An empirical investigation of the Pollution Haven Hypothesis in Iran

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ABSTRACT

The Pollution Haven Hypothesis is one of the most influential theories that reviews the effects of environmental laws and policies. In keeping with the implementation of milder environmental laws or the lack of strictness in implementing relevant laws, polluting industries have been transferred to some developing countries. This process turned the above countries into a haven for polluting industries worldwide. The pollution haven hypothesis argues that polluting industries will relocate to regions with looser environmental regulations known as "Pollution Havens," generally low-income countries, when countries open up to international trade. In the present research, the experimental investigation of the pollution shelter hypothesis was carried out in Iran using an econometric model of Auto Regressive Distributed Lag (ARDEL). The results indicate that an increase in CO_2 emissions per capita increases Foreign Direct Investment (FDI) flows in Iran. The relationship between economic openness and the foreign direct investment flow was confirmed by the positive and significant coefficient of the Trade Freedom index in Iran. Finally, it was found that there is a positive relationship between the population growth rate and foreign investment flow in Iran.

KEYWORDS: Pollution haven hypothesis, Pollution haven, Foreign direct investment, Environment, Globalization

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1. Introduction

Over the last half-century, environmental degradation along with the increasing growth of industrial production in developed countries led to an awareness-raising and reaction to the adverse effects of economic activities that destroy the environment (Oskoyi and Yavari, 2007). Beginning in the 1970s, strict environmental policies became popular in developed countries. At the same time, the production rate of polluting industries in these countries decreased significantly. However, polluting industries have been transferred to some developing countries after the establishment of milder environmental laws or the lack of strictness in the implementation of relevant laws, which changed these countries into a haven for polluting industries. In general, trade liberalization and strict environmental regulation cause developed countries to concentrate on producing clean goods, while developing countries concentrate on producing polluting goods and become a haven for polluting industries in the world. Several theories have been proposed to describe this problem, which the pollution shelter hypothesis is the most important It has explained the mechanism of the severity of environmental regulation and policies on the reduction of pollution in developed countries using the theories of free trade and foreign direct investment (Eslamluian and Manshadi, 2015).

The pollution haven hypothesis is one of the most important theories that explain the effects of environmental laws and policies. It argues that under free trade, highly polluting goods will have transferred from countries with strict pollution regulations (developed countries) to countries with looser pollution regulations (developing countries) (Copeland and Taylor, 2004). In other words, the pollution haven effect posits that differences in environmental regulations impact factory location decisions and trade flows, or that enforcing strict environmental regulations reduce Net exports of polluted goods. In keeping with the mentioned materials, this study aimed to investigate the pollution haven hypothesis in Iran.

2. Literature review

Since the 1970s, international trade and environmental issues have been widely explored. Environmental effects of international trade and the environment on international trade have been the main focus of these studies. In other words, the issue of the link between environment and business started in the 1970s and become broader and more complex in the 1990s, when free trade was expanded by various treaties such as the North American Free Trade Agreement (NAFTA), the United Nations Conference on Environment and Development (UNCED), and the global distribution of industrial pollution became an important issue in the environmental economics literature and the global distribution of industrial pollution became an important topic in the environmental economics literature. Subsequently, economists, researchers, and industrial and political groups became concerned about the impact of this increase in international trade on the environment (Edrington, 2007). During that period, two conflicting views emerged about the link between trade and environmental protection, and the contradictory theoretical explanation was presented with the same dynamics. On one side of the spectrum, the pollution haven hypothesis and on the other side, Porter's hypothesis were proposed (Gill et al., 2018). The pollution haven hypothesis, which was introduced by Pethig (1976), suggests that differences in environmental legislation and regulation may be a specified source of comparative advantage. According to NAFTA, firms operating in highly regulated countries such as the USA and Canada came in direct competition with firms in poor countries that have loose environmental policies like Mexico. Copeland and Taylor (1994) predicted that NAFTA would become an environmental disaster for Mexico and a job disaster for the USA. They further submitted that under the trade liberalization, the firms that produce dirty goods1 would move from rich countries that have strict environmental regulations to those developing countries that have comparatively loose environmental regulations. Therefore, in open and liberalized trade the developing countries would become pollution havens for the dirty industries of the advanced countries. The pollution haven hypothesis predicted an environmental disaster in these developing countries that had comparatively loose environmental regulations (Gill et al., 2018).

In recent decades, globalization has created foreign direct investment flows. Foreign direct investment is considered a source of knowledge transfer, innovation, and technology and a business accelerator as well

as an economic development engine, however, it rises concerns about negative environmental emissions in host and importing countries. Foreign direct investment flows from countries with stricter environmental policies to host countries with fewer environmental restrictions to reduce the costs of industrial pollution, which is known as the pollution haven hypothesis. From a globalization perspective, the pollution haven hypothesis may be interpreted as a reflection of a trans-territorial process or set of processes involving increased monetary transactions and economic exchanges and growing multidirectional flows of people, objects, places, and information (Ritzer & dean, 2015).

1.2. Components of the pollution haven hypothesis
The pollution haven hypothesis has been structurally examined by various studies through two unique channels and pathways:
Structural origin of the pollution haven hypothesis
A series of studies and research consider foreign investment as a pollution transfer channel, while another series of studies address net exports, which acts as a proxy for the pollution haven hypothesis (Guha, 2015). Strict environmental laws increase the cost of producing polluting goods. Since developed countries enforce these strict regulations, it is expected that developing countries will enjoy low production costs of polluted goods in the polluting industry. Therefore, the pollution haven hypothesis that posits developed countries will use FDI as a channel to relocate highly polluting activities and industries to developing countries. On the other hand, the second structural series focuses on examining the impact of environmental regulations on the exports and imports of a trading nation. There would be significant evidence to support the pollution haven hypothesis if it were found that countries with stricter environmental regulations export cleaner and less polluting products and import more polluting ones (ibid).
Structural index of the pollution shelter hypothesis
The pollution haven hypothesis claims that natural and environmental resources are scarce phenomena that attract polluting industries across the world. The less developed countries may perform loose environmental regulations at the cost of damage to the environment to attract more foreign investment. As a result, these countries may become pollution havens for global polluting industries, and measures of pollution control in developed countries may lead to the relocation of pollution industries instead of enhancing the quality of the global environment (Yang et al., 2018). Research in the pollution haven hypothesis has recommended several indicators of the severity of environmental regulations regarding the hypothesis concept. Burnel & Levinson (2013) classified these indicators into five categories:1. Reduce the costs in private sector
2. Environmental policy stringency index
3. Comprehensive environmental indicators
4. Pollution emission and energy use
5. Implementation of environmental regulations

2.2. The determinant factors in the pollution haven hypothesis
In general, two classes of determinant factors for the pollution haven hypothesis are suggested by researchers:
1. In examining the pollution haven hypothesis, much research focused on the impact of international trade on environmental pollution. Generally, developed countries were not interested to produce highly polluting goods domestically, instead, they import from developing countries with fewer environmental restrictions. Michida and Nishikim (2007) in an empirical study proved that environmental pollution increases in low-income economies but decreases in high-income economies during a wave of trade liberalization. Nguyen et al made use of the data from 1978 to 2014 of the group of the international Group of Seven (G7) and found that capital market expansion and trade opening were the main drivers of carbon emission.
2. The environmental impact of foreign direct investment has been widely studied in the literature, which can be classified into two classes with contradictory perspectives. Some studies claim that increased

foreign direct investment flows can increase pollutant emissions and prove the pollution haven hypothesis. On the other hand, some other studies claimed that foreign direct investment from developed countries can promote more energy-efficient and eco-friendly technology along with better managerial expertise and technical knowledge in developing countries and show the pollution Halo effect (Yang et al, 2018).

3.2. Scales to test the pollution haven hypothesis
The pollution haven hypothesis has been analyzed and investigated at three scales:
1. Country-level: Most related studies use cross-country samples to test hypotheses. For example, Kellenberg (2009) examines the main reasons why US multinational affiliates produce the top and bottom twenty percentiles for all countries in terms of GDP growth. He/She found that the reduction of environmental strictures in developing and transitioning economies is the main reason for the production of pollutants and a more polluted environment with the pollution haven hypothesis.
2. Industrial scale: To date, only very few studies have used the FDI index to examine the pollution haven hypothesis at the industrial scale. Cole and Elliott (2005) reveal a reason why many related studies find little or no evidence of pollution havens by focusing on the capital intensity of polluting industries. In most cases, developing countries with loose environmental policies do not have enough capital to attract investments that cause pollution. Accordingly, it should be admitted that industrial capital intensity is a prerequisite for countries to become pollution shelters.
3. Firm scale: Microdata at the firm level can show some of the more recent findings about the pollution haven hypothesis because macro analysis in country and industry scale samples cannot show the more detailed and finer processes. This analysis leads to the examination of some unconsidered defects that (the same unconsidered defects) can create biased results in their place and during the examination of the pollution shelter hypothesis (Shao et al., 2019).

4.2. Testing the pollution haven hypothesis and challenges
Although the hypothesis of the pollution haven seems relatively simple and understandable, it is difficult to transition from the hypothesis test statement to the hypothesis test in the real world. This hypothesis predicts an exogenous transition from economic autocracy (mere government restrictions) to free trade, but there is no truly free trade in the world, nor are trade liberalizations exogenous events. (Taylor, 2005). Another important point in testing the pollution haven hypothesis is to evaluate the general changes in pollution and emissions. Although the pollution haven hypothesis has been investigated theoretically and empirically in various studies with different properties and different data sets, no decisive conclusion can be drawn about the pollution haven hypothesis. This hypothesis claims that developed countries want to specialize in clean goods while developing countries like to specialize in the production and export of polluting goods, but global pollution is still increasing and only transferred from one place to another. And the pollution haven hypothesis claims that world pollution can only be reduced if developed countries control the consumption of pollution-intensive products (Gill et al, 2018). The following hypotheses have been proposed and tested to achieve the main goal of the research:

H1: The pollution shelter hypothesis holds in Iran.
H11: There is a direct relationship between economic openness and foreign investment flow in Iran.
H12: There is a direct relationship between the population growth rate and foreign investment flow in Iran.

3. Methodology
An Inferential data analysis using an econometric model based on the Autoregressive Distributed Lag (ARDL) has been used to analyze the results. Levinson's theory (2003) was used to investigate the hypotheses:

$$Y_i = \beta_i R_i + \alpha_i X_i + \mu_i \tag{1}$$

Where,

Yi: Economic Activity Index

Rsi: Emissions Monitoring Index

Xi: vector of control variables and μi: error component

Therefore, in the above model, $\partial Y/\partial R$ should be significantly negative ($\hat{\beta} < 0$) if there is evidence of a pollution haven.

Symbolically, the following model is used in this study:

(2)

$$FDI_t : \beta CAB_t + \alpha_1 OPEN_t + \alpha_2 INF_t + \alpha_3 POP_t + \alpha_4 NRES_t + \alpha_5 ELE_t + \alpha_6 GDP_t + \mu_t$$

Where,

FDI_t: Foreign direct investment as an economic indicator

CAB_t: Greenhouse gas emissions as a monitoring intensity of emitted pollution (therefore, the higher the CO2 means less monitoring of released emissions).

$OPEN_t$: the value of international trade as the gross domestic product (GDP) percentage as well as the economic openness index.

INF_t: Inflation rate

POP_t: Population growth rate

$NRES_t$: Total natural resources rent as a percentage of GDP

ELE_t: Electricity production per capita (kW·h/yr) as an infrastructure indicator

GDP_t: Gross Domestic Product

And μ_i: is an error element

The above model is estimated using the ARDL method. Therefore, the description of this model is presented below:

Pesaran et al. (2001) introduced a new and alternative version of the Co-clustering algorithm, which is known as the Autoregression test with Autoregressive Distributed Lag (ARDL). The general form of the ARDL(p,q) model is as follows:

(3)

$$Y_t = \mu + \sum_{j=1}^{p} \gamma_j Y_{t-j} + \sum_{j=0}^{q} \beta_j X_{t-j} + u_t$$

where p is the number of intervals of the dependent variable and q is the number of intervals of the independent variables.

4. Findings

The ARDL model estimation results are shown in Table 1. The results show that the population growth rate has the maximum effect on foreign direct investment. The coefficient of this variable estimated at 9.659 indicates that with an increase of one unit in the population growth rate, the foreign investment increases by 9.659 units, as well as the economical openness (Trade freedom index) has a positive effect on foreign direct investment. The coefficient of this variable is 0.144, which shows that foreign direct investment increases by 0.144 units with an increase of one unit in the trade freedom index. The variable coefficient related to the natural resource rent variable as a percentage of the gross domestic product (GDP) was negative and significant, which shows that the increase of natural resources rent leads to a decrease in foreign direct investment. The coefficients of other variables are not statistically significant or the calculated coefficient is very close to zero. The coefficient of determination of the model is 0.87, which shows 78% of the changes in the endogenous variable are explained by the exogenous variables of the model. The value of the F statistic shows the overall model significance.

Table 1: Model estimation results by ARDL method

Variable	t Statistics	Coefficient	Prob
C	-9.769	-3.11	0.009
FDI(-1)	-0.188	-0.60	0.555
CAB	-0.520	-1.22	0.245
CAB(-1)	0.350	0.62	0.542
CAB(-2)	0.743	1.29	0.218
ELE	-0.004	1.91	0.080
ELE(-1)	-0.000	0.00	0.992
ELE(-2)	-0.005	-2.48	0.028
INF	0.003	0.37	0.715
INF(-1)	-0.0130	-1.19	0.256
POP	9.659	2.35	0.036
POP(-1)	-5.728	-2.13	0.054
OPEN	0.144	2.73	0.018
ERES	-0.086	-2.73	0.018
GDPPER	0.000	2.61	0.022
GDPPER(-1)	0.000	1.24	0.235
GDPPER(-2)	0.000	-2.87	0.014
R^2	0.87		
F Statistics	5.26		

The Goodness of Fit tests was done to ensure the obtained results. These tests are performed to ensure the absence of Autocorrelation (LM test), Homogeneity variance (ARCH test), and the correct form of model dependence (Ramsey Reset test). In all these tests, the null hypothesis is the desired hypothesis. The results of the Goodness-of-Fit tests are shown in Table 2. As we can see, the null hypothesis cannot be rejected in all these tests and therefore the model follows a normal distribution.

Table 2: Goodness of fit test results

Test	F Statistics	Prob
lagrange multiplier (LM) test	3.63	0.076
ARCH test	2.07	0.13
Ramsey Reset test	1.81	0.12

Discussion and conclusion

The results of the present study showed that the increase in CO2 emissions per capita (as an indicator of monitoring of emitted emissions) has led to an increase in foreign investment flow in Iran. In other words, the increase in CO2 emissions per capita, which means less monitoring the CO2 emissions increased foreign investment flow to Iran. Therefore, the pollution haven hypothesis (which argues industries with polluting technologies tend to move to countries with loose environmental regulations) holds to Iran, which indicates a disregard for the quality of the environment and, as a result, the increasing development of polluting industries in this country.

The coefficient of the trade freedom index is positive and significant, which indicates the open economy leads to an increase in foreign direct investment in Iran. Therefore, the second hypothesis of the research "there is a direct relationship between economic openness and foreign investment flow in Iran" is accepted. Trade openness has a positive and significant effect on foreign direct investment flows in the long term. This means that globalization encourages foreign direct investment.

The variable coefficient of the population growth rate has been positive and significant, which shows the population growth rate has a direct effect on the attraction of foreign direct investment in Iran. Accordingly, the third hypothesis "there is a direct relationship between population growth rate and foreign investment flow in Iran" is accepted. In other words, the population as a measure of the economic demand for the host country has a positive and significant relationship with foreign direct investment flows in the long term. It shows that a country's population increase means it has more potential to attract more foreign direct investment.

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ETHICAL CONSIDERATION

Authenticity of the texts, honesty and fidelity has been observed.

CONFLICT OF INTEREST

Author/s confirmed no conflict of interest.