy, e.g. emerging or developing countries. However, statistical data depicts that developed countries in Europe and North America have high amount of FDI inflow. Even considering the percentage of FDI inflow of the GDP, as shown in Figure.1, some developed countries such as United Kingdom, Canada; have a higher average value than developing countries. One example to indicate level of pollution control enforcement is a change of CO2 over time. As shown in Figure.2, developing countries in ASEAN like Thailand, Malaysia and Indonesia have increasing CO2 emissions while developed countries like the U.S., United Kingdom and Germany shows a decreasing trend.

Different trends in pollution but similar increasing trends for FDI inflows to the host country motivates this study to find out whether the pollution heaven hypothesis still exist and in what country groups. More detail for Thailand, the impact of stringent pollution control enforcements on FDI inflow will be analyzed in overall industries and individual industries. The empirical model with econometric analysis of pollution control enforcement and FDI inflow will be presented in the next sections.

2.2 Theoretical Framework

Following the theory by Copeland and Taylor (2003) and similar to Chung (2014), we use the concept of gravity model and consider that FDI has an exponential function form.

$$FDI_{it} = \exp(\beta Vertical_{it} + \emptyset Horizontal_{it}) \quad (1)$$

Where horizontal and vertical are two distinct fundamentals of FDI motivation to host country i in year t. Assume that there is small open economy and an industry that jointly produces two outputs; good of industry, X and pollution, Z . Firm allocates an endogenous fraction, θ of its inputs to environmental abatement activities, K is capital and L is labor. To produce one unit of good X we deploy the production function in equation (2). When X is produced, one unit of pollution Z is also produced as per equation (3), where function $\varphi(\theta)$ imply efficiency of fraction θ, higher θ cause lower pollution Z, and $0 \leq \theta \leq 1$; $\varphi(0) = 1$ and $\varphi(1) = 0$, $\frac{\partial \varphi}{\partial \theta} < 0$.

$$x = (1-\theta)\cdot F(K_X,L_X) \quad (2)$$
$$z = \varphi(\theta)\cdot F(K_X,L_X) \quad (3)$$

From those two equation, if $\theta = 0$, there is no pollution abatement activity, each unit of output x generates one unit of pollution z, such that $x = F(K_X,L_X)$ and $z = x$. Let functional form of abatement be $\varphi(\theta) = (1-\theta)^{1/\alpha}$, where $0 < \alpha < 1$, x and z will be combined in a single Cobb-Douglas function form in equation (4). This equation shows that pollution z in equation (3) is a joint output; therefore we can equivalently treat it as an input of production x.

$$x = z^{\alpha}\cdot [F(K_X,L_X)]^{1-\alpha} \quad (4)$$

Together with pollution input z, to produce x we need F, the product from K and L, as another input. When considering production for one unit of F, we can write unit cost function as $c^F(w,r) = \min_{k,l}\{rk + wl\}$ w.r.t. $F(k,l) = 1$; where r is capital price and w is labor price. Therefore to produce one unit of X, it has unit cost function $c^x(w,r,\tau) = \min_{z,F}\{\tau z + c^F(w,r)\cdot F\}$ w.r.t. $z^{\alpha}F^{1-\alpha} = 1$; where τ is the price of pollution and z is pollution input used in x production. By first order condition we have cost function in equation (5) which is the heart of vertical FDI and play the most important role in this study.

$$c^F = \left(\frac{1-\alpha}{\alpha}\right)\cdot\frac{z}{F}\cdot\tau \quad (5)$$

Horizontal FDI is assumed to play a less important role in this study because of the indirect relationship with pollution and environment when compared to the cost function in equation (5). Horizontal variables in this study adopted Heckscher – Ohlin model, using factor intensity of infrastructure such as energy and water produced; and other factor prices such as cost of business setup in each country, cost of import and export.

Thailand's Environment Regulation and FDI inflow

Thailand's environmental regulations related to air and water pollution from 1970 until 2012 is shown in Figure 3. From the total of 85 regulations, they can consider two regimes for issuing environmental regulations; the first regime during 1970 – 1991 had issued only 10 regulations while the second regime stated since 1992 with 17 regulations issuing in that single year. Those regulations are categorized for three groups consisting of 24 regulations for water pollution, 27 regulations for air pollution and 34 regulations for both air & water pollution. All of the three categories have small but different proportions which would imply that the Thai government took a similar approach for air and water pollution.

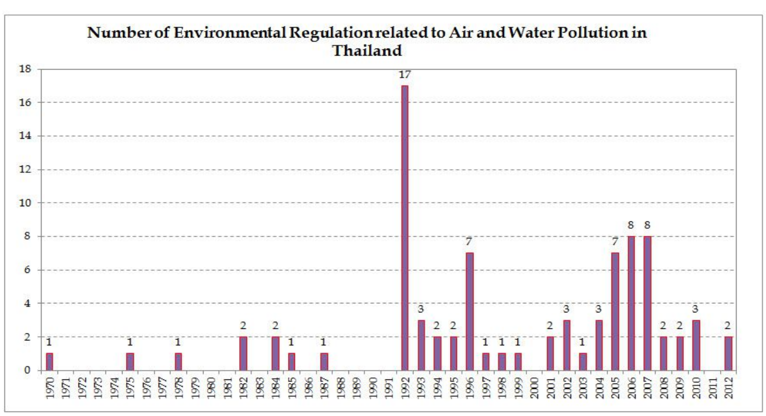

Figure.3. Environmental Regulation related to Air and Water Pollution in Thailand 1970 -2012

Consolidation of FDI inflow data and pollution indicators, as shown in Figure 4, depicts the same increasing trend overtime, especially for CO2 emission. Despite the lack of other continuous pollutant data a question about pollution heaven regarding this scheme remains for Thailand. There are facts that the Thai government was concerned for its environmental position because they issued a lot of regulations in 1992 and rapid FDI growth also occurred in that same period, but it seems that the quantity of regulations had very little effect on pollutant emissions.

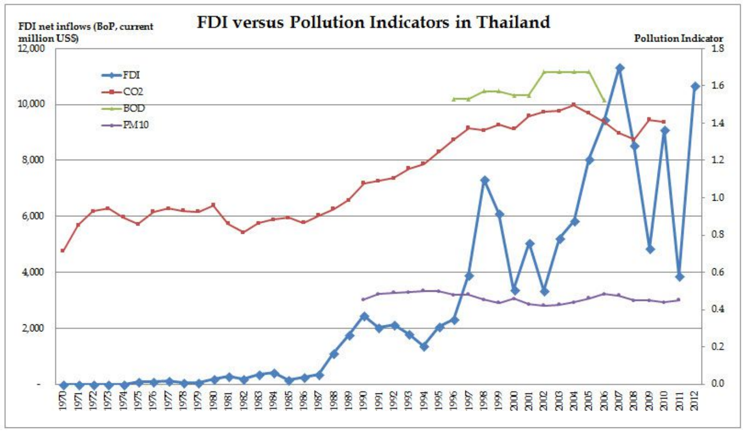

Figure.4. FDI versus Pollution Indicators in Thailand

3. The Data

3.1 Data Arrangement

Data arrangement is one of the crucial parts in this study because of its complexity. Net FDI inflow data, reported by UNCTAD valued in millions of US dollars is used for the analysis globally and in ASEAN countries levels. In an analysis of Thailand (country level), the data was reported by Thailand's Board on Investment Promotion (BOI) valued at millions of Thai Baht however, currency unit does not affect the result of the study since the impacts are considered in percentage. Environmental indicators, reported in World Development Index (WDI) by the World Bank, are used to calculate the pollution control enforcement variable. Data from WDI is used for all other control variables except wage rate which is reported by the International Labor Organization (ILO). Pollution intensity is calculated from production data of the US Census of Manufacturing.

With regard to data from WDI, countries are grouped into two categories; by region and by income level. This study has a completed FDI data but not for some other variables in some years. Therefore, to increase completeness of data set, the missing data will be unsteadily used from other years and from the average value of the country group.

3.2 Measuring Pollution Control Enforcements

The critical questions in this kind of study relates to quantifying environmental variables. Smarzynska and Wei (2001) set their own environmental enforcement indices; number of international environmental treaties the countries had endorsed, number of countries' environmental standards and number of environmental NGO were used in calculation. Dean, Lovely and Wang (2009) calculated environmental variables by using data from industrial pollution intensity such as actual water pollution and levy charge per pollution. Chung (2014) used survey information from the Global Competitiveness Report, indicating the countries' environmental laxity score rated by businessmen across the world. Together with pollution intensity measured by energy intensity of each industry, he quantified environmental variable and then used it in his regression equations.

Measuring pollution control enforcements in this study deploys methodology from Dean, Lovely and Wang (2009), using quantitative environmental indicators from the World Development Index to calculate the degree of laxity on pollution control. Applying pollution intensity from Chung (2014) into environmental laxity to indicate the level of pollution control enforcements for each industry group, this method will only apply for Thailand level because of its availability in the industrial level's FDI data. Notations of all variables are described in Table 1.

Three environmental indicators are used in calculating the laxity on pollution control. These consist of LAX1 which is notation for CO2 emissions (kg per 2005 US$ of GDP); LAX2 which is notation for Organic water pollutant (BOD) emissions (kg per day per worker); and LAX3 which is notation for PM2.5 pollution, the dust content in ambient, measured by mean annual exposure (micrograms per cubic meter). There are three kinds of quantified environmental laxity variables; each is calculated in relative number to the benchmarked country. All of them are weighted at an average by pollution price, the U.S. pollution abatement cost in the year 2005 from PACE (Pollution Abatement Operating Cost) was calculated as shown in Table 2, and therefore environmental variables are finally quantified to indexed numbers.

First, ILAX is an index of laxity in environmental control of individual country used in the analysis for global level. Second, RLAX is a relative laxity in environmental control of host country used in the analysis for individual countries at the ASEAN level. Third, RLAXPI is a combination between pollution intensity of specific industry and relative laxity in environmental control of host country, used for firm level data in the analysis of Thailand level. ILAX and RLAX variables refer to α in equation (5) while RLAXPI refer to combination of α term with z, where z is considered as a proxy of pollution intensity. Using the concept of pollution heaven hypothesis, the higher α value the lower unit cost (c^F) and the higher z value the higher unit cost.

Although there is evidence that the environmental indicator in the U.S. is weaker than many of its developed counterparts in Europe, the U.S. still has more complete data for both environment and other control variables. Therefore, the U.S. would be the best benchmarked country in the calculation of relative number of the three environmental indicators; hence ILAX of the U.S. is set equal to 1. Countries which have ILAX value greater than 1 means those countries have weaker pollution control than the U.S. Higher values indicate the larger degree for countries to be considered as pollution heaven. For example, in the cases of Malaysia in year 2009, Malaysia has value of LAX1 = 1.2258, LAX2 = 0.1227 and LAX3 = 13.0863; while the U.S. has value of LAX1 = 0.4005, LAX2 =0.1425 and LAX3 = 13.7376. Then ILAX of Malaysia is calculated by weighted average as (1.2258/0.4005)*0.281 + (0.1227/0.1425)*0.438 + (13.0863/13.7376)*0.281 = 1.505.

RLAX is calculated from ILAX. It is measured relatively between host and home country, to show how the home country considers the host in terms of laxity in pollution control enforcement when compared to their own level. For example Thailand, as a host country, compared with Malaysia in year 2009, Thailand had ILAX = 1.8909, Malaysia = 1.505, Therefore, Thailand had a weaker pollution control enforcement than Malaysia. RLAX of Thailand is set as 1.8909/1.8909 = 1, RLAX of Malaysia = 1.8909/1.505 = 1.2564 means that Malaysia (the home) considers Thailand (the host) to be weaker in pollution control enforcements than they are by about 1.2563 times. The higher the RLAX number of the host country, the home country will consider the host as being weaker in pollution controls.

RLAXPI is calculated by multiplying pollution intensity (PI) with RLAX value. Similar to Chung (2014), only relative laxity in pollution control enforcement has less effect when deep considerations are given to industrial level; including PI into relative laxity which distinguishes high pollution industries from low ones. Pollution intensity (PI) value is calculated by using data from the 2011 Annual Survey of Manufactures by US Census of Manufacturing. 'Energy spending ratio as per value of product shipment' of each industry is used as a proxy of such PI. The industry code number in that survey follows the North America Industry Classification System (NAICS). Using this code matching with Thailand BOI's action code we will then have pollution intensity (PI) value of each BOI's approved project. Similar to RLAX, the higher RLAXPI number, the higher level that home country considers the host country as weaker in pollution control in specific industries.

Two other important variables related to the environment are IENVITAX and RENVITAX, with reference to τ in equation (5). Both variables are proxies of the pollution price of each country, the higher the value the higher product unit cost (c^F). There are similar calculation methodologies to ILAX and RLAX, where IENVITAX is the variable notation for global level and RENVITAX is for individual country in ASEAN and Thailand level. The weighted average by pollution abatement cost from PACE is also applied as shown in Table 2.

Notation	Type	Description in relative term	Refer to variable in theory	Measurement	Source of Data
FDI		Net FDI inflow		In million US Dollars at current prices and current exchange rates for Global and ASEAN level In million Thai Baht for the study in Thailand level	UNCTAD and BOI of Thailand
LAX	Vertical	Laxity of country's pollution control	α	Average of CO2, BOD, PM2.5 emission	World Bank
ENVITAX,	Vertical	Environmental tax	τ	Average of adjusted saving for energy depletion, natural resources depletion and particulate emission damage	World Bank
r	Vertical	Capital price	F	Government bond or Lending Rate or Treasury rate 2012	World Bank
w	Vertical	Labor wage	F	Average Monthly wage, in million US dollar at Y2005 price	ILO
TARIFF	Horizontal	Import tariff		Tariff rate, applied, simple mean, manufactured products (%)	World Bank
BUSET	Horizontal	Cost of business set up		Cost of business start-up procedures (% of GNI per capita)	World Bank
EXCOST	Horizontal	Cost of export good		Cost to export and import (US$ per container)	World Bank
MCOST	Horizontal	Cost of import good		Cost to import (US$ per container)	World Bank
ROAD	Horizontal	Road intensity		Road density (km of road per 100 sq. km of land area)	World Bank
ENERGY	Horizontal	Energy abundant		Energy production (kt of oil equivalent)	World Bank
WATER	Horizontal	Water abundant		Annual freshwater withdrawals, total (billion cubic meters)	World Bank
GDP				In US Dollars at Year 2005 prices	World Bank

Table 1: Notation of variables used in this study

ILAX , RLAX	Description	Abatement Cost (million USD)	Weighted
LAX1	CO2 emissions (kg per 2005 US$ of GDP)	4,314.6	0.2810

LAX2	Organic water pollutant (BOD) emissions (kg per day per worker)	6,725.2	0.4380
LAX3	PM2.5 pollution, mean annual exposure (micrograms per cubic meter)	4,314.6	0.2810
	Total	15,354.3	1.0000
IENVITAX, RENVITAX	Description	Abatement Cost (million USD)	Weighted
ENVT1	Adjusted savings: energy depletion (% of GNI)	5,712.3	0.2763
ENVT2	Adjusted savings: natural resources depletion (% of GNI)	5,709.7	0.2761
ENVT3	Adjusted savings: particulate emission damage (% of GNI)	9,255.48	0.4476
	Total	20,677.5	1.0000

Table 2: Example of calculation of environmental laxity

4. The Model

From equation (1), the model includes environmental laxity (or degree of pollution control enforcements) and other economics variables which is written in function form as

$$FDI_{it} = f(LAXITY_{it}, Set\ of\ Economic\ Variables_{it})$$

Where, host country i, time t; and null hypothesis is pollution control enforcements, does not affect the FDI inflow. Panel data analysis is used in this study. The panel in the global level and cross-sectional countries data is balanced. The data spans from the year 2008 – 2013 including 202 countries in the study of global levels which can be divided to seven groups of countries considered by region and five groups if divide by income level. For individual countries in ASEAN, the panel is unbalanced because of missing data for some home countries. The firm level in Thailand' consists of a pooled data observed during year 2009 – 2013.

Regarding the analysis technic, I initially used time dummy variables in modeling the difference in intercept term between periods. Interaction term between time dummy and environmental variables, ILAX, RLAX and RLAXPI, are further analyzed to determine differences of slope coefficients. Other dummy variables including country dummy, regional dummy and income level dummy are also analyzed, but when these dummies enter the global level model, it leads to a heteroscedasticity problem. Therefore, time fixed effects is a major technic used in this study. Exponential function in equation (1) is transformed to log-linear models which can be written in general form as shown in equation (6), (7) and (8) for global level while equation (9) is country fixed effect model using in comparison between time fixed effect and unit fixed effect method.

$$logFDI_{it} = c + \alpha_1 ILAX_{it} + \sum_{t=2}^{T=6} \lambda_t YEAR_t + \sum_{t=2}^{T=6} \alpha_t ILAX_{it} \cdot YEAR_t + \boldsymbol{\beta_k}(\boldsymbol{IX_{k,it}}) + \varepsilon_{it} \quad (6)$$

$$logFDI_{it} = c + \alpha_1 ILAX_{it} + \sum_{s=2}^{S=7} \gamma_s REGIONID_s + \sum_{s=2}^{S=7} \gamma_s ILAX_{it} \cdot REGIONID_s + \boldsymbol{\beta_k}(\boldsymbol{IX_{k,it}} + \varepsilon_{it} \quad (7)$$

$$logFDI_{it} = c + \alpha_1 ILAX_{it} + \sum_{s=2}^{S=5} \gamma_s INCOMEID_s + \sum_{s=2}^{S=5} \gamma_s ILAX_{it} \cdot INCOMEID_s + \boldsymbol{\beta_k}(\boldsymbol{IX_{k,it}}) + \varepsilon_{it} \quad (8)$$

$$logFDI_{it} = c_1 + \alpha_1 ILAX_{it} + \sum_{j=2}^{J=202} c_j CONID_{ji} + \boldsymbol{\beta_k}(\boldsymbol{IX_{k,it}}) + \varepsilon_{it} \quad (9)$$

Equation (10) is the general form used for individual countries in ASEAN; it is focused on the time fixed effect method because the empirical study which will be described in section 5 shows better result than the country fixed effect.

$$logFDI_{it} = c + \alpha_1 RLAX_{it} + \sum_{t=2}^{T=6} \lambda_t YEAR_t + \sum_{t=2}^{T=6} \alpha_t RLAX_{it} \cdot YEAR_t + \boldsymbol{\beta_k}(\boldsymbol{IX}_{k,it}) + \varepsilon_{it} \quad (10)$$

In the case of firm level in Thailand, because of another new data set from BOI, country dummy is introduced again to compare with fixed time effect. Equation (11) and (12) are year fixed effect models while equation (13) and (14) are country fixed effect, all of them will be compared using the regression result in next section.

$$logFDI_{it} = c + \alpha_1 RLAXPI_{it} + \sum_{t=2}^{T=5} \lambda_t YEAR_t + \boldsymbol{\beta_k}(\boldsymbol{RX}_{k,it}) + \varepsilon_{it} \quad (11)$$

$$logFDI_{it} = c + \alpha_1 RLAXPI_{it} + \sum_{t=2}^{T=5} \lambda_t YEAR_t + \sum_{s=2}^{S=6} \gamma_s RLAXPI_{it} \cdot IND_s + \boldsymbol{\beta_k}(\boldsymbol{RX}_{k,it}) + \varepsilon_{it} \quad (12)$$

$$logFDI_{it} = c_1 + \alpha_{it} RLAXPI_{it} + \sum_{j=2}^{J=202} c_j CONID_{ji} + \boldsymbol{\beta_k}(\boldsymbol{RX}_{k,it}) + \varepsilon_{it} \quad (13)$$

$$logFDI_{it} = c_1 + \alpha_{it} RLAXPI_{it} + \sum_{j=2}^{J=202} c_j CONID_{ji} + \sum_{s=2}^{S=6} \gamma_s RLAXPI_{it} \cdot IND_s + \boldsymbol{\beta_k}(\boldsymbol{RX}_{k,it}) + \varepsilon_{it} \quad (14)$$

Where, c is constant term, $YEAR_t$ is year dummy; $REGIONID$ is regional dummy in which the countries is located and $INCOMEID$ is country's income level dummy, $CONID$ is country dummy and IND is industry dummy. $\boldsymbol{\beta_k}$ is coefficient vector of control variables beside environmental control laxity. $\boldsymbol{IX}_{k,it}$ is vector of control variables, as described in section 3.2, for the global level study .The control variables are measured in index numbers, because the study of global level doesn't consider bilateral relation. $\boldsymbol{RX}_{k,it}$ is vector of control variables for the study in individual country in ASEAN and Thailand. This is measured in relative number because it is a bilateral consideration between Thailand as a host country and investors as a home country.

Omitting some terms in the models for difference analysis can be applied, for example of equation (6), omit $\sum_{t=2}^{6} \lambda_t \cdot YEAR_t$ term if we would like to consider only difference of slope coefficients without different in year intercept, or omit the interaction term $\sum_{t=2}^{6} \alpha_t \cdot ILAX_{it} \cdot YEAR_t$ to consider only different in year intercept.

5. Estimation Results

5.1 Global level

Comparison between time fixed effect and unit fixed effect models is shown in Table 3. Because of the different kinds of fixed effects, regression analysis of each model is tested for heteroscedasticity problem, which will lead to inefficient model, by using Breusch-Pagan / Cook-Weisberg test. To find out which modes are suitable for next analysis, equation (6), (7) to (8) are analyzed for sub models.

Staring from equation (6) for time fixed effect model, there are three other sub models to be examined. Omit all YEAR dummy variables; I got equation (6.1) the model without time fixed effect. Omit interaction term; I got equation (6.2) the time fixed effect model with different in year intercept. Omit YEAR dummy term but keep interaction term; I got equation (6.3) the time fixed effect model with same year intercept for all years but difference slope coefficient.

$$logFDI_{it} = c + \alpha_1 ILAX_{it} + \ \boldsymbol{\beta_k}(\boldsymbol{IX}_{k,it}) + \varepsilon_{it} \quad (6.1)$$
$$logFDI_{it} = c + \alpha_1 ILAX_{it} + \sum_{t=2}^{T=6} \lambda_t YEAR_t + \ \boldsymbol{\beta_k}(\boldsymbol{IX}_{k,it}) + \varepsilon_{it} \quad (6.2)$$
$$logFDI_{it} = c + \alpha_1 ILAX_{it} + \sum_{t=2}^{T=6} \alpha_t ILAX_{it} \cdot YEAR_t + \ \boldsymbol{\beta_k}(\boldsymbol{IX}_{k,it}) + \varepsilon_{it} \quad (6.3)$$

Lastly, equation (6) itself is the time fixed effect model with different in year intercept and slope coefficient. From low chi square value, with null hypothesis for constant variance, the test results suggest not to reject the null hypothesis, implying that all equation (6) series have no heteroscedasticity problem.

Breusch-Pagan / Cook-Weisberg test	Equation										
	(6.1)	(6.2)	(6.3)	(6)	(7.1)	(7.2)	(7)	(8.1)	(8.2)	(8)	(9)
Chi Square	1.36	0.99	0.59	1.16	6.01	3.04	6.23	5.34	5	4.25	49.22
Ho: Constant variance	Do not Reject	Do not Reject	Do not Reject	Do not Reject	Reject	Reject	Reject	Reject	Reject	Reject	Reject

Table 3: Heteroskedasticity test, comparison between time fixed effect and unit fixed effect models

Equation (7) models unit fixed effect by regions. Following to WDI report, there are seven regions which consist of East Asia Pacific, Europe and Central Asia, Latin America, Middle East and North Africa, North America, South Asia and Sub-Sahara Africa. Beside equation (7) itself which is considered different in both regional intercept and slope coefficient, there are two sub models to consider for the difference in regional intercept (7.1), and the difference in slope coefficient but having the same regional intercept (7.2). From low high square value, the test results suggest rejecting null hypothesis for constant variance, such that all equation (7) series have heteroscedasticity problems.

$$logFDI_{it} = c + \alpha_1 ILAX_{it} + \sum_{s=2}^{S=7} \gamma_s REGIONID_s + \boldsymbol{\beta_k}(\boldsymbol{RX}_{k,it}) + \varepsilon_{it} \quad (7.1)$$
$$logFDI_{it} = c + \alpha_1 ILAX_{it} + \sum_{s=2}^{S=7} \gamma_s ILAX_{it} \cdot REGIONID_s + \boldsymbol{\beta_k}(\boldsymbol{RX}_{k,it}) + \varepsilon_{it} \quad (7.2)$$

Equation (8) models for unit fixed effect by country income level. Also following WDI report, there are five income levels consisting of High Income OECD country, High Income non OECD country, Upper Middle Income, Lower Middle Income and Low Income. Besides equation (8) itself, (8.1) which considers difference in income intercept and (8.2) which considers difference in slope coefficient but same income intercept. Again for high chi square value, all equation (8) series have heteroscedasticity problems. Equation (9) models for unit fixed effect by country, similar to other unit fixed effect models, there exists heteroscedasticity problems.

$$logFDI_{it} = c + \alpha_1 ILAX_{it} + \sum_{s=2}^{S=5} \gamma_s INCOMEID_s + \boldsymbol{\beta_k}(\boldsymbol{RX}_{k,it}) + \varepsilon_{it} \quad (8.1)$$
$$logFDI_{it} = c + \alpha_1 ILAX_{it} + \sum_{s=2}^{S=5} \gamma_s ILAX_{it} \cdot INCOMEID_s + \boldsymbol{\beta_k}(\boldsymbol{RX}_{k,it}) + \varepsilon_{it} \quad (8.2)$$

As per the result of the above analysis, the unit fixed effect model is not appropriate; therefore the next analysis in global level and ASEAN level will focus only for time fixed effect model. Table 4 shows coefficient values of all terms in equation (6). The model according to (6.2) is selected for global level analysis, because every different in year intercept (6.2) has a significant result. By such model, between year 2008 to 2013, there were significant evidence that the countries that had higher laxity in environmental control (or weaker in environmental control) enforcements will attract more FDI inflow. Individual country whose laxity index, increase for 1 point, FDI inflow to that country will increase by 53.5%. In conclusion, pollution heaven existed during that period.

Using the same model (6.2) for different in year intercept to separately examine the regional group, report in Table 5, with no heteroscedasticity problem, the model can be used for East Asia & Pacific region, Europe & Central Asia region and Latin America . Only East Asia & Pacific region have significant evidence that higher laxity in environmental enforcements will attract more FDI inflow. This is quite interesting since ASEAN countries are located in this region. When considerations relate to income groups, with no heteroscedasticity problem, the model is suitable only for Lower Middle Income groups, where significant result of higher laxity in environmental enforcements will attract more FDI inflow.

5.2 ASEAN level

As consequences of global level analysis, time fixed effect model regarding equation (6) is also used at ASEAN level. Using the same data set from global level but separately considering the ten ASEAN countries which includes Thailand, Indonesia, Malaysia, Philippines, Singapore, Vietnam, Brunei, Cambodia, Laos and Myanmar; regression results are shown in Table 4. Two of four sub models have no heterscedasticity problem; the model with different in year intercept but constant ILAX slope coefficient (6.2) and the model that have both different in year intercept and ILAX slope coefficient (6) which is selected for ASEAN countries analysis by reason of better significant result. In overview of ASEAN between years 2008 to 2013, there was significant evidence that higher laxity in environmental control enforcements will attract more FDI inflow. However, the impact of weak environmental control enforcements to FDI inflow had decreasing trend; in year 2008, if laxity index increase for 1 point then FDI inflow to ASEAN will increase by 378.8%, but reduce to 221 % in year 2013.

Not only was the pollution heaven hypothesis tested for the entire ASEAN region, but each country in the group will be examined according to equation (10). Results shown in Table 6 demonstrate a heteroscredasticity problem only for Malaysia, while Myanmar has no GDP data which will be omitted in regression analysis. There are different impacts for weak environmental control enforcements to FDI inflow for each country, significant results appear for Singapore, Vietnam and Laos and have negative signs which mean weaker environmental control enforcements will detract FDI inflow to those countries. Surprisingly for Vietnam and Laos, who are in the Lower Middle Income country group, the signs differ from the entire group. But not for Singapore because it is a high income country, if we revert back to the global analysis by income group there are also negative signs of ILAX coefficient for all high income group countries even if results are insignificant. There are insignificant impacts on weak environmental control enforcements in countries like Thailand, Indonesia, Malaysia and Philippines who compete with each other to attracting FDI inflow to their respective host country.

5.3 Thailand level

Thailand is a country within ASEAN and also in the Asia & Pacific region. The regression analysis using data from Thailand shows significant results of the impact of pollution control enforcements on FDI inflow. However, there are inconsistencies as what was described in section 5.2 which shows Thailand has insignificant result. This inconsistency motivates me to re test the same hypothesis with other data set. I used firm level data of FDI inflow reported by Thailand's BOI during year 2009 to 2013 to reexamine the pollution heaven hypothesis. To distinguish from previous examination, six industry types are divided for the analysis of different impact of pollution control enforcement on FDI inflow. Because there are different

pollution intensity for each industry, Pollution Intensity (PI) was induced to create a new pollution control enforcements variable called RLAXPI as described in section 3.2.
Following the equation (11) and (12) for year effect model, regression analysis shows significant result of RLAXPI coefficient. However, the model in equation (12) which test for both different in year intercept and different in slope coefficient among industries has heteroscedasticity problems. Both of equation (13) and (14), for country fixed effect, have significant results and without the problem. As shown in Table 7, when using time fixed effect model, in overview of Thailand during year 2009 to 2013 for similar kind of specific industry, if Thailand has relative weaker pollution control enforcements in relation to home country of more than 1 time, it will attract more investment by 3.84%. Once considered by industry group by using country fixed effect as per equation (14), if Thailand has relatively weaker pollution control enforcements in relation to the home country of more than 1 time, it will increase investment by 11.3% for Agricultural Industry, no impact for Mineral & Ceramic industry, increase investment by 1.78% for Light Industries & Textiles, increase investment by 0.7% for Metal Products and Machinery, detractive Electric & Electronics industry and decrease investment by 4.1% and still attract for Chemical & Paper industry by 1.67% increasing in investment.

6. Conclusion

To analyze whether pollution control enforcements have significant impact to the host country FDI inflow, the level of pollution control enforcements is quantified by using three measurable environment parameters and convert into index and relative number because this method reflects on how strong the host country pays intention to pollution control. Other control variables were included in the model according to the theory by Copeland and Taylor (2003), and regression of panel data used to reexamine this pollution heaven hypothesis.
Results of this study are consistent with many previous researches; even though our world became more concerned with environmental impact for past decades, as a consequence of international trade and investment, yet evidence of a pollution heaven still exist. The reexamination by using global FDI inflow data during year 2008 to 2013 demonstrated that, in overview, weak pollution control enforcements still attract FDI inflow to the host country. Group of country in Asia & Pacific region include ASEAN have a significant impact of pollution control enforcements on FDI inflow, which should be taken into consideration because these country groups also have high FDI growth rate as well. In Thailand, there are four industry groups that pollution heaven has significantly impacted with FDI inflow. These industries consist of Agricultural, Light industries & Textiles, Metal Products & Machinery, and Chemicals & Papers. However the Electrical & Electronics industry has a significant but decreasing impact on FDI inflow and Mineral & Ceramics industry has no significant impact.

7. Direction for Future research

Future research may find other important results for a country's welfare and overall wellbeing either as a participant on the global platform or within the ASEAN regional structure. Such forecasting and findings has not been answered in this study. The methodology such as the Computable General Equilibrium (CGE) may be applied to the welfare investigation according to important questions like: 'What about the impact to a country's welfare if the host country relaxes or continue to show a weak pollution control enforcement to attract FDI inflow?' The answers from future research can be used for debating the opportunities costs and tradeoffs between environmental impact in terms of social cost and a country's benefit from foreign direct investment which is essential for policy makers and overall economic understanding.

VARIABLES	Global				for ASEAN countries			
	Equation (6)				Equation (6)			
	(6.1)	(6.2)	(6.3)	(6)	(6.1)	(6.2)	(6.3)	(6)
	log FDI	log FDI	log FDI	log FDI	log FDI	log FDI	log FDI	log FDI
ILAX	0.558***	0.535***	0.764***	0.496**	1.197**	2.584***	1.920***	3.788***
	(0.105)	(0.105)	(0.130)	(0.213)	(0.591)	(0.655)	(0.602)	(0.710)
YEAR 2009		-0.468**		-0.468		-0.0865		2.833**
		(0.209)		(0.484)		(0.325)		(1.037)
YEAR 2010		-0.701***		-0.688		0.526		2.463**
		(0.210)		(0.486)		(0.351)		(0.941)
YEAR 2011		-0.367*		-0.384		0.637		3.044***
		(0.209)		(0.491)		(0.379)		(0.865)
YEAR 2012		-0.586***		-0.766		0.883**		3.054***
		(0.209)		(0.485)		(0.378)		(0.878)
YEAR 2013		-0.507**		-0.680		0.920**		3.059***
		(0.213)		(0.490)		(0.345)		(0.878)
ILAX x YEAR 2008			0	0			0	0
			(0)	(0)			(0)	(0)
ILAX x YEAR 2009			-0.254**	-0.00121			-0.293	-2.110***
			(0.127)	(0.294)			(0.229)	(0.685)
ILAX x YEAR 2010			-0.380***	-0.00821			0.104	-1.424**
			(0.127)	(0.294)			(0.252)	(0.635)
ILAX x YEAR 2011			-0.191	0.0106			0.0924	-1.824***
			(0.128)	(0.300)			(0.277)	(0.612)
ILAX x YEAR 2012			-0.296**	0.120			0.292	-1.627**
			(0.127)	(0.294)			(0.276)	(0.612)
ILAX x YEAR 2013			-0.251*	0.115			0.390	-1.578**
			(0.128)	(0.295)			(0.252)	(0.615)
IENVITAX	0.0514***	0.0571***	0.0567***	0.0571***	-0.0814*	-0.0558	-0.0546	-0.0898*
	(0.00964)	(0.00976)	(0.00979)	(0.00980)	(0.0411)	(0.0430)	(0.0414)	(0.0465)
Ir	-0.0149	0.0108	0.00699	0.0114	0.0104	-0.115	0.0180	-0.166
	(0.0340)	(0.0350)	(0.0349)	(0.0351)	(0.141)	(0.162)	(0.161)	(0.152)
Iw	1.828***	1.861***	1.858***	1.861***	0.638	-1.079	-0.129	-0.398
	(0.162)	(0.162)	(0.162)	(0.163)	(1.319)	(1.368)	(1.348)	(1.378)
ITAFF	-0.116***	-0.111***	-0.112***	-0.112***	0.281	-0.245	-0.00635	-0.0782
	(0.0374)	(0.0374)	(0.0374)	(0.0375)	(0.293)	(0.333)	(0.333)	(0.315)
IBUSET	-0.007***	-0.008***	-0.007***	-0.008***	-0.0069**	0.000667	-0.00223	-0.00113
	(0.00095)	(0.00101)	(0.00100)	(0.00101)	(0.00295)	(0.00330)	(0.00335)	(0.00307)
IEXCOST	0.106	0.0639	0.0798	0.0623	-1.525	-0.678	0.204	-0.461
	(0.204)	(0.207)	(0.207)	(0.208)	(2.320)	(2.768)	(2.866)	(2.525)
IIMCOST	-0.211	-0.179	-0.195	-0.179	-1.166	-1.219	-2.591	-1.800
	(0.192)	(0.197)	(0.196)	(0.197)	(2.546)	(3.139)	(3.241)	(2.862)
IROAD	-0.0245	-0.0268	-0.0264	-0.0269	0.545***	0.731***	0.593***	0.713***
	(0.0285)	(0.0284)	(0.0284)	(0.0285)	(0.176)	(0.175)	(0.178)	(0.162)
IENERGY	-1.958***	-1.960***	-1.941***	-1.967***	10.64	8.418	5.575	13.09*
	(0.530)	(0.528)	(0.529)	(0.530)	(6.944)	(7.319)	(7.225)	(7.382)
IWATER	1.771***	1.796***	1.789***	1.799***	0.775	-0.401	0.626	-0.0335
	(0.486)	(0.484)	(0.485)	(0.485)	(2.272)	(2.243)	(2.299)	(2.086)
IGDP	7.183***	7.227***	7.211***	7.229***	-32.24	-45.10	-14.57	-78.54
	(0.859)	(0.856)	(0.857)	(0.858)	(48.88)	(54.66)	(53.58)	(55.16)
Constant	5.724***	6.088***	5.660***	6.148***	7.411***	6.183***	6.491***	4.796***
	(0.256)	(0.280)	(0.257)	(0.397)	(1.121)	(1.035)	(1.090)	(1.055)
Observations	1,021	1,021	1,021	1,021	54	54	54	54
R-squared	0.399	0.407	0.405	0.407	0.914	0.944	0.939	0.961
Breusch-Pagan / Cook-Weisberg test for heteroscedasticity test.								
Chi Square	0.2432	0.3188	0.4417	0.282	0.0397	0.2857	0.0775	0.9099
Ho: Constant variance	Do not Reject	Do not Reject	Do not Reject	Do not Reject	Reject	Do not Reject	Reject	Do not Reject
AIC	4160.547	4157.376	4160.422	4166.948	97.41266	83.67131	88.55893	74.75621

Table 4: Effect of pollution control enforcements on FDI inflow for Global and ASEAN level

VARIABLES	Country group by Region					Country group by Income Level				
	East	Europe	Latin	Middle	Sub	High	High	Upper	Lower	Low

	Asia & Pacific log FDI	& Central Asia log FDI	America log FDI	East & North Africa log FDI	Sahara Africa log FDI	Income OECD log FDI	Income nonOECD log FDI	Middle Income log FDI	Middle Income log FDI	Income log FDI
ILAX	2.610***	0.101	-0.603	-0.0784	0.522*	-1.025	-0.0185	0.283*	0.768***	0.494
	(0.502)	(0.146)	(0.394)	(0.269)	(0.271)	(0.713)	(0.175)	(0.159)	(0.149)	(0.445)
YEAR 2009	-0.940	-0.101	-0.455	-0.273	-0.603*	-0.280	-0.567	-0.509*	-0.511	-0.640
	(0.718)	(0.260)	(0.309)	(0.319)	(0.334)	(0.319)	(0.356)	(0.293)	(0.325)	(0.408)
YEAR 2010	-1.114	-0.445*	-0.634**	-0.514	-1.068***	-0.625*	-0.295	-0.485*	-0.879**	-0.843*
	(0.738)	(0.261)	(0.301)	(0.323)	(0.357)	(0.329)	(0.334)	(0.293)	(0.344)	(0.450)
YEAR 2011	-0.999	0.00349	-0.488*	-0.388	-0.652*	-0.0115	-0.0411	-0.275	-0.744**	-0.316
	(0.747)	(0.258)	(0.288)	(0.314)	(0.360)	(0.322)	(0.328)	(0.288)	(0.345)	(0.445)
YEAR 2012	-1.170	-0.349	-0.389	-0.86***	-0.895**	-0.361	-0.369	-0.355	-0.844**	-0.529
	(0.710)	(0.262)	(0.297)	(0.305)	(0.364)	(0.327)	(0.322)	(0.293)	(0.334)	(0.456)
YEAR 2013	-1.057	-0.376	-0.203	-0.578*	-0.913**	-0.203	-0.123	-0.241	-0.929***	-0.610
	(0.724)	(0.290)	(0.310)	(0.319)	(0.369)	(0.379)	(0.330)	(0.304)	(0.334)	(0.459)
IENVITAX	0.121***	0.050**	0.122***	0.00353	0.0791***	0.230***	0.0228*	0.0283	0.0550***	0.091**
	(0.0421)	(0.021)	(0.0339)	(0.0177)	(0.0147)	(0.0698)	(0.013)	(0.017)	(0.0172)	(0.043)
Ir	0.0729	-0.19***	-0.17***	-0.47***	0.0865*	-0.474***	-0.0236	0.0268	-0.0787	0.19***
	(0.223)	(0.064)	(0.0509)	(0.139)	(0.0479)	(0.129)	(0.167)	(0.055)	(0.0679)	(0.052)
Iw	4.182***	0.63***	6.826***	-1.141**	-2.753	-0.191	0.806*	-0.661	-4.814**	1.581
	(0.715)	(0.154)	(1.751)	(0.472)	(1.676)	(0.246)	(0.420)	(1.028)	(2.073)	(4.437)
ITAFF	0.621**	-0.306*	0.0259	-0.18***	0.0327	0.848***	0.15***	-0.0607	0.0880	0.0555
	(0.254)	(0.169)	(0.0523)	(0.0499)	(0.103)	(0.241)	(0.055)	(0.051)	(0.0726)	(0.120)
IBUSET	-0.0104	-0.017*	-0.01***	-0.004**	-0.007***	-0.00283	0.016**	-0.003	-0.009***	-0.003*
	(0.0065)	(0.01)	(0.0019)	(0.0017)	(0.00125)	(0.0197)	(0.008)	(0.003)	(0.00234)	(0.001)
IEXCOST	-1.747	-0.0210	2.561***	-0.261	0.335	1.975	0.626	0.888**	-0.794**	0.232
	(3.024)	(0.530)	(0.549)	(0.484)	(0.253)	(1.609)	(0.682)	(0.418)	(0.359)	(0.267)
IIMCOST	-0.682	0.0105	-1.281**	0.522	-0.256	-1.200	-2.27***	-1.18**	0.423	-0.326
	(3.734)	(0.552)	(0.550)	(0.630)	(0.224)	(1.909)	(0.768)	(0.462)	(0.315)	(0.253)
IROAD	0.0840	0.33***	-0.65***	-0.18***	0.679*	0.419***	-0.0256	-0.72***	-0.561**	-4.46***
	(0.0550)	(0.069)	(0.170)	(0.0283)	(0.404)	(0.0825)	(0.020)	(0.155)	(0.238)	(0.779)
IENERGY	-4.614**	3.64***	-42.5***	-11.4***	-11.46	6.229***	-14.9***	-6.86***	-23.45***	-172***
	(1.824)	(0.824)	(6.297)	(3.907)	(8.305)	(1.929)	(2.823)	(1.050)	(2.823)	(51.04)
IWATER	0.310	9.32***	4.819	7.082***	-2.346	-8.925***	11.6***	-4.06***	-11.22***	6.405
	(2.327)	(2.523)	(3.839)	(2.448)	(4.159)	(2.407)	(2.831)	(1.541)	(1.248)	(5.368)
IGDP	11.19***	6.86***	102.8***	163.1***	293.4***	6.280***	2267***	61.2***	324.6***	2,41***
	(3.777)	(1.804)	(13.30)	(34.99)	(64.86)	(1.945)	(19.74)	(3.897)	(23.83)	(343.7)
Constant	2.400**	7.36***	6.377***	9.625***	4.756***	8.404***	7.25***	7.93***	7.122***	3.87***
	(1.059)	(0.367)	(0.847)	(0.780)	(0.612)	(1.006)	(0.643)	(0.490)	(0.493)	(0.870)
Observations	164	267	167	105	254	169	139	277	256	180
R-squared	0.516	0.601	0.757	0.755	0.395	0.517	0.772	0.650	0.639	0.380
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity test.										
Chi Square	1.38	0.00	1.35	27.37	7.08	13.52	10.57	4.84	0.03	6.71
Ho: Constant variance	Do not Reject	Do not Reject	Do not Reject	Reject	Reject	Reject	Reject	Reject	Do not Reject	Reject

Table 5: Effect of pollution control enforcements on FDI inflow for Global level by region and income level group of country

VARIABLES	By individual country in ASEAN									
	Thailand log FDI	Indonesia log FDI	Malaysia log FDI	Philippines log FDI	Singapore log FDI	Vietnam log FDI	Brunei log FDI	Cambodia log FDI	Laos log FDI	Myanmar log FDI
RLAX	0.838	-1.027	2.950	-0.557	-2.964*	-2.95***	16.45	0.253	-8.211*	-1.885
	(0.684)	(0.945)	(1.910)	(1.879)	(1.658)	(0.727)	(8.960)	(1.024)	(4.240)	(3.282)
YEAR 2009	0.783	1.330	2.842	-2.316	-0.215			0.122	-1.056	-2.327

	(1.409)	(1.804)	(2.257)	(2.169)	(1.400)			(1.049)	(2.125)	(3.096)
YEAR 2010	1.073	1.485	4.483**	0.202	0.655		13.69**	-0.235	-0.241	-1.484
	(1.537)	(1.777)	(1.871)	(2.101)	(1.368)		(4.444)	(1.060)	(2.071)	(4.043)
YEAR 2011	0.785	1.412	1.172	1.383	1.160		14.92**	0.330	0.803	-6.903**
	(1.458)	(1.763)	(1.838)	(2.123)	(1.407)		(4.523)	(1.067)	(2.152)	(3.273)
YEAR 2012	1.668	1.443	2.384	0.915		-1.455		0.920	2.066	0.648
	(1.407)	(1.730)	(1.801)	(2.432)		(1.181)		(1.096)	(2.271)	(3.600)
YEAR 2013										
RLAX x YEAR 2008	0	0	0	0	0		0	0	0	0
	(0)	(0)	(0)	(0)	(0)		(0)	(0)	(0)	(0)
RLAX x YEAR 2009	-0.590	-1.274	-1.918	2.516	1.431			-0.760	-0.734	-0.246
	(0.807)	(1.110)	(1.473)	(2.135)	(1.961)			(1.020)	(2.704)	(3.751)
RLAX x YEAR 2010	-0.470	-0.827	-2.704**	1.034	0.554		-11.64**	-0.0820	-3.062	-1.913
	(0.862)	(1.102)	(1.202)	(1.886)	(1.953)		(4.373)	(1.029)	(2.742)	(3.757)
RLAX x YEAR 2011	-0.276	-0.967	-0.529	-0.00078	0.171	0	-12.12**	-0.614	-2.969	3.455
	(0.814)	(1.079)	(1.188)	(1.925)	(1.951)	(0)		(1.022)	(2.938)	(2.986)
RLAX x YEAR 2012	-0.798	-0.785	-1.744	0.581		0.441		-0.739	-4.004	-4.184
	(0.821)	(1.064)	(1.128)	(2.218)		(0.728)		(1.037)	(3.085)	(4.459)
RLAX x YEAR 2013										
RENVITAX	0.141	-0.0040	-0.0838	0.132	0.0107	0.279***	-0.0012	0.00929	0.393	-0.0426
	(0.0862)	(0.0484)	(0.0563)	(0.144)	(0.025)	(0.0694)	(0.0922)	(0.0447)	(0.327)	(0.185)
Rr	0.187	0.182***	0.311***	0.253	0.185	0.0639	0.501	0.0387	-0.110	0.136
	(0.121)	(0.0455)	(0.106)	(0.160)	(0.116)	(0.0393)	(0.277)	(0.0234)	(0.338)	(0.108)
Rw	-0.62***	-3.94***	-1.216*	-6.013**	-0.06***	-2.62***	-0.115	0.327	-2.492	0.706
	(0.206)	(0.805)	(0.615)	(2.356)	(0.023)	(0.746)	(0.284)	(0.799)	(2.202)	(3.644)
RTAFF	0.0203*	0.116***	0.0294	-0.00032	4.443	0.063***	0.170	-0.0085	0.555	0.0120
	(0.0120)	(0.0275)	(0.0397)	(0.0299)	(17.61)	(0.0194)	(1.114)	(0.0065)	(0.436)	(0.0929)
RBUSET	-0.0394	-0.0074	-0.035**	0.00202	-0.0542	-0.0088	-0.152	-0.0004	-0.455	-0.0012
	(0.0266)	(0.0047)	(0.0146)	(0.0180)	(0.240)	(0.0229)	(0.186)	(0.0013)	(0.332)	(0.0064)
REXCOST	-2.388	6.478*	13.42*	13.96***	1.150	3.936	2.947	3.355*	-3.210*	-5.253
	(2.173)	(3.723)	(6.942)	(4.189)	(4.618)	(2.544)	(20.10)	(1.786)	(1.633)	(4.399)
RIMCOST	3.165*	-6.395*	-13.71*	-11.7***	-1.414	-0.386	-15.11	-0.763	2.579**	5.643
	(1.734)	(3.684)	(7.165)	(3.598)	(4.604)	(2.538)	(14.30)	(1.471)	(1.208)	(4.237)
RROAD	-0.0979	0.613	0.00828	-0.0843	0.00412	0.135	-0.681	0.266*	6.330**	-1.593
	(0.119)	(0.374)	(0.165)	(0.103)	(0.021)	(0.129)	(0.689)	(0.147)	(2.687)	(2.364)
RENERGY	0.00070	0.0005*	-0.0004	0.00380	0.0809	0.005***	0.00752	0.00624	0.0267	0.0104
	(0.0010)	(0.0002)	(0.0017)	(0.0039)	(0.115)	(0.001)	(0.206)	(0.0114)	(0.0219)	(0.0099)
RWATER	-0.0014	0.00027	0.00172	0.00418	0.679	-0.0003		-0.0077	-2.030	-0.0056
	(0.0013)	(0.0007)	(0.0094)	(0.0032)	(0.513)	(0.0002)		(0.0084)	(2.108)	(0.0085)
RGDP	0.00337	0.00389	-0.0112	0.00599	-0.27**	0.024***	288.9*	-0.18***	96.20	
	(0.0029)	(0.0144)	(0.0206)	(0.0481)	(0.102)	(0.0079)	(153.9)	(0.0625)	(71.66)	
Constant	0.841	4.811***	1.446	0.440	7.39***	3.986***	-8.692	0.0773	9.152*	8.141**
	(1.308)	(1.714)	(3.657)	(2.527)	(1.717)	(1.307)	(7.054)	(1.402)	(4.617)	(3.267)
Observations	168	111	66	75	87	70	25	111	36	40
R-squared	0.288	0.497	0.625	0.482	0.453	0.641	0.924	0.440	0.772	0.601
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity test.										
Chi Square	2.07	0.01	4.76	0.07	1.8	1.75	0.01	0.16	0.22	1.78
Ho: Constant variance	Do not Reject	Do not Reject	Reject	Do not Reject	Do not Reject	Do not Reject	Do not Reject	Do not Reject	o not Reject	Do not Reject

Table 6: Effect of pollution control enforcements on FDI inflow for countries in ASEAN

VARIABLES	Time Fixed Effect		Country Fixed Effect	
	Equation (11) log FDI	Equation (12) log FDI	Equation (13) log FDI	Equation (14) log FDI
RLAXPI	0.0384***	0.0878***	0.0424***	0.113***
	(0.0109)	(0.0323)	(0.0108)	(0.0323)
YEAR 2010	0.315***	0.326***		
	(0.105)	(0.105)		
YEAR 2011	0.0324	0.0551		
	(0.114)	(0.113)		
YEAR 2012	0.560***	0.571***		
	(0.101)	(0.101)		
YEAR 2013	0.516***	0.532***		
	(0.103)	(0.103)		
RLAXPI x IND1 (Agricultural)		0		0
		(0)		(0)
RLAXPI x IND2 (Minerals and Ceramics)		-0.00278		-0.0228
		(0.0356)		(0.0355)
RLAXPI x IND3 (Light Industries/Textiles)		-0.0747*		-0.0952**
		(0.0404)		(0.0403)
RLAXPI x IND4 (Metal Products and Machinery)		-0.0859**		-0.106***
		(0.0346)		(0.0345)
RLAXPI x IND5 (Electric and Electronic Products)		-0.172***		-0.154***
		(0.0427)		(0.0425)
RLAXPI x IND6 (Chemicals and Paper)		-0.0753**		-0.0963***
		(0.0324)		(0.0324)
RENVITAX	0.0362**	0.0380**	-0.00570	-0.00448
	(0.0163)	(0.0164)	(0.0765)	(0.0763)
Rr	0.0285	0.0295	0.313***	0.317***
	(0.0193)	(0.0192)	(0.0662)	(0.0660)
Rw	-0.187***	-0.204***	-0.326	-0.319
	(0.0678)	(0.0677)	(0.550)	(0.548)
RTAFF	0.0109***	0.0116***	-0.142*	-0.135
	(0.00173)	(0.00173)	(0.0829)	(0.0827)
RBUSET	-0.0354***	-0.0344***	-0.00134	-0.00666
	(0.00687)	(0.00686)	(0.0366)	(0.0365)
REXCOST	5.668***	5.561***	-0.837	-0.800
	(0.767)	(0.769)	(1.130)	(1.127)
RIMCOST	-4.352***	-4.315***	0.186	0.132
	(0.624)	(0.625)	(1.229)	(1.225)
RROAD	-0.0630	-0.0733	-0.201	-0.253
	(0.0456)	(0.0455)	(1.804)	(1.798)
RENERGY	0.000349**	0.000439***	0.00354	0.00259
	(0.000166)	(0.000169)	(0.00671)	(0.00670)
RWATER	-0.000248	-0.000257	-0.000321	-0.00231
	(0.000196)	(0.000195)	(0.0301)	(0.0300)
RGDP	-0.000464	-0.000296	0.0166	0.0199
	(0.000992)	(0.000992)	(0.0353)	(0.0353)
Constant	3.316***	3.425***	5.317	5.822
	(0.193)	(0.196)	(13.35)	(13.31)
Observations	3,285	3,285	3,285	3,285
R-squared	0.121	0.128	0.181	0.187
Breusch-Pagan / Cook-Weisberg test for heteroskedasticity test.				
Chi Square	1.64	3.03	2.44	1.72
Ho: Constant variance	Do not Reject	Reject	Do not Reject	Do not Reject

Table 7: Effect of pollution control enforcements on FDI inflow in Thailand

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