

Study the Effects of Public Policy in Developing Countries on the Relationship between FDI and Environmental Pollution

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Abstract

Foreign direct investment (FDI) is considered as a key artery of capital flows that have a positive impact on the economic growth of nations. An indisputable fact is that many developing countries pursue FDI attraction policies for the sake of growth, ignoring environmental hazards. Under the pollution haven hypothesis, developing countries, which attract a lot of FDI inflows, will gradually become " polluted paradise" compared to developed countries. process of industrialization. On the other hand, public policy also plays a significant role in the relationship between FDI and the level of environmental pollution. Accordingly, the objective of the study is to empirically assess the role of public policy in the relationship between FDI and the level of environmental pollution in developing countries. In terms of methodology, the author built an experimental model evaluated by testing the hypothesis of the Kuznets-EKC environmental curve with the database of 86 developing countries from 2007 - 2019. The study results imply that FDI has a positive impact on the level of environmental pollution in developing countries. In particular, public policy plays an important role in the relationship between FDI and the level of environmental pollution in this case study. From this result, the author draws on the policy implication that developing countries need to consider carefully in receiving FDI inflows and managing FDI enterprises more effectively to minimize negative impacts of this factor to the environment.

Keywords: *FDI, public policy, environmental pollution, CO₂ emissions, developing countries.*

Introduction

Environmental pollution (EP) is becoming a major concern in many countries, and many scholars interested in research. However, the variables affecting the level of EP are still unclear

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and controversial. Practical contexts indicate that EP's issue is currently alarming (Abid, Schilling, Scheffran, & Zulfiqar, 2016). The environmental quality is deteriorating due to increasing emissions from production and consumption activities. This affects the quality of life and human health and causes global warming, which seriously threatens human survival (Hill, 1997). Due to climate change, natural disasters such as super typhoons, droughts, or forest fires occur continuously with increasing intensity, greater and greater losses (Department for Farming and Rural Affairs, 2010).

Remarkably, although the current environmental problem is very alarming, many developing countries focus on economic growth targets ignoring environmental harm (Lan, Kakinaka, & Huang, 2012). To promote growth and investment, these countries apply policies and enforce regulations relating to protecting the natural environment that is still tight and limited (Solarin, Al-Mulali, Musah, & Ozturk, 2017). This leads to more serious environmental problems. According to an annual study on the environment conducted by US universities and published at the World Economic Forum in Davos, among the 10 countries most seriously affected by global warming, 9 countries are poor and developing countries along the continents such as the Philippines, Nigeria, Vietnam, Haiti, Bangladesh, Papua New Guinea, Malawi, Fiji, Sudan (Phuong, 2019). Specifically, the largest urban area in Vietnam, Ho Chi Minh City, has a concentration of pollutants in the air along the roads (mainly CO₂) (H. Wang, Liao, & Zhao, 2014) is 1.44 times higher than the recommended level. World Health Organization. If this problem is not resolved, the worst thing that can happen is that rising sea levels may wipe out some countries. Therefore, exploring variables affecting the environment and finding effective solutions is essential and urgent (Welford, 2014).

Meanwhile, in the theoretical context, the role and the direction of the impact of factors on the level of EP still have many points to be clarified (Victor, 2017). The study overview shows that previous studies have shown the role of various factors (economic growth, urbanization, FDI, institutions, etc.) to the level of EP (Cole, Elliott, & Fredriksson, 2006). However, the trend, the level of impact, and the channel of these factors have not been clarified and reached a consensus, both theoretical and empirical evidence (Desfiandi, A., et.al., 2019).

The survey results show that, corresponding to the actual context, the controversial issue in this topic is whether there is a trade-off between environmental protection goals and economic growth. Although many studies support the Environmental Kuznets curve (EKC) hypothesis, the hypothesis describes the nonlinear relationship between economic growth and environmental protection (Ulanowicz, 2012). There are still many issues to be clarified. According to Dinda (Dinda 2004), the EKC hypothesis describes the relationship between

growth and EP as a nonlinear U-shaped relationship (inverted-U-shaped relationship). The shape of this nonlinear curve is generally explained as follows: when the economy is still at a low level, economic growth creates a negative impact, resulting in a more polluted environment due to production and business activities. However, when economic growth reaches a threshold value, growth will create positive externalities, reducing environmental pollution by advanced technology becoming more environmentally friendly. However, the empirical evidence on the EKC hypothesis is still unclear and not convincing. In the case of developed countries, according to Ekins (Ekins 1997) and Roca et al. (Roca, Padilla, Farré & Galletto 2001), although there is certain evidence of declining levels of EP in these countries, there is no empirical evidence yet. Apply the EKC hypothesis explicitly. In developing countries, empirical studies find results inconsistent with interpreting the EKC hypothesis (Qiang & Xinwei, 2019).

Some countries have had remarkable economic growth rates, but environmental problems have been exacerbated (Chakravarty & Mandal, 2019). Similarly, the STIRPAT model explains three main factors affecting the level of EP: population, affluence, and technology. Based on this background, empirical studies explore the factors that affect the EP's level, but there is still a large gap in test evidence (McGee, Clement, & Besek, 2015).

Similarly, with foreign direct investment (FDI), while most studies show the positive impact of this factor on economic growth, the impact of FDI on EP is still uncertain and inconsistent (Cole, 2004). According to the explanation of the pollution halo hypothesis, FDI will help improve environmental issues (Antweiler, Copeland, & Taylor, 2001). Meanwhile, the pollution haven hypothesis states that developing countries, which attract many FDI inflows, will gradually become "pollution havens" compared to countries developed by industrialization (Aliyu, Jolly, Ehiri, & Salihu, 2005). The survey results show that the inconsistency of the impact of FDI on the level of EP or the relationship between growth and environment objectives depends on the government's role in each country (Gani & Scrimgeour, 2014). Some studies indicate that EP's level will be more and more serious unless the environmental protection policies are strictly followed (Cole & Elliott, 2003). However, most of these studies have focused on analysis from the perspective of public administration, and the empirical evidence is also unclear and inconsistent (J. J. Wang & Cheng, 2015). (Damania, Fredriksson, & Mani, 2004) point out that corruption seriously undermines the implementation of environmental policies. Officials, for personal gain, often "ignore" regulations on reducing environmental pollution (A. T. Hoang & Pham, 2019). More detailed analysis of institutional factors (Abid et al., 2016) point out the heterogeneous impact of institutional variables on the

level of environmental pollution. Specifically, the level of political stability, government effectiveness, democracy, and corruption control reduces the amount of environmental pollution. In contrast, the quality of regulations and the degree of compliance with the law have an impact on increasing CO₂ emissions (A. T. Hoang & Le, 2019). Meanwhile, studies focusing on the role of government in public policy aspects in the relationship between FDI and EP are still modest and focused in the case of developed economies (Chakravarty & Mandal, 2019).

Accordingly, besides the institutional aspect, the research focuses on analyzing the role of government in public policy (fiscal policy) in the relationship between FDI and EP. In general, the analytical framework of the study is depicted in the following diagram.

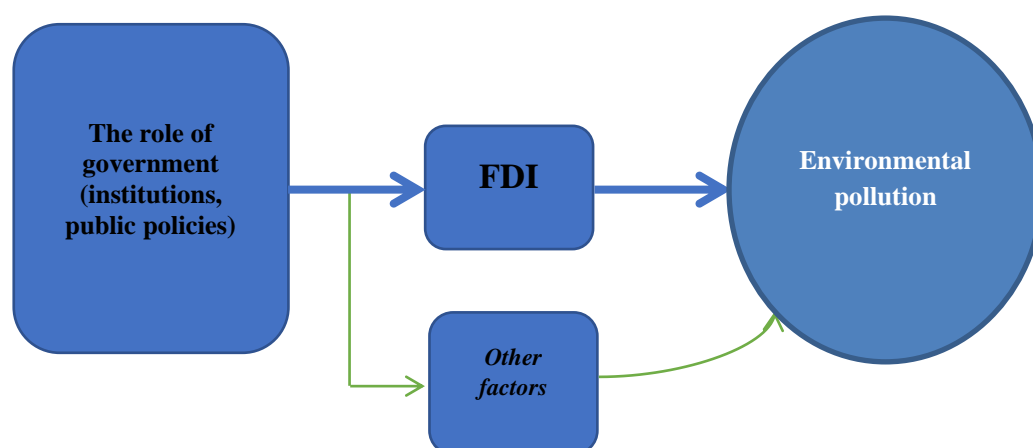


Figure 1. *Framework for Analyzing the Relationship between Public Policy, FDI and Environmental Pollution*

From figure 1, the above comments, it can be seen that it is necessary and urgent to study the role of government in the aspect of public policy in the relationship between FDI and EP in developing countries today. Both in practical contexts and research gaps. This study was conducted to highlight the role of government in both public policy aspects in the relationship between FDI and environmental pollution; This is also the main goal of the study to fill the gaps the research has found. Regarding the research, subjects are the objects in the relationship between institutions, taxes, public spending, FDI, and environmental pollution (CO₂ emissions) and control variables shown in the model such as average income military per capita, trade openness, domestic investment, energy use ... Regarding the scope of the research, and the authors focus on studying the impact of FDI on CO₂ emissions and take into account the role of institutions and public policies in developing countries during 2007-2019.

Literature

Public Policy and Environmental Pollution

(Armon & Hänninen, 2015) stated that policy factors play an important role in the change in emissions of the environment in countries. According to (Zhang, Zhang, Ding, & Hao, 2017), public policy includes fiscal policy, monetary policy, and fiscal policy. Within the scope of this study, the study focused on the impact of fiscal policy on EP and the role of fiscal factors in the relationship between FDI and the level of EP. According to (Halkos & Paizanos, 2016), although improving environmental quality is not the main objective of fiscal policies, it is important to consider the potential impact of fiscal policies. To the level of pollution.

(Halkos & Paizanos, 2016) Through fiscal policy, governments regulate the economy towards development goals such as improving per capita income, thereby, the need for environmental quality. People's schools also improve. A related study (Marengo et al., 2017) stated that environmental quality is considered a luxury public good. So, when more needed public needs have been addressed, the need to live in a "clean" environment is what the community expects. Therefore, this is more likely to occur in countries with large spending scales from the government (T. H. Hoang, Hoang, & Vladimirovich, 2019).

More specifically, in terms of public expenditure, (López, Galinato, & Islam, 2011) explain four different mechanisms that fiscal policy can affect environmental quality: First, higher income levels often come from the increasing government spending the need to improve environmental quality. (Adewuyi, 2016) discuss that public expenditure on public goods (assisting households through education, health, and social transfer, environmental protection, research) research and spread, dissemination of knowledge) has a positive impact on economic growth and creates a scale-up effect on the pressure to protect the environment.

Secondly, the expansionary fiscal policy also promotes capital deepening activities. These activities are less environmentally detrimental than physical capital intensive activities (Adewuyi, 2016) explain that the allocation of government spending more on human capital deepening activities than physical capital intensive activities can create motivation for the output components. Environment quality can improve.

Thirdly, another channel that expansionary fiscal policy has also created to improve EP is improving labour efficiency related to higher government spending on health, education, and research (Halkos & Paizanos, 2016). The increasing public spending on public goods and services such as education, health, research, and development (R&D) will create technological diffusion. This process helps to design, produce, and consume intermediate and final goods better.

On the other hand, higher government spending supports the establishment, enforcement, and effectiveness of environmental regulations, leading to the development of environmental quality improvement organizations (Zhang et al., 2017), representing the environmental regulatory channel. Besides, public spending can also have an income effect through subsidies to households that increase purchasing power, leading people to consume cleaner goods and demand a cleaner environment (Adewuyi, 2016). Therefore, hypothesis (1) indicates that public spending harms environmental pollution in developing countries.

Meanwhile, environmental taxes are mainly through technical effects by reducing emissions per unit of manufactured or consumed goods (Martimort-Asso, Görlach, Knigge, & Schaper, 2018). Meanwhile, environmental taxes are mainly through technical effects by reducing emissions per unit of manufactured or consumed goods (Martimort-Asso, Thoyer, & Martimort-Asso, 2018). Taxes increase "dirty" input costs or "dirty" consumer goods such as fuel or gasoline, thus creating thrift and replacement. These policies can also create some output component effects by increasing output products' relative price using "dirty" input materials (Pham & Hoang, 2019).

Besides, considering the impact of taxes on the level of EP, many scholars support the argument of Pigou about tax and the level of EP (Yesuf & Bluffstone, 2009). The principle of effective environmental taxation, according to Pigou, is that the pollution tax levied on each unit of output resulting in EP is equal to the external costs caused by this product unit on the environment at the output level of social optimization. Accordingly, these environmental taxes aim to make companies localize their foreign partners and adjust their activity level to socially optimal output. Accordingly, the Pigou tax is also known as the "optimal pollution tax." Thus, according to this argument, an optimal environmental tax rate exists to create the optimal output level and the optimal pollution level. However, this optimal tax rate is difficult to determine in practice because it is difficult to assess the external costs of production activities. These countries may the sake of economic development, design the optimal tax policy to offset the companies' externalities that cause the environment. Therefore, the author hypothesizes (2) about the impact of taxes on the EP level as follows: Taxes harm the level of environmental pollution in developing countries.

Public Policy, FDI and Environmental Pollution

While the impact of FDI on EP is controversial, many studies point to the positive impact of fiscal policy in attracting FDI inflows. (Amirahmadi & Weiping Wu, 1994) Emphasized the importance of fiscal incentives to attract FDI. For example, a country's fiscal policy may

influence multinationals' decision to decide whether or not to open a branch in the country by increasing or decreasing the advantages associated with ownership (e.g., the tax treatment of royalties, dividend repatriation). The host country's corporate income tax policy helps determine the comparative advantage it can bring to international investors compared to other countries. Concerning Pigou tax theory, (De Santis & Stähler, 2004) studied the connection of FDI, tax, and environmental quality between two countries (investment and receiving countries). According to the author, the FDI investment itself does not lead to pollution because the host country can select FDI investors. Therefore, they choose investors who bring benefits from FDI investors to their country. Also, receiving countries will set Pigou tax rates to eliminate pollution effects. However, this argument seems only suitable for developed countries. In fact that developing countries often tend to target economic development without environmental factors. FDI ineffective as well as environmental tax policies are still inadequate. Or more specifically, instead of establishing optimal tax policies to eliminate pollution effects, developing countries can create preferential tax policies (tax reduction) to attract maximum FDI inflows for the sake of growth. Therefore, hypothesis (3) is presented that taxes reduce the positive impact of FDI on the level of environmental pollution in developing countries.

Meanwhile, from a budget spending perspective, depending on the relationship between the crowding-out effect or the impetus between public investment and private investment, public spending can also play a significant role in the relationship between FDI and the level of EP. Several works explain the hypothesis of the "impulse" effect of government spending on private sector investment, including foreign investment (Armon & Hänninen, 2015). "According to this hypothesis, increased public spending drives the increase in demand for goods and services of the private sector, encouraging the investment sector to invest more due to expectations of better revenues and profits. Several works explain the hypothesis of the "impulse" effect of government spending on private sector investment, including foreign investment (Zhang et al., 2017). "According to this hypothesis, increased public spending drives the increase in demand for goods and services of the private sector, encouraging the investment sector to invest more due to expectations of better revenues and profits. Also, increasing public spending on public goods such as education, health, and research and development (R&D) will create technological diffusion. This process encourages the private sector to improve technology, production, and consumption of intermediate and final cleaner goods (Adewuyi, 2016).

"Meanwhile, the 'crowding out' hypothesis explains that increased public spending reduces private sector investment, including foreign investment. Scholars support this hypothesis explain that public sector investment can directly substitute for private sector investment. Besides, a loan or tax increase to create a budget for public spending will make it more difficult for the economy's private companies to access capital because of the limited financial resources (Kolko, 2010)." Therefore, hypothesis (4) is proposed that public spending reduces the positive effect of FDI on the level of environmental pollution in developing countries.

Thus, in addition to the direct impact (or through factors other than FDI), institutions and public policies also play an important role in the relationship between FDI and EP level. However, studies considering the interaction between these factors are still very limited and unclear. Accordingly, based on the hypotheses, empirical testing of the impact of FDI on economic growth and the role of institutions and public policy in the relationship between FDI and the level of environmental pollution in developing countries.

Methodology and Materials

Experimental Model

The model assesses public policy's role in the relationship between FDI and environmental pollution in developing countries. Finally, to assess the role of government in public finance in the correlation between FDI and EP, the author uses the variables to represent the two main tools of fiscal policy: taxes and public spending on the empirical model. For certainty, appropriate interaction variables are also included in the model to assess the factors' interaction. Based on a review of previous studies (Bakhsh, Rose, Ali, Ahmad, & Shahbaz, 2017)(Cole, Elliott, & Zhang, 2017); Accordingly, the experimental models have the form of equations (1), (2), (3) and (4).

$$Lnc_{it} = a_{it} + b_1 Lnc_{it-1} + b_2 Lnrg_{it} + b_3 f_{it} + b_4 i_{it} + b_5 tr_{it} + b_6 Z_{it} + \eta_i + \xi_{it} \quad (1)$$

$$Lnc_{it} = a_{it} + b_1 Lnc_{it-1} + b_2 Lnrg_{it} + b_3 f_{it} + b_4 i_{jt} + b_5 p_{it} + b_6 Z_{it} + \eta_i + \xi_{it} \quad (2)$$

$$Lnc_{it} = a_{it} + b_1 Lnc_{it-1} + b_2 Lnrg_{it} + b_3 f_{it} + b_4 i_{it} + b_5 t_{it} + b_6 ft_{it} + b_7 Z_{it} + \eta_i + \xi_{it} \quad (3)$$

$$Lnc_{it} = a_{it} + b_1 Lnc_{it-1} + b_2 Lnrg_{it} + b_3 f_{it} + b_4 i_{it} + b_5 p_{it} + b_6 fp_{it} + b_7 Z_{it} + \eta_i + \xi_{it} \quad (4)$$

Where:

c_{it} is a representative variable for the level of EP, measured by CO₂ emissions per capita in the country, in logarithms.

$\ln r g_{it}$ is a proxy for income, measured in real income per capita in the country i logarithm.

Z_{it} is a set of control variables: domestic investment, trade openness, energy consumption, infrastructure development as well as urbanization.

i_{ijt} is a proxy for institutions, which is determined by the measures of public governance of country i in year t and the average index of public governance. 6 indicators of public governance include: Controlling the level of corruption (i1); Governmental efficiency (i2); Political stability and non-violence (i3); Quality regulations (i4); The rule of law (i5) and the Voice and accountability (i6). The index ranges from -2.5 to +2.5.

t_{it} is a representative variable for tax, determined by the tax revenue of country i in year t (% of GDP).

p_{it} is a proxy for public expenditure, which is determined by country i 's a public expenditure in year t (% of GDP).

ft_{it} , fp_{it} Respectively are the interaction variables between FDI and tax, FDI and public spending.

Research, in turn, implements corrects and expands the experimental model to achieve the research objectives. Specifically, the study established four empirical models as follows: (1) Assess the impact of factors on the level of EP; (2) Empirically estimating the impact of FDI inflows on EP in developing countries; (3) Empirically estimating the role of institutions in the relationship between FDI and EP in developing countries and (4) Empirically estimating the role of public policy in the relationship between FDI and EP in developing countries.

Methods and Data

To test the models, the study used Arellano-Bond's two-step GMM estimation method (S-GMM) to take advantage of this method in dealing with econometric issues such as chain correlation, non-fixed variance and especially endogenous phenomena. Also, Hansen / Sargan tests on instrumental variables and quadratic series AR (2) are performed in the system GMM method.

The study's research data are secondary data extracted from World Bank Indicators (WDI and Worldwide Governance Indicators-WGI) data sources. The study extracted data from 86 developing countries from 2007 to 2019. The indicators were extracted to measure the factors described accordingly in the model.

1. The CO₂ Dependent variable Represents Environmental Pollution

The average CO₂ emissions in the 2007-2019 period can be seen that CO₂ emissions increased continuously over the years. There is a big difference between developing countries with high average income and low average income in a more detailed analysis. High-income countries have more CO₂ emissions than lower-middle-income countries. Accordingly, visually, the data shows the possibility of a trade-off between income and consumption in developing countries.

2. Foreign Direct Investment (FDI)

FDI in the period of 2007 - 2019 of developed countries had many fluctuations, and the highest increase was from 2012 to 2013, then dropped sharply due to the global economic crisis. Similarly, FDI also has differences between developing countries with high and low average incomes. The amount of FDI in the group of low-middle income countries increased rapidly, exceeding the group of high-middle-income countries from 2014-2019.

3. Institutions

Institutions of nations developed an 86-nation model, averagely in the period from 2007 to 2019, there were many limitations (both low) in all 6 indicators. In particular, the weakest group of indicators is corruption control, the rule of law state and political stability; The index at the highest average level is the regulations' quality. High-middle income countries have a higher institutional quality index by income quintile than low-middle income countries.

4. Tax Revenue

The tax revenue of developing countries in the 2007-2019 period, tax revenues in many countries almost increased steadily over the years. However, due to the impact of the global economic crisis in 2014, tax revenue decreased sharply during 2013-2014. From 2015, along with the global economy's recovery, tax revenues in developing countries are constantly increasing over the years. Thus, based on the studies' profile, the author chooses and calculates the variables in Table 1.

Table 1.

Descriptive Statistics

The variables	Obs	Mean	Std. Dev.	Min	Max
CO ₂ emissions per capita	1118	3.70	4.99	0.02	36.09
Real income per capita	1118	5825.7	5593.79	276.25	25447.4
Net FDI	1118	6.44	22.44	-15.99	451.72
Domestic investment	1081	23.61	7.34	6.40	68.02
The level of energy consumption	968	1719.2	2,105.5	149.73	15109.2

Industrialization rate	1103	28.93	11.66	3.24	77.41
Commercial openness	1097	89.63	42.65	22.11	326.00
Public spending	1094	14.509	4.557	0.951	26.242
The infrastructure	1,108	14.850	12.845	.006	59.629
Tax revenue	898	16.458	6.896952	0.5832	62.858
The degree of urbanization	1118	53.536	18.82859	14.24	94.945

Table 1 records the average per capita CO₂ emissions in 86 developing countries over the 2007-2019 period is 3.7 tons/year; The standard deviation is also relatively high (4.99).

Similarly, the net amount of net FDI attraction is also unevenly distributed among developing countries. On average, in the 2007-2019 period, developing countries attracted an average FDI amount of 6.44% of GDP. Especially in some countries, the net value of FDI is negative, which shows that the amount of FDI inflows decreases compared to the amount of FDI carried out for investment.

Table 2.

Descriptive Statistics (Institutional Governance)

The variables	Obs	Mean	Std. Dev.	Min	Max
Corruption control (i1)	1118	-0.27	0.72	-1.53	1.72
Governmental efficiency (i2)	1118	-0.16	0.73	-1.85	1.98
Political stability (i3)	1118	-0.26	0.90	-2.81	1.60
Quality rules (i4)	1118	-0.07	0.72	-1.86	1.68
Jurisdiction state(i5)	1118	-0.24	0.74	-1.81	1.63
Voice and accountability (i6)	1118	-0.16	0.81	-1.78	1.48

Meanwhile, the statistical results of public governance quality in Table 2 also different. In general, the quality of public governance in developing countries is relatively low, below the average of zero (a neutral scale of public governance quality). In particular, middle-income and high-income countries have better governance quality, which is largely above the average. This also implies that when incomes increase, the quality of institutions in countries has improved significantly.

In short, to ensure uniformity, indicators are collected from World Bank data sources. Indicators are collected to measure the corresponding factors described in the empirical model. Accordingly, the indicators are presented in Table 3.

Table 3.

Variables and Measurements

Symbol	Variable names and measurements
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Lnc	CO ₂ : The quantity of emission per capita, which represent the environmental quality (logarithms).
FDI	Foreign direct investment: net FDI inflows to a country (% of GDP)
i	Institutional (public administration): measured by 6 variables of Governance Indicators with a scale of -2.5 to 2.5
Lnrg	Economic growth: per capita income (logarithm)
urban	Level of urbanization: the ratio of urban population to the total population (%)
industry	Degree of industrialization: industrial value (% of GDP)
dinv	Domestic investment: total domestic investment (% of GDP)
open	Trade openness: total import and export (% of GDP)
p	Public expenditure: total annual public expenditure (% of GDP)
t	Taxes: annual total government tax revenue (% of GDP)
tinf	Infrastructure: number of telephone subscribers per 100 people (logarithm).
energy	Energy use (% of total)
i1	Control of Corruption Index
i2	Government Effectiveness Index
i3	Political Stability and Absence Index
i4	Regulatory Quality Index
i5	Ruler of Law Index
i6	Voice and Accountability Index

Results and Discussions

The Role of Public Policy on the Environment

The survey results show that most of the studies on government's role often focus on an institutional analysis (Abid et al., 2016). Meanwhile, studies analyzing the role of government in the relationship between public finance are still modest and focused on the case of developed countries (Halkos & Paizanos, 2016).

(Bakhsh et al., 2017) stated that policy factors play an important role in the change in emissions of the environment in countries. Within the scope of this study and institutional factors, the study focused on the impact of fiscal policy on EP and the role of fiscal factors in the relationship between FDI and the level of EP. Accordingly, to consider fiscal policy's role in the environment, the author turns the tax and public expenditure variables into the empirical model described (1) and (2) describe. The testing results are presented in Table 4.

Table 4.

Role of Public Policy for CO₂ Emissions in Developing Countries.

Dependent variable: Degree of environmental pollution (lnco2)

The variables	MH taxes	MH Public spending
Pollution level last year	0.9117***	0.9455***
Income (Lnrg)	0.0668***	0.0167

Domestic Investment (dinv)	0.0027***	0.0010**
Commercial openness (open)	0.0004***	0.0004***
The infrastructure (tinf)	0.0012***	0.0011*
Energy consumption (energy)	0.0001	0.0001
The degree of urbanization (urban)	0.0002	0.0003
The degree of industrialization (industry)	0.0023***	0.0015***
FDI (f)	0.0009***	0.0021***
Institutional quality (i)	-0.0173**	-0.0121*
Taxes (t)	-0.0027***	
Public spending (p)		-0.0010*
Hansen test	0.4954	0.3699
Sargan test	0.2857	0.5062
AR(2) test	0.9749	0.9585
Number of tool variables	72	68

The estimation results show that, although environmental protection is not the main objective of fiscal policy, fiscal policy also has a significant impact on CO₂ emissions in developing countries. Specifically, taxes and public spending harm the level of EP. In other words, the increase in taxes and public spending creates positives, helping to improve the environment. As (Halkos & Paizanos, 2016) explains, governments regulate the economy towards development goals such as improving per capita income through fiscal policy. Thereby, the need for quality people's environment also improved. A related study (Halkos & Paizanos, 2016) stated that environmental quality is considered luxury public goods. So, when more needed public needs have been addressed, the need to live in a "clean" environment is what the community expects. Therefore, the government's responsibility and effectively providing public goods can positively impact environmental issues. Analyzing from the perspective of taxes, increasing the overall tax limits production, business, and consumption, creating fewer activities that cause EP. Moreover, developing countries have increasingly focused on environmental taxes, special consumption taxes on environmentally damaging products. This creates a direct impact, reducing the activities that harm the environment (A. T. Hoang, Nguyen, & Nguyen, 2020).

The Role of Public Policy in the Relationship between FDI and Environmental Pollution

Similarly, the study also examines the role of public policy in the relationship between FDI and EP through the introduction of interaction variables between FDI and tax (FDI \times trev), FDI \times public expenditure (FDI \times pubexp) into experimental models (3) and (4). The testing results are presented in Table 5.

Table 5.

Role of Public Policy, FDI to CO₂ Emissions in Developing Countries

Dependent variable: Degree of environmental pollution (CO₂)

The variable	MH taxes	MH Public spending
Pollution level last year	0.9111***	0.9359***
Income (Lnrg)	0.0695***	0.0483***
Domestic investment (dinv)	0.0028***	0.0015***
Commercial openness (open)	0.0004***	0.0002***
The infrastructure (tinf)	0.0011***	0.0011**
Energy consumption (energy)	0.0001	0.0001**
The degree of urbanization (urban)	0.0001	0.0003
Degree of industrialization (industry)	0.0024***	0.0019***
FDI (f)	0.0023***	0.0104***
The quality of institutions (i)	-0.0149*	-0.0205**
Taxes (t)	-0.0018***	
ft	-0.0001***	
Public spending (p)		-0.0012
fp		-0.0005***
Hansen test	0.4564	0.3722
Sargan test	0.2161	0.4298
AR(2) test	0.7641	0.906
Number of tool variables	72	70

However, the test results only show the interaction variable between tax and FDI; FDI and public spending are statistically significant. The interaction between FDI and public expenditure is also statistically significant, suggesting that appropriate public spending policies such as spending on education, research, and development will help accelerate technological innovation activities, thereby, help reduce the negative impact of FDI on EP.

Similarly, the statistically significant interaction between tax and FDI emphasizes the limited impact of business activities and the consumption of taxes on enterprises, including FDI enterprises. Thereby, the activities causing environmental harm are limited. However, the environment's tax policy should be carefully considered by the trade-off between economic goals and environmental protection. In summary, through the test results and the above analysis, the research answers the research question and the fourth research hypothesis in Table 6.

Table 6.

The Research Answers the Research Question and the Fourth Research Hypothesis

Research question	Research hypotheses	Testing and analytical results in developing countries
What is the role of public policy in the relationship between FDI and environmental pollution in developing countries?	Hypothesis (1): Public spending hurts the level of environmental pollution in developing countries.	Public spending hurts the level of environmental pollution.
	Hypothesis (2): Taxes hurt the level of environmental pollution in developing countries.	Taxes hurt the level of environmental pollution.
	Hypothesis (3): Tax reduces the positive effect of FDI on the level of environmental pollution in developing countries.	Taxes reduce the positive impact of FDI on the level of environmental pollution.
	Hypothesis (4): Public spending reduces the positive impact of FDI on the level of environmental pollution in developing countries.	The test results point to public spending in regulating the impact of FDI on the environment.

Conclusions

To answer the question of the effect of FDI inflows on CO₂ emissions in this case study by adding the FDI variable into the empirical model, this test result supports the author. "pollution paradise" theory. In developing countries, the increase in FDI inflows has the effect of increasing the level of EP. The effect of FDI is also consistent with testing the hypothesis of the Kuznets-EKC environmental curve in this case study. Based on the above test results, the research has clarified the role of government in the perspective of public policy on the environment and their role in the relationship between FDI and EP. Specifically, the author, in turn, adds the tools of fiscal policy to the empirical model. The test results show that, although environmental protection is not the main objective of fiscal policy, fiscal policy also has a significant impact on CO₂ emissions in countries. Developing. Specifically, taxes and public spending harm the level of EP. In other words, the increase in taxes and public spending creates positives, helping to improve the environment.

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