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### **Environmental Regulation Stringency and Inflow of Foreign Direct Investment: With Special Reference to India**

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#### **Abstract**

*The study aims at solving three research questions. First, does stricter environmental regulation discourage the flow of foreign direct investment? Second, does difference in environmental policy stringency with FDI contributory developed countries have association with the increased inflow of Foreign Direct Investment in India? And lastly, is there any association between inflow of foreign direct investment in Indian polluting industries and Indian exports? By using objective specific data and methodology with panel data regression analysis this study concludes that there exist negative relationship between environmental regulation stringency and foreign direct investment in the manufacturing sector. Secondly, difference in environmental regulation stringency with that of the developed countries is significant in explaining the inflow of FDI in India. FDI inflow in India is a positive function of the difference in the environmental regulation stringency with developed countries. Lastly, in India inflow of FDI in the polluting industries is one of the reasons for the increasing export in those industries which suggests that inflow of FDI in the polluting industries is increasing the export of those industries.*

**Keywords:** *Environmental Regulation Stringency, Foreign Direct Investment, Panel Data, Exports, Pollution Haven*

**JEL Codes:** C23, F18, F21, F64, Q56

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**1.1 Introduction:** Foreign direct investment (FDI) has become a key factor of growing integration among countries. FDI is also very closely associated to GDP and its growth prospects (the FDI Report 2017). Trade and FDI are becoming gradually major drivers of economic development and technology transfer (Omri and Kahouli, 2014). In India FDI has become an important part of the economy after the adoption of the New Economic Policy. Though FDI has become a dynamic participant in economic growth yet, trade liberalization and FDI are becoming a real environmental threat. It is because FDI may reduce welfare through increasing pollution emissions level and resource exhaustion (Hassaballa 2014).

The Pollution Haven hypothesis postulates that loose environmental regulation attracts foreign direct investment. On the other hand a stricter pollution control policy could mean a substantial reduction in impending FDI inflows (Copeland & Taylor, 2004). The adoption of more stringent environmental standards could reduce a country's competitive advantage. Environmental regulations add to the production cost and international investors choose their destination where the cost is the minimum. Developing countries therefore may resort to increasing their comparative advantage by implementing lower environmental standards to attract foreign investment (Zhu, He, & Liu, 2014).

While conducting research on the relationship between FDI and environmental policy stringency it is important to note that the association between the two variables is significant only if FDI is estimated from the polluting industry only. It is because environmental regulation is a matter of concern for polluting industries only. Therefore we have to limit our effort on FDI mainly invested for establishing manufacture industries in foreign countries (Yoon 2017).

## **1.2 Objectives of the study:**

*The study aims to undertake the following objectives*

1. To enquire the relationship between changing environmental regulation stringency and inflow of foreign direct investment in manufacturing sector across countries.
2. To test the proposition that loose environmental policy stringency is attracting foreign direct investment to India.
3. To see the relationship between inflow of foreign direct investment in polluting industries in India and Indian exports.

**1.3 Data and Methodology:** The data on Foreign Direct Investment has been collected from official websites of OECD, Reserve Bank of India and the Dept. of Commerce, Govt. of India. The data on the Environmental Regulation Stringency Index (ESI) is being collected from the official website of OECD. The data covers twenty two countries (India, USA, Germany, UK, Japan, South Korea, Netherlands, Switzerland, France, Spain, Australia, Austria, Canada, Denmark, Finland, Greece, Hungary, Norway, Poland, Sweden, Ireland and Italy) for the period 2003 to 2015. Selection of the countries has been made keeping eye on the trend of environmental regulation stringency. In all of the selected countries the stringency of regulation is improving significantly. Manufacturing sector has been taken into consideration for the analysis because this sector is pollution incentive. The time period has been selected because of the spread of international environmental awareness during this period.

Export data of Indian manufacturing industries have been collected from the official website of the Dept. of Commerce, Govt. of India. The export data covers six most polluting manufacturing industries selected by the Pollution Control Board of India. These industries are fertilizer industry, pharmaceutical and drugs industry, cement industry, leather industry, sugar industry and paper-pulp industry. The dataset covers the time period 2000 to 2017. This time period has been selected because this period is important from both side of environmental regulations and Indian foreign direct investment regulation policy.

First, the environmental regulation stringency improved in this period and secondly, the government of India adopted many revision of its FDI policy.

To satisfy the first objective i.e. to enquire the relationship between changing environmental regulation stringency and inflow of FDI in manufacturing sector across countries, panel data analysis has been conducted by taking year wise environmental regulation stringency indices of the selected twenty one countries (USA, Germany, UK, Japan, South Korea, Netherlands, Switzerland, France, Spain, Australia, Austria, Canada, Denmark, Finland, Greece, Hungary, Norway, Poland, Sweden, Ireland and Italy) as independent variable and year wise percentage share of manufacturing FDI of the same countries as dependent variable.

The model for panel data analysis is-

$$\mathbf{FDI}_{it} = \alpha + \beta \mathbf{ESI}_{it} + \epsilon_t$$

Here,

‘**FDI**’ is the dependent variable: the percentage inflow of FDI in manufacturing sector

‘**i**’ denotes countries United States, United Kingdom, Germany, South Korea etc.

‘**t**’ denotes time period from 2003 to 2015

‘**ESI**’ is the independent variable: the Environmental Policy Stringency of the selected countries

To solve our second objective of examining whether the difference in environmental policy stringency with the developed countries is influencing the FDI inflow in India, we are considering the inflow of FDI in India from nine countries (USA, UK, Japan, Germany, South Korea, Netherlands, Switzerland, France and Spain) where environmental regulations are highly stringent. Inflow of FDI into India has been taken as dependent variable in the analysis. We are calculating the differences of Environmental Stringency Index of these countries with that of India and have taken it as independent variable. Next, we are calculating the year wise contribution of these countries to Indian FDI which is taken as the dependent variable in our statistical analysis. GDP growth rate (PPP) of the host country, GDP growth rate (PPP) of home country and distance between the host country and the home country (in kilometre) are taken as independent variable. The year wise infrastructure index of the host country India has also been used as an independent variable. The infrastructure index is the government investment in infrastructural development as a percentage of the gross domestic product.

The model for the panel data analysis is-

$$\mathbf{FDI}_{it} = \alpha + \beta_1 \mathbf{diff\_Esi}_{it} + \beta_2 \mathbf{GDP\_home}_{it} + \beta_3 \mathbf{GDP\_host}_{it} + \beta_4 \mathbf{DIST}_{it} + \mathbf{Infra}_{it} + \epsilon_t$$

‘**FDI**’ denotes inflow of FDI inflow in India from the selected countries.

‘**diff\_Esi**’ denotes difference of environmental regulation stringency of the selected countries with that of India.

‘**GDP\_host**’ denotes GDP growth rate of India

‘**GDP\_home**’ denotes GDP growth rate of selected home countries

‘**DIST**’ denotes the distance between the home country and host country India

‘**Infra**’ denotes infrastructure index of India

'i' denotes countries United States, United Kingdom, South Korea etc.

't' denotes time period from 2007 to 2015

To satisfy the third objective of assessing the relationship between inflows of FDI in polluting industries and increase in export in those industries, the year wise FDI inflow has been considered as independent variable and the year wise export value of the products of those industries have been taken as dependent variable.

*The model for panel data analysis is*

$$\text{Export}_{it} = \alpha + \beta_i \text{FDI}_{it} + \epsilon_t$$

'Export' denotes the exports of products of the selected polluting industries of India

'FDI' denotes the FDI inflow in the selected polluting industries of India

'i' denotes industries: Fertiliser, Cement, Pharmaceuticals, Paper and pulp etc.

't' denotes time period from 2000 to 2017

#### 1.4 The OECD Environmental Regulation Stringency Index

The Environmental Policy Stringency Index constructed by OECD is a country-specific as well as internationally-comparable measure of the stringency of environmental policy. In this index stringency of environmental regulations is defined as the degree to which environmental policies cause an explicit or implicit cost on polluting or environmentally harmful behaviour. The index ranges from 0 (which means not stringent) to 6 (highest degree of stringency). Based on the degree of stringency of 14 environmental policy instruments, mainly related to climate and air pollution the index covers 28 OECD and 6 BRICS countries. In this study we are using this index in order to quantify the environmental regulation stringency of different countries.

#### 1.5 Review of Literature:

Significant number of research work has been conducted to enquire the relationship between environmental policy and the direction of FDI. However research work carried out in Indian context is few and far between.

**Levinson (1996)** studying the impact of environmental regulation on manufacturer's locational choice both internationally and domestically for United States of America concluded that environmental regulation stringency doesn't influence the entry of new plants and new investment. **Muthukumara and David (1998)** testing the validity of the Pollution Haven Hypothesis using Japanese outward FDI data for the period 1960 to 1995 concluded that their study doesn't prove the pollution haven hypothesis. **Mabey and Richard (1999)** examining the relationship between FDI and environmental regulation concluded that because of the slack environmental regulations the less developed countries have become attractive fields for international investment. **List and Co (2000)** examining the effect of environmental regulation on inflow of FDI in United States of America by using inward FDI data found that stringent environmental regulations discourage the entry of new firms. **OECD in 2002** conducting a survey to investigate the relationship between environmental regulation and FDI found that FDI in mining sector in sub-Saharan African countries is encouraging better environmental management practices. **Xing and Kolstad (2002)** testing the relationship between environmental regulation stringency and flow of FDI using time series data of Chinese manufacturing industry reported strong evidence on

the impact of loose environmental regulation in attracting foreign direct investment. **Eskeland and Harrison (2003)** examining the association of FDI and environmental policy strictness, making use of the data from four developing countries showed weak evidence for the proposition that investors chose location of high pollution. **Fredriksson et al. (2004)** tested the relationship between FDI and environmental policy stringency using panel data from 33 countries and found that countries with less stringent environmental policies become the Pollution Havens. **Aliyu and Aminu (2005)** examining the impact of environmental regulation on flow of 'dirty' FDI in OECD countries found that in eleven OECD countries environmental regulation had significant impact on locational decision for 'dirty' FDI. **Cole and Elliott (2005)** investigated the relationship between US outward FDI and factor endowments across sectors to two developing countries and found that the level of environmental regulation cost in US industry was statistically significant determinant of FDI. **Jie He (2006)** studied FDI-environment nexus by constructing a simultaneous model with panel data from 29 provinces of China and concluded that environmental regulation stringency has a modest restricting effect on foreign direct investment inflow in China. **Spatareanu (2007)** investigating the impact of environmental regulations on foreign direct investment using data of FDI flows across 25 Western and Eastern European countries found evidence that the relative stringency of environmental policy in investor's country compared to that of possible host country increases the probability of more foreign investment abroad. **Kukenova and Antonio (2008)** investigated if difference in environmental regulation could affect FDI flows using OECD investment database for the period 1981 to 2005 and found the existence of a negative relationship between FDI and environmental regulation stringency. **Kellenberg (2009)** by analysing the enforcement of environmental policy of a few countries found robust confirmation of the pollution haven effect of foreign investment. **Rezza (2013)** made an empirical study on the determinants of foreign direct investment and found significant negative effects of environmental regulations on investment made by the multinationals. **Chung (2014)** using Korean outward FDI data for the period 2000 to 2007 found that Korean multinational firms chose to invest more in polluting industries which are located in host countries having slack environmental regulation. **Hassaballa (2014)** investigated the effect of loose environmental regulations on foreign direct investment inflows in developing countries using carbon dioxide emissions as proxy variable for environmental regulation stringency found that loose environmental regulation is one of the most significant determinants of FDI inflow in developing countries. **Kahouli et al. (2014)** conducted a study by taking the issues of 14 home countries and 39 host countries for six Regional Trade Agreements for the period 1990 to 2011 and found that impact of the environmental regulation on FDI was positive. **Sarmidi et al. (2015)** assessed the role of environmental regulation stringency on FDI inflows in 110 countries in the period 2005 to 2012 employing dynamic panel GMM technique and concluded that stringent environmental regulations alone discourage the inflow of FDI but if the stringency of regulation is coupled with low level of corruption, it encourages the flow of FDI. **Doytch and Uctum (2016)** by using multi country panel data for the period 1970 to 2000 found that in manufacturing sector loose environmental regulation attracts more FDI. **Yoon and**

**Heshmati (2017)** using Korean outward FDI data covering manufacturing sector for 2009-15 and 75 host countries found significant statistical evidence that environmental regulation stringency negatively impacts the flow of FDI in manufacturing sector.

**2.1 Environmental Regulation Stringency and FDI: A Cross Country Panel Data Analysis**

To satisfy our first objective, using the specified cross-country panel data we first conducted the Fixed Effect and Random Effect Regression analysis. Then we conducted Hausman Test to find out appropriate model between Fixed Effect Model and Random Effect Model.

We found the following result

**Table 1.0: Results of Regression Analysis**  
(Dependent variable is FDI<sub>it</sub>: FDI in manufacturing industry)

Variables	Fixed Effect	Random Effect
<b>ESI</b>	<b>-4.003*</b>	<b>-4.058982*</b>
	Hausman Fixed Random Chi2(1) =0.79 Prob>chi2= 0.3741	R squared : 0.42

(\* ) denotes significant at 1% level

The null hypothesis of the Hausman Test is –the Random Effect model is the appropriate model. The significant probability value (0.3741 which is greater than 0.05) indicates the acceptance of the null hypothesis. The variable ‘ESI’ (the environmental regulation stringency) is significant in explaining the dependent variable ‘FDI<sub>it</sub>’ (foreign direct investment inflow in manufacturing sector) at 1 per cent significance level.

The regression result reveals a negative and significant relationship between environmental regulation stringency and inflow of FDI in the manufacturing sector. It means that stringency in environmental regulation discourages the inflow of foreign direct investment in the manufacturing sector. An increase in the environmental regulation stringency causes a reduction in the flow of FDI in the manufacturing sector.

Further, we checked the effect of Heteroscedasticity and the presence of outliers using Robust Regression Analysis and found that the variable ‘ESI’ is still significant equally.

**2.2 Environmental Regulation Stringency and inflow of FDI in India**

For our second objective, adopting the given methodology and using the appropriate data we conducted the Fixed Effect and Random Effect Regression analysis. After that, the Hausman Test was conducted in order to find out the appropriate model between the Random Effect model and the Fixed Effect Model. The result is as follows:

**Table 2.0: Results of Regression Analysis**  
(Dependent variable is FDI inflow in India)

Variables	Fixed Effect	Random Effect
<b>diff_esi</b>	<b>346.9318*</b>	<b>338.2961*</b>
<b>gdp_home</b>	10.76211	10.8634
<b>gdp_host</b>	-5.407875	-6.509934
<b>dist</b>	0.87668	0.0955816

<b>infra</b>	<b>94.26295*</b>	<b>94.46201*</b>
	R square:0.41	R square:0.41
	Hausman Fixed Random Chi2(3) =0.34 Prob>chi2= 0.9868	

(\*) denotes variables are significant at 1% level

The significant probability value (0.9868 which is greater than 5 percent) suggests the acceptance of the null hypothesis, meaning Random Effect model is the most appropriate model.

The result shows that difference in environmental regulation stringency is significant in explaining the inflow of FDI in India. The positive co-efficient suggests that the growth of difference in Indian environmental regulation stringency with the developed countries is encouraging to have more FDI inflow from those countries. It suggests that to experience steady flow of FDI from the developed countries India should maintain a gap of environmental regulation stringency with those countries.

Secondly, infrastructure is a significant determinant of FDI inflow in India. The positive coefficient suggests that development in infrastructural facilities is positively correlated to the inflow of FDI. India can attract more FDI by investing more in the infrastructural development.

The distance between home country and host country, GDP growth of Home and Host country are not significant in explaining the inflow of FDI in India.

**2.3 FDI and Exports in Polluting Industries of India:** A question which comes to our mind is -whether India is becoming a Pollution Haven? In other words, has India become an attractive place where dirty goods can be produced without intervention and can be traded to the rest of the world? To answer this question it is necessary to examine the composition of Indian foreign trade. Here we have selected six most polluting industries listed by the Pollution Control Board of India and then examining the FDI-export relationship in these industries. These six industries are fertilizer industry, pharmaceutical and drugs industry, cement industry, leather industry, sugar industry and paper-pulp industry. The data covers the time period 2000 to 2017.

The panel data Regression Result is as follows:

**Table 3.0: Results of Regression**  
(Dependent variable is Exports)

Variables	Fixed Effect	Random Effect
<b>LogFDI</b>	<b>0.2320404*</b>	<b>0.232827*</b>
	<b>R square:0.4778</b>	<b>R square:0.4778</b>

	<b>Hausman Fixed Random</b> Chi2(1) = 0.02 Prob > chi2 = 0.9011	
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(\*) denotes significant at 1% level

The Hausman Test suggests that the Random Effect Model is the appropriate model because the probability value is significant (0.9011 which is greater than 5 per cent). To take care of Heteroscedasticity and the presence of outliers we conducted the Robust Regression analysis and found that the variables are still significant equally.

The result shows that the variable FDI is significant in explaining the dependent variable Export. The positive coefficient suggests that an increase in foreign direct investment in these industries increases the exports of these industries. In other words inflow of FDI in the polluting industries is increasing the export of those industries. This implies the possibility that India is becoming a Pollution Haven.

### 3. Summary and Findings:

We found the following results to match our objectives.

- There exist negative relationship between environmental regulation stringency and foreign direct investment in the polluting manufacturing sector. An increase in the environmental regulation stringency reduces the inflow of FDI in the manufacturing sector.
- Difference in environmental regulation stringency with that of the developed countries is significant to explain the inflow of FDI in India. FDI inflow in India is a positive function of the difference in the environmental regulation stringency with developed countries. This means that the gap of regulation stringency with other countries is one of the reasons for the increasing inflow of FDI in India.
- Distance between home country and host country, GDP growth of Home and Host country are not significant to explain the inflow of FDI in India.
- Infrastructural development is important factor which affects the inflow of FDI significantly. This study finds that development in infrastructure is attracting FDI to India.
- In India inflow of FDI in the polluting industries is one of the reasons for the increasing export in those industries. This suggests that inflow of FDI in the polluting industries is increasing the export of those industries. This finding indicates that India has become an attractive zone for investing in the polluting industries. This implies the possibility that India is becoming a Pollution Haven.

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