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# TRADE LIBERALIZATION AND ITS ENVIRONMENTAL IMPACT IN INDIA: AN EMPIRICAL ANALYSIS

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**ABSTRACT**

*Trade openness has become an increasingly important global economic activity in the competitive world. At one hand a move towards trade liberalization has shown an extraordinary growth and integration in the world economy over last three decades, on the other hand several empirical studies reflect trade openness and FDI as magnifiers of environmental deterioration, especially in developing countries like India. This study aims to explore and examine the environmental quality of India and its association with trade liberalization and economic growth. Pooled regression technique was used to examine the data, which covers 30 years from 1991-2020. The findings suggest negative association between trade openness and environmental quality in India. We found that all types of pollution have a positive relationship with industrial output. The results of the study suggest that while trade openness measures have been pursued to promote economic growth in India but they have led to some potentially adverse environmental consequences. However, it is suggested that Indian government and policy makers should make an effort and formulate appropriate policies to improve environmental quality along with economic development which could help economy to achieve a clean environment and sustainable long-term development.*

***KEYWORDS****: Trade Liberalization, Pollution, India, Environment, Manufacturing Industries.*

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## Introduction

The Indian economy has witnessed high economic growth in the past two decades, with the share in global trade increased from 0.5 percent in 1990 to 1.6 percent in 2020, population having expanded by sixty percent and Net National Income (NNI) per capita multiplying by 3.5 times through 1990-2020. After trade liberalization, India is growing with an annual average rate of 8 percent, which was only 3.1 percent during the pre-reform period. Concomitantly there has been greater integration of the global economy on account of liberalization of international trade and lowering of barriers to cross border investment flows.

In 1990-91, industry (manufacturing) contributed twenty-six percent of India's Gross Domestic Product (GDP), employing fifteen percent of the workforce and using thirty-nine percent of the economy's net renewable capital stock. In the 1980s, industry was the economy's leading sector, growing annually at around 6 percent, while the domestic output grew annually at around 5.5 percent and exports at 8.5 percent in current dollar terms. (Various economic surveys)

The composition of India's exports and imports has also altered significantly since liberalization. Organization of the Petroleum Exporting Countries (OPEC) and Asian developing countries are sharing major market for India's export and European Union, Eastern Europe and Organization for Economic Co-operation and Development (OECD) countries have become less important for India's export as compare to 1991-92. On account of linkage between trade and the environment through scale, composition and technique effects, this shift in India's trade partners could have important implication for the environmental quality and use of natural resources.

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For the past decade and a half, environmentalists and the trade policy community have been engaged in a heated debate over the environmental consequences of liberalized trade. This debate has been intensified by the creation of World Trade Organization (WTO) and subsequent commencement round of North American Free Trade Agreement (NAFTA), Uruguay round and Doha round on trade negotiations. But this debate was quite unproductive because both parties differed greatly in their trust of market forces and typically value the environment differently. (Copland and Taylor, 2004)

In India, trade liberalization program has led to economic growth and development but this development took place at the cost of environmental damages, either in the form of air and water pollution or depletion of natural resources. (Jena et al., 2006) Recent emergence of global environmental issues such as climate change, global warming, ozone depletion and acid rain has raised threat about environmental quality. All these concerns become questionable of the assertion that free trade leads to welfare maximization.

A policy of trade liberalization is often suggested as a means of stimulating economic growth in developing countries. The basic aim of Trade liberalization is opening up the economy to attract foreign investment and lowering trade barriers in the form of tariff reduction. Given the potential benefits of trade liberalization policies, it is important to examine whether such policies are in conflict with the environment as they expand production and accelerate economic growth. (Kalkali and Debesh, 2005)

But, increasing free trade in countries with weak environmental norms and policy has raised concerns about the adverse environmental consequences of trade liberalization policies. There is a concern that trade liberalization could potentially encourage the use of India as a production base for more pollution intensive production. (Rabindran and Jha, 2004) However, Karl Marx, in his critique of merchandise in the first chapter of Das Kapital, predicted that Liberalization is incapable of giving any meaning to life other than consumerism, waste, hijacking natural resources and economic income and worsening inequality.(Karl Marx,1867). Therefore it will be noteworthy to study this nexus in detail.

In this study, an attempt will be made to encapsulate industry-level economic and environmental data aggregated at the all India level for the fifty-eight India's manufacturing industries. This will help to determine environmental effect of trade liberalization for the entire manufacturing sector across India.

**Review of Literature**

Many studies lend support to the nexus between trade liberalisation and environmental externality. Various relevant studies tried to find out the relationship between trade and environment and found varying results. The purpose of literature review is to convey what knowledge and an idea have been established on the topic. A brief review of prior research related to objectives of the study has been discussed below.

**Shafik and Bandyopadhya (1992)** analysed relationship between economic growth and environmental quality by analysing patterns of environmental transformation at different income levels. They explored that macroeconomic policies affected the evolution of environmental quality. They took eight indicators of environmental quality using cross-section regression and three basic models-log linear, quadratic and cubic. **Grossman and Krueger (1993)** supplied evidence with a cross country study that emissions of both sulfur dioxide (SO2) and dark matter (smoke) grow with income until a certain threshold, above which emissions begin to diminish. This study suggests implementation of integration of both trade and environment policies in a coherent manner (Trade related environment measures and environment related trade measures) in order to realize gains from trade while protecting the environment. **John and Pecchenino (1994)** explored potential conflict between economic growth and the maintenance of environmental quality in an overlapping generation's model. They used multiple Pareto-Ranked Steady-State Equilibrium Model which arise as a result of the interaction between capital accumulation and environmental quality.

**Beghin and Potier (1997)** took five specific manufacturing sectors: chemicals, electronics, metals, automobiles, textiles or clothing which were at different development levels. They concluded that trade liberalization will not induce wholesale specialization in dirty manufacturing industries in the developing world. To the contrary, several situations are likely to arise as more efficient resource allocation benefits the environment in several industrial sectors. **Xing and Kolstad (1997) & Low and Yeats (1992)** submitted that the dirty industries relocate to countries with lax environmental regulation. Thus, study supports the existence of Pollution Heaven Hypothesis. **Dessus and Bussolo (1998)** found that environmental taxes alone, produce a small reduction in growth but sharply reduce emissions. On the other hand, unilateral trade reform, with border tariff reductions, promotes growth but also promotes specialization in dirty industries which translates into strong environmental damage. **Antweiler et al. (2001)** submitted that how openness to trading opportunities affects pollution concentrations. They estimated that one percent increase in the scale of economic activity raises pollution concentrations by 0.25 to 0.5 percent, but the accompanying increase in income drives concentrations down by 1.25-1.5 percent via a technique effect.

**Dasgupta et al. (2002)** found that the EKC is actually flattening and shifting to the left. The driving forces appeared to be economic liberalization, clean technology diffusion and new approaches to pollution regulation in developing countries. **Copeland and Taylor (2004)** showed that with the advent of trade, pollution decreases in the rich country and increases in the poor country, confirming in a broader sense that the dirty industry migrates from the richer to the poorer country. **Jha and Rabindran (2004)** found that exports and FDI grew in the more polluting sectors relative to the less polluting sectors in the post-liberalization period. **Mukhopadhyay (2006)** used input-output techniques for evaluating the impact on the environment of Thailand's trade with OECD countries, focusing on the two conflicting hypothesis (Pollution Heaven Hypothesis and Factor endowment Hypothesis) considering three pollutants-Carbon dioxide, Sulphur dioxide and Nitrogen oxide ($CO_2$, $SO_2$ and $NO_2$). Results support Pollution Heaven Hypothesis implying that export related pollution is much greater than the import related pollution. **Jena et al. (2006)** examined the validity of Pollution Heaven Hypothesis in the Indian context of post liberalization period using a pooled cross-section model with sample of 17 major states of India to find out that is more responsible for influencing and damaging the environmental quality-FDI or regional development. The study does not find strong evidence for support of PHH in India. Authors concluded that regional economic growth and development is more responsible for the accumulation and concentration of air pollutants than foreign investment inflow. But they caution about the Pollution Heaven arguments.

**Feridun et al. (2006)** revealed that trade intensity, real GDP per square kilometre and GNP were positively related to environmental degradation. **Azhar et al. (2006)** applied Johanson- Juselius Co-integration technique and Error Correction Model using the time series data for Pakistan economy over the period of 1972-2001. The paper found the existence of a co-integrating vector, indicating a valid long run relationship among the trade liberalization and environmental indicators. In long run, trade liberalization causes to increase air and water pollution. The result supports that trade liberalization has a negative impact on environmental indicators. **Kukla (2009)** investigated the impact of economic growth and international trade on the level of air pollution. Author explored that the impact of economic growth on environmental quality varies between the developing and developed countries. **Naughton (2010)** took five specific Globalization variables for examining the impact of sulphur dioxide and nitrogen oxide emission. The five variables are Trade, FDI, Neighbouring countries wealth, Cross-Border pollution and participation in international environmental treaties. he found that increase in trade intensity reduces per capita emissions with a larger effect for $SO_2$.

**Ahmed (2014)** observed pollution heaven hypothesis in the context of Mongolia. This study empirically examined the relationship between $CO_2$ emission and three explanatory variables viz. economic growth, energy consumption and trade openness to the period 2001-10 using Johansen method of co-integration and Granger causality test for empirical investigation. The study confirms the existence of EKC hypothesis. **Marquez and Ramos (2015)** analyzed the effect of international trade, environmental performance and agglomeration externalities on $CO_2$ emission arising from goods transport. They calculated a global transport emission indicator using existing $CO_2$ emission data. This study suggests that environmental performance reduces trade related global transport emission and confirms inverted U-shape hypothesis.

## Objectives of the Study

- To study the growth and composition of domestic production within the manufacturing sector at the all-India level during pre and post liberalization.
- To examine the pollution effects of trade liberalization in terms of composition effects on domestic production in post liberalization period.

## Coverage

The study determines the environmental degradation emerging due to trade liberalization. For this, we have assembled aggregated industry level economic and environmental data for the all-manufacturing sector. With the help of time series data from 1991-2020 the trade environment nexus has been determined. According to factor endowment theory, India has a comparative advantage in labour intensive technique and relatively lax environmental regulations and monitoring compared to its main trading partners. Therefore, there is a concern that India continually expanded its international trade in pollution intensive industries. Therefore, this study covered the composition effect of trade liberalization in India. Using the secondary database, following hypothesis are tested in the present study.

**$H_0$:** There is no significant contribution in production of manufacturing industries from dirty industries relative to clean industries.

**$H_1$:** There is significant contribution in production of manufacturing industries from dirty industries relative to clean industries. (The composition effect on domestic production)

**Sample and Data**

This study is entirely based upon secondary data which are collected from CMIE, Planning Commission, Inter-governmental Panel on Climate Change (IPCC), Foreign Trade by Commodities, Annual Survey of Industries, Reserve Bank of India, Forest Statistics of India, National Accounts Statistics published by CSO, World Bank Report, Economic Surveys and official websites like www.indiastat.com, www.mospi.nic.in, etc. Due to insufficient pollution data on Indian manufacturing industries, to measure industrial pollution-load and pollution intensity we used air, water and toxic pollution measures given by the Industrial Pollution Projection System developed by the World Bank which is based on United States (US) industries. These measures were given under the four digit ISIC (International Standard Industrial Classification) code and therefore the industries. Many studies use IPPS outcome and data for studies on countries where pollution data are insufficient. We use the assumption that global technological constraints make some industries more polluting than others.

To calculate the pollution load for industries in India, we first mapped the NIC categories to ISIC codes. Using purchasing power parity between India and the US, we converted IPPS pollution intensities to Indian Rupees. We deflated the value-added data from the Annual Survey of Industries and the pollution loads from IPPS to 1987-88 Indian prices using wholesale price index for the manufacturing sub group. We applied the deflated pollution load (in kilograms per thousand Indian Rupees) to value-added (per thousand Indian Rupees) to obtain the pollution-intensity for each manufacturing sub group.

**Estimation Models**

To test hypothesis, we measure whether domestic production has shown greater increase in dirty industries relative to clean industries from 1991 to 2020 using a simple Cobb-Douglas Production function. In this function capital (K) and labor (L) are taken as a proxy for capital and labor productivity. Pollution-intensity is also included as a proxy for pollution generated or pollution load by a particular industry. Pollution can be regarded as either a cost or an input to the production process. Due to the lax nature of environmental laws in India, the abatement costs associated with pollution in India are minimal in comparison to those of developed countries. It is therefore more logical to take pollution as an input in the production process, a method used by Gamper-Rabindran and Jha (2004).

The Cobb Douglas Production Functions used and the associated cost function is of the form

$$Y=f(K, L, P)$$

Where Y is output, K is capital stock, L is labor, and P is amount of pollution released during the production process. The costs associated with this production function are, r which is the cost of capital, w which is the wage rate and c which is the cost of pollution. Capital, labor and pollution produced are inputs to the production process. Pollution is regarded as an input as motivated previously; c/r and c/w would be lower for developing countries than corresponding ratios for developed countries under no trade. With trade liberalization, developing countries would specialize in pollution intensive industries and export pollution intensive goods, turning into pollution havens. We use 3-digit NIC level data for manufacturing industries to estimate pollution load. The regression model is:

$$\ln (Y_{it}) = \alpha + \beta_1 \ln (K_{it}) + \beta_2 \ln (L_{it}) + \beta_3 \ln (Pa_{it}) + \beta_4 \ln (Pw_{it}) + \beta_5 \ln (Pt_{it}) + \mu$$

where, Y is the total output as a fraction of gross value added in per manufacturing industry i for time period t measured at the 3-digit NIC level (there are total 58 3-digit NIC manufacturing industries); K is industry-wise capital productivity; L is industry-wise labor productivity(here we use worker productivity as a proxy); Pa, Pw and Pt is industry-wise total estimated pollution-load respectively for air, water and toxic pollutants with respect to the value added; T is the liberalization dummy that takes the value 1 for post-1991 years and 0 otherwise; and μ is industry fixed effects. Worker productivity is calculated by dividing No. of workers by the gross value added. Capital productivity is calculated by dividing the total stock of fixed capital by the net value added. The coefficient of interest is $\beta_3$, $\beta_4$ and $\beta_5$ which capture the significant contribution in production of manufacturing industries from dirty industries. If domestic production does not show significant contribution in production of manufacturing industries from dirty industries, we would find that $\beta_3 = 0$, $\beta_4 = 0$ and $\beta_5 = 0$. The results for equation are presented in Table 2.

**Empirical Results**

**Table 1: Descriptive Statistics**

| Variable | Mean | Standard Dev. |
|---|---|---|
| Total output/Gross value added | 5.40 | 2.74 |
| Capital productivity | 2.16 | 1.70 |
| Labour productivity | 5.92 | 10.81 |
| Air pollution load | 62.69769 | 224.0259 |
| Water pollution load | 37.82915 | 258.9367 |
| Toxic pollution load | 2042.227 | 7063.928 |

**Table 2: Pooled Regression Output**

| Dependent Variable: Output/Value Added | Output | Output (Without Including Air Pollution Load)# |
|---|---|---|
| Constant | 1.954068 (0.075536) | 1.990822 (0.083592) |
| Capital productivity | 0.104071* (0.027043) | 0.101666* (0.030116) |
| Labour productivity | -0.106589* (0.021947) | -0.103683* (0.024542) |
| Air pollution load | -0.011920 (0.010128) | |
| Water pollution load | 0.027867* (0.005196) | 0.026450* (0.004529) |
| Toxic pollution load | -0.029099* (0.014671) | -0.039712* (0.010172) |
| Observations | 550 | 550 |
| R-squared | 0.146091 | 0.143917 |
| Adjusted R-squared | 0.138242 | 0.137633 |

(Standard errors in parentheses. * Significant at 5 percent. #Air pollution load is not an omitted variable and it does not play a significant and a very important role in the determination of the Total output/Gross value added.)

Table 1 shows the descriptive statistics. Annexure 13 presents the regression results from on changes in the composition of manufacturing output. The dependent variable in logged Total output/gross value added. Here we use polled ordinary least square estimates and The Log – Log or Constant Elasticity Model. Our regression results show that manufacturing value added from more Water pollution intensive sectors increased at a greater rate than less toxic pollution intensive sector because the size of the coefficient on toxic pollution load is smaller than water pollution load. After conducting an omitted variable test and redundant variable test, here we don't omit toxic pollution load variable (explanatory variable) which does not play a significant and a very important role in the determination of the Total output/Gross value added.

The results presented in Annexure 13 corroborate the descriptive analysis in Figure 8 and 9. We find robust evidence that water pollution load with respect to the value added increased at a greater rate (217%) relative to toxic pollution load (117%). regression results show that water pollution intensive output showed a positive and significant increase during this period, we find that an increase of one percent point in water pollution loads leads to a 0.02 percent increase in output. Toxic pollution intensive output showed a negative but significant increase, we find that an increase of one percent point in toxic pollution loads leads to a 0.03 percent decline in output. Capital productivity showed a positive and significant increase, an increase of one percent point in capital productivity leads to a 0.10 percent increase in output. Labor productivity showed a negative but significant increase, an increase of one percent point in labor productivity leads to a 0.10 percent decline in output. P value of 'F statistics' is significant which proves our model is significant. $R^2$ is 0.14 implies 14% variation in dependent variable explained by explanatory variable.

**Conclusion and Limitations**

In this paper, we empirically analyzed the impact of trade liberalization on the environment in the Indian context during 1991-2020. We conclude from our analysis that there has been a change in composition of output in India that parallels the gradual improving and opening up of the economy.

Manufacturing output has been significantly higher from the water pollution intensive sectors compared to the air and toxic pollution intensive sectors. This evidence provides some support for concerns raised about that there is significant contribution in production of manufacturing industries from dirty industries as compare to the clean industries. These findings suggest that one side trade liberalization promote economic growth in India, other side they have led to some potentially adverse environmental consequences. These results suggest that there is a trade-off between the economic gains from liberalization and the environmental consequences from liberalization.

There are several limitations with this study. First, The IPPS is based upon the 4-digit industrial classification at SIC level for the year 1987 while the NIC and ASI has revised its classification up to the year 2008. In order to determine the pollution intensity coefficient of various manufacturing industries, the study has to depend on the 1987 classification. Therefore the IPPS classification is not able to capture the effects of the modernization of techniques that emits less pollution. Second, absence of Indian pollution-intensity data, we have used pollution measures from the US as proxies (as suggested by previous IPPS studies). Should pollution-intensity data from India become available. Third, Due to lack of plant-level emission data it is not possible to actually test whether emissions increased or decreased in manufacturing industries.

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