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FDI and its Impact on Environment : The Indian Experience

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ABSTRACT

This research paper attempts to determine whether FDI has a negative impact on environment to analyze this objective FDI across various polluting industries is examined during a period of 1992-2005 then FDI in polluting industries by country of origin is also examined. It has been found that though substantial share of FDI is approved in polluting sectors but it has not been still implemented. In the research paper pooled cross sectional model is used taking a sample of 7 states covering a period of 1992-2005. To represent state environmental quality air pollutant such as SO_2 is used. From the paper it could be concluded that Foreign Direct investment has played a negligible role in causing environmental pollution.

INTRODUCTION

Foreign direct investment is expected to bridge the foreign exchange gap , saving Gap and increase managerial abilities and improve balance of payment deficit in developing countries .Hence trade is termed as an engine of growth (Balassa 1978, Bhagwati and Srinivasan, 1983, Krueger, 1997). There has been an inherent fear among the members of the environmental community that trade liberalization is likely to exacerbate environmental problems (Esty, 1994, Lyman, 1993; Strohm and Thompson, 1996). Thus the relationship between trade expansion and environmental protection has been characterized by two extreme viewpoints – promoting trade worsens environmental conditions and higher environmental standards impose an economic cost. As competition becomes more global, people are concerned that relatively lenient environmental regulation and lax enforcement in developing countries give them a comparative advantage in pollution intensive goods. Lowering trade barrier may encourage a relocation of polluting industries from countries with strict environmental policy to those with lenient policy. These shifts may increase global pollution or lead to race-to-the-bottom environmental policy practices, as countries become reluctant to tighten environmental regulations due of their concerns over comparative advantage in international trade.

In the context of the above problem it is very essential to explain Pollution Haven hypothesis. The Pollution haven hypothesis refers to the possibility that foreign investment could sensitive to weaker environmental standards. A possible asymmetry exists between foreign capital and local environmental standards. When firms avoid environmental regulations by relocation it could trigger competition for lax environmental policy in order to gain comparative advantage in "dirty" goods production. The power of foreign firms, especially, and the desperate attempt

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to woo and tame foreign capita by poor countries might sometimes force these countries to lower the country-specific regulation.

JUSTIFICATION OF THE STUDY

This problem has been taken as India has a history of poor enforcement of and weak compliance with environmental regulations. This counters the predictions of the factor endowment effect. If less strict environmental policies do influence production decisions, 'environment' can be considered a non-traditional factor of production, and India may have an advantage in pollution-intensive product . In this context what is more important is to implement environmental regulations, effectively so that the fruits of economic growth do not turn sour.

OBJECTIVES

- To determine FDI and pollution Intensive industries
- To examine how the composition of FDI is directed towards environmentally polluting sectors
- To develop an empirical model to find out the impact of FDI on environment quality in India during the post WTO period

HYPOTHESIS

1. Though substantial share of foreign investment is approved in the polluting sectors , but many are yet to be implemented in the field.
2. The foreign direct investment has played a very significant role in the concentration of air pollutant $SO_{2,}$ which has resulted in the aggravation of environmental problems

STUDY AREA

To determine the impact of FDI on environment seven states are reviewed; Maharashtra, Delhi, Tamil Nadu, Karnataka, Gujarat, Andhra Pradesh , Madhya Pradesh

RESEARCH METHODOLOGY

Model Building

In order to test whether FDI creates pollution in India we have developed an empirical model to test the pollution haven hypothesis in India. To this end, an attempt has been made in this thesis to conceptualize a model in which the impacts of the inflow of FDI on environment can be captured. There is huge literature in this context that test for the existence of an Environmental Kuznet Curve (EKC) which proposes a hump-shaped relationship between economic growth and environment (Selden and Song, 1996). Second, most empirical studies that perform straightforward regression analysis yield relatively little insight into the driving forces that give rise to an EKC. At best, they conclude time trends to test for development unrelated to per capita income. These trends may reflect technological progress resulting in lower energy intensities, but they may as well be the resultant of, for example, substitution away from energy in periods of rising energy prices.

These problems can be overcome to some extent by decomposition techniques (Anteweiler 1998). These techniques decompose changes in pollution of energy use into a scale effect, a technique effect, and a structural effect. Thereby, they give some descriptive idea of the quantitative importance of the factors that may give rise to an EKC.

This model however, introduces yet another explanatory variable except income per capita, i.e. FDI inflow. The purpose is to assess the effects of both foreign investment and regional economic growth on the regional environment. Therefore, we have used a pooled time series and cross-section analysis. In order to allow for the detection of the wide range of potentially relevant functional relationships between FDI inflow, income and emissions, we use a flexible specification of the regression equation that allows for linear and quadratic polynomial relationships between pollution, FDI, and income.

Data and Variable Description

In the above model three specifications where the air pollutants such as sulphur dioxide is a dependent variable. The air pollution variables is monitored by Central Pollution Control Board. Further, as we claim that trade liberalization will induce the polluting multinationals to relocate to countries like India where environmental standards are low; so for the convenience of our study we have taken state-wise FDI approvals as the explanatory variable. However, we have corrected this data by multiplying it with the ratio of total FDI approvals during 1991-2005 to actual FDI inflow during the same period. Data for FDI is available in the secretariat of industrial assistance (SIA) newsletters.

Moreover, net state domestic product (NSDP) is taken as another explanatory variable to measure the impact of regional economic growth on regional environment. This relationship is conventionally known as Environmental Kuznet Curve (EKC). Data for NSDP is collected from the handbook of statistics, RBI. The sample of this study consists of 7 states for which pollution data is available and the study period spans 1992 to 2005. Therefore, to maintain consistency we are contained with this time period.

Model Specification

For expositional purposes, we distinguish between two basic classes of models that can be estimated. These models contain the FDI and NSDP as the explanatory variables. The index i will denote the state and t refers to time. The first model is:

$$Z_{it} = \alpha_i + \beta_1 FDI_{it} + \beta_2 FDI_{it}^2 + \beta_3 Y_{it} + \beta_4 Y_{it}^2 + \varepsilon_{it}$$

where, Z_{it} refers to the pollution indicator. In this model, the intercepts are region specific but the slope coefficients are uniform. This model is thus based on the idea that states experience a similar pattern of development of emissions as they are infused with foreign investment and develop, albeit at potentially different levels.

In the second model log linear model is made where all the variables are taken in logarithm form. The slope coefficients in this equation will measure the respective elasticities.

$$\text{In } Z_{it} = \alpha_i + \beta_1 \text{InFDI}_{it} + \beta_2 \text{InFDI}_{it}^2 + \beta_3 \text{InY}_{it} + \beta_4 \text{InY}_{it}^2 + \varepsilon_{it}$$

All regressions are estimated with a full set of fixed effects to control for unobserved state-specific heterogeneity. Special case is required in controlling for autocorrelation and

heteroscedasticity. Autocorrelation has been addressed by estimating an AR(1) model. To account for heteroscedasticity, we estimate and report White's heteroscedasticity consistent estimators (Gujarati (2003) and Johnston and Dinardo (1997).

Review of Literature

The positive research to test hypothesis about trade policy and growth impact on environment outcomes started in 1990's from the pioneer work of Grossman G. and Krueger A (1993) in their paper entitled "Environmental impacts of NAFTA, in the US –Mexico Free trade Agreement" .They proposed an environment Kuznet curve (EKC) that hypothesizes an inverse U-shape relationship between country's per capita income and its pollution level ie increased income due to increased flow of FDI are associated with an increase in pollution in poor countries, but a decline in pollution in rich countries. Ravishankar Jayadevappa and Sumedha Chhatre (2000) in their paper published "International trade and environment quality: a survey" discussed that interaction between international trade and types of pollution , their sink and assimilative capacity need to be analyzed by general equilibrium analysis. The intensity and type of environmental measures vary across countries. Hence harmonizing environmental measures creates an inefficient atmosphere and to assume that trade restriction will either improve or reverse environmental damage is a serious mistake. Erik Dietzenbacher and Kakali Mukhopadhyay (2006) in their paper entitled "An they empirical examination of pollution haven hypothesis for India: Towards a green Leontief paradox?" used input output analysis to determine whether India could be regarded as a pollution haven. Jyosri Acharyya (2009) in his paper entitled "FDI, growth and the environment: Evidence from India on CO_2 emissions during the last two decades", examined the two most important benefits and cost of foreign direct investment in the Indian context-GDP growth and environmental degradation.

FDI and Pollution Intensive Industries

To examine the impact of FDI on environment FDI Approvals have been used as a proxy for actual FDI inflows. They can be divided into two categories.

1. FDI into pollution intensive industries and FDI into non-pollution intensive industries. Central Pollution Control Board (CPCB) has classified 17 industries as pollution intensive sectors (termed as Red) – they are Cement, Sugar, Thermal power plants, Tanneries, Textiles, Iron and steel, Drugs and pharmaceuticals, Paper and pulp, Dyes and Dye intermediates, Fermentation industries, Fertilizers, Zinc, Aluminum, Copper smelter, Petrochemicals, Oil refinery, and Pesticides. However, we have reclassified the pollution intensive industries according to the data availability as follows: metallurgical industry, fuels (power and oil refinery), fertilizer, chemicals, dye and dye intermediates, drugs and pharmaceuticals, textiles, paper and pulp, sugar, fermentation industry, leather, cement and gypsum products (these sectors will be considered as falling under Red category henceforth). The share of polluting sectors in total FDI during the period 1991-2005 is calculated as 42.89%. This gives an early indication that after opening up of the economy, the tendency of foreign investment is significantly tilted towards the polluting sectors.

Table 1
Share of Polluting Industries in Total FDI Approval 1992-2005

S. No	*Polluting Industries*	*% share in total FDI approval*	*% share in the Approvals in Polluting industries*
1	Metallurgical Industry	1.91	12.65
2	Fuels (power & Oil refinery)	9.65	63.42
3	Fertilizers	0.29	0.26
4	Chemicals	6.06	10.20
5	Dye stuff	.04	0.10
6	Pharmaceuticals	1.10	2.46
7	Textiles	1.22	2.84
8	Paper and pulp	1.24	2.88
9	Sugar	0.37	0.86
10	Fermentation industry	0.73	1.70
11	Leather and /leather goods	0.20	0.46
12	Cement and Gypsum	1.17	1.73

Source: SIA, Newsletter Ministry of Commerce and Industry

It is clear from the above table that among the Red category industries in fuels both (power plant and oil refinery) about 63.42% of FDI approved is in polluting industries. Apart from power and fuel the other two sectors attracting maximum FDI in polluting industries are metallurgical industry with a share of 12.65% and chemical industry with a share of 10.20%. The combined share of power , metallurgical industries and chemical industry is very alarming. It is 86.67% leaving only 13.23% of industries for rest of the industries in this category. The distribution of foreign investment across most of the polluting industries shows that foreign investors are relocating their polluting industries in India. They have significant interest in the areas of power plant, oil refineries, metallurgical industries and chemical industries.

FDI in Polluting Industries by Origin

FDI in polluting industries by country of origin can be explained with the help of following

Table 2
FDI in Polluting Industries by Country of Origin

S. No.	*Countries*	*% Share in totalFDI*	*% Share in polluting Industries*
1	Mauritius	91.40	26.23
2	USA	69.95	37.08
3	UK	95.77	18.86
4	Germany	69.20	5.02

Source: SIA, Newsletter, DIPP, Ministry of Commerce and Industry

An interesting observation is found when the figures for the origin of foreign investment to polluting sectors by country are compiled. It shows that the top five investing countries in these

sectors in India are U.S., Mauritius, U.K., Germany, and Australia . Except Mauritius, rest of the countries are from OECD block, which is again a step further in testifying the claim that polluting industries in countries having stricter environmental regulation are incentivized to migrate to countries with lenient environmental standards. Among other determinants, an increasing tightening of regulations in OECD, a lower level of environmental standards and weak monitoring mechanisms in India are the main reasons for inducing FDI into polluting industries in the country. In fact, the relocation of pollution-intensive industries is not a unique phenomenon in India. As one cross-country analysis (Mani and Wheeler, 1997) illustrates that pollution-intensive output as a percentage of total manufacturing has fallen consistently in the OECD and risen steadily in the developing world.

Regional Distribution of FDI

Since the initiation of economic reforms there has been a tremendous inclination of various states in attracting Foreign direct Investment. Due to the interstate disparities in industrialization, location of projects has assumed great significance. The available information has serious limitations in reflecting the actual amounts that are likely to flow to different states. Regional Distribution of FDI in polluting Industries can be analyzed from the following Table 3.

Table 3
Regional Distribution of FDI

S. No.	*States*	*% share in Total FDI*	*% share in FDI in polluting Industries*	*Ranking*
1	Maharashtra	20.6	23.43	1
2	Delhi	16.95	4.05	7
3	Tamil Nadu	12.58	16.23	3
4	Karnataka	10.60	13.36	4
5	Gujrat	6.92	18.45	2
6	Andhra Pradesh	6.46	4.56	6
7	Madhaya pradesh	5.15	12.69	5

Source: SIA Newsletter, Ministry of Commerce and Industry

If one goes by the official figures for the period 1995-2005 it is clear that Maharashtra stands top in the industry wise FDI approval with a whooping share of 20.61 % followed by Delhi (16.95%), Tamil Nadu (12.58%), Karnataka (10.60%), Gujarat (6.92%), Andhra Pradesh (6.46%), Madhya Pradesh (5.15%). We have gone a step further by calculating the states that have received substantial amount of FDI in the most polluting industries. This analysis points that the states that are major beneficiaries of total FDI have also topped the list in case of FDI in polluting industries. In the latter case, Maharashtra again topped the ranking by securing a share of 23.43% followed by Gujarat with 18.45%, and Tamil Nadu with 16.23%. However, there is only one exception that Delhi didn't figure in the polluting industries list which suggests that most of the FDI that have flown into polluting industries didn't land up in Delhi.

Panel Regression Estimates

Table 4
Panel Regression Estimates for SO_2

Dependent variables	*SO2 in levels*	*SO2 in logarithms*
FDI	.0001* (115.29)	.005**(2.88)
FDI^2	-6.40E -05* (-39.55)	-1.10***(1.65)
NSDP	-7.97E -10* (-147.47)	0.0001(1.21)
$NSDP^2$	-6.18E -11* (-8.46)	0.03(0.81)
Andhra Pradesh	17.78	11.12
Delhi	23.38	11.07
Gujarat	36.96	11.85
karnataka	9.51	11.62
Madhya pradesh	23.81	11.37
Maharashtra	26.18	11.83
Tamil Nadu	16.67	11.15
R^2	0.79	.97
F statistics	209.64	2198.39
DW statistics	1.65	1.75
Observation	187	187

Note: Values in parentheses are the t-statistics. The reported t-statistics are White-heteroscedasticity consistent t-statistics. They are robust to heteroscedasticity within each cross-section, but do not account for the possibility of contemporaneous correlation across cross-sections. Significance levels are indicated with stars: *, **, and *** means significant at 1, 5, and 10 percent respectively. The fixed effects are reported for each cross-section. The coefficients which are significant at specified level of significance have undergone Wald coefficient test

The estimation results for SO_2 as dependent variable are reported in Table. There is a positive relationship found out between FDI and SO_2 concentration in level but, the coefficient is too small (0.0001) to provide any meaningful information. Interestingly, the quadratic term of FDI is found to have a negative relationship with SO_2 concentration suggesting a positive influence on air quality and the coefficient is also fairly large. This is surprising since there is difference of impact between linear term and the quadratic term though the former is almost insignificant in its effect. On the other hand, both the linear and quadratic terms of NSDP bear strong negative relation with SO_2 concentrations in levels and are highly statistically significant. This finding suggests that higher economic growth tends to reduce the concentration levels of pollution which is in contradiction with the findings of earlier studies (Selden and Song, (1994). A possible explanation for this contradiction is that the earlier studies have considered a cross-country approach where the environmental regulatory practices and income patterns are very different. Whereas, in our study within a country, there is homogeneity in regulation practices and the income patterns are not widely different. In the second model, where variables are taken in logarithmic form, the coefficient of FDI in linear term is again positive and dominates over the quadratic term. This means the rate of change of concentration of SO_2 has a positive relation with the rate of change of FDI inflow. The other explanatory variable, namely NSDP is not statistically significant. The fixed effects for each of the states that are reported in the results

table demonstrates that some states having greater inclination towards manufacturing activities have large fixed effects, for example, Gujarat, Madhya Pradesh . High fixed effects suggest that these states have greater concentration of SO_2. This is because these states have high concentration of manufacturing and mining activities which are polluting in nature. Some of the advanced states like Maharashtra, Delhi, Tamilnadu , Andhra Pradesh and Karnataka have shown moderate fixed effects.

CONCLUSION

If actual FDI inflow is taken into consideration then polluting sectors have just received about one fourth of the total FDI inflow whereas the share of non-polluting sectors is about three fourth The fixed effects from the estimated results describing differences between states are statistically significant and imply that there are major differences among the states. States with high level of transportations, mining and industrial activities show high level of air pollution emission. These states are Delhi, Gujarat, Uttar Pradesh, Bihar, and West Bengal. Though inclination of FDI approvals was towards the polluting sectors but it has not been actually translated into realized figures Our panel regression results show that foreign investment has negative impact on the concentration of sulphur dioxide across the states. So, the growth of concentration of this air pollutant is not caused by the trade liberalization induced-foreign investment. It is also found out that state domestic product has negative impact on concentration of SO_2.

POLICY RECOMMENDATION

Foreign Direct Investment plays a negligible role in polluting the environment, thus environmental community should not suspect trade liberalization policies which could increase the inflow of FDI. In these circumstances environmental regulations should be implemented cautiously so that the fruits of FDI do not turn sour. Economic instruments such as pollution permits, leivies are very effective in controlling pollution

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