

Foreign Direct Investment, International Trade, and the Environment: Evidences from India

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ABSTRACT

India has adopted the liberalization policy in 1991 which has reduced the trade barriers and investment restrictions and increased the foreign direct investment (FDI) inflows and GDP (Gross Domestic Product) growth of the economy. At the same time it has impacted the environment and energy usage. This paper examines the direction of causality between FDI inflows, trade, GDP, energy use and CO₂ by using Granger Causality test since liberalization. The findings of the paper revealed that there is one uni-directional (GDP and Energy Use) and bi-directional causal relationships (Imports and energy use) found. The direction of causality reveals that economy is majorly dependent on energy sources (Coal, Gas etc) for development and growth which makes India dependant on conventional sources of energy. In long run these conventional sources of production turns out as major factor of environmental degradations. The paper concludes the policy recommendations that will ensure environmental friendly investment and growth in India for future.

1. Introduction

FDI is very well defined by UNCTAD (United Nations Conference on Trade and Development) and its World Investment Report in 2006 by stating that "FDI is an investment involving a long-term relationship and reflecting a lasting interest and control by a resident entity in one economy (foreign direct investor or parent enterprise) in an enterprise resident in an economy other than that of the foreign direct investor (FDI enterprise or affiliate enterprise or foreign affiliate)". In the global economic scenario, dependency for trade and investment has increased drastically. Trade on the one side of the globalization helps in transferring goods and services from one territory to another, while FDI is seen as a driver of international economic integration and a major catalyst of economic growth. Economic integration in form of FDI gives opportunity to developing countries to make a move from domestic exports to international trade, reduce foreign government's pressure, increase the capacity to produce with the inflows of better technology, opportunity for joint-ventures, joint marketing arrangements, licensing etc.

The analysis of FDI since liberalization has substantiated the fact that FDI is bringing in technology, managerial skills, and investment, which in the end have contributed to GDP and growth positively. But the contribution of FDI in Indian economy is much more nuanced than just the above listed impact areas; FDI brings various other spillover effects along with it to the host country also. FDI inflows and outflows became a matter of debate when these spillover effects were seen on society, geographies and environment. The matter was then acknowledged and analyzed by academicians, researchers and environmentalists with various different points of view. Those who encourage FDI, point towards its role in economic development of developing and underdeveloped countries as it brings better technology, capital, employment, skills, environmental awareness, and growth stimulation. On the other end of the argument's spectrum, it is said that FDI hampers

economic growth because of instability causing macroeconomic factors such as environmental deterioration, terms of trade deterioration and balance of payment crisis. After four decades of restrictive trade policy, India adopted economic liberalization policy and emerged to amongst the FDI and trade destinations in the world. The increasing importance of FDI cannot be ignored, but the impact of FDI on environment needs more detailed investigation.

There are many researches and theories that favour FDI such as Porter hypothesis, which claims that, with increasing income developing countries tend to adopt more strict environmental regulations, as the environment is considered as a normal good. Similarly OECD report (2001) also found that by transferring techniques of production that are more efficient and environment friendly can help achieve higher environmental standards. The famous Endogenous Growth Theories believe that FDI has a major role in promoting growth in the host country as per this theory suggested by Lan, FDI is a way to transfer knowledge, bring in technology spillover and human capital growth. Another approach called the Technology-gap approach deduced that by transferring environmental friendly techniques of production in the form of FDI might have positive effects on environment of developing countries. The famous Simon Kuznets in 1955 states that as the per capita income levels rise, the people begin demanding a cleaner environment by creating political demands for tougher environmental standards. It is generally stated in the FDI-environment debate that FDI brings pollution intensive inflows to low-income industries because of their lenient regulations.

Alternatively, FDI is accused of being a major factor in resource depletion, environmental degradation and is also accused of welfare loss. The argument against FDI is supported by pollution haven model that asserts the line of thought that the environmental standards and regulations are

relatively lax under globalization in developing countries. Thus these pollution havens have a comparative advantage in attracting pollution-intensive foreign capital and have low domestic expenditure on environment protection. The weak environmental regulations have made developing countries a prime destination for trade and investment. As stated in the classical trade theory of comparative advantage, lowered (less stringent) environmental laws decrease the cost of production and vice versa. Therefore, these countries with loose environmental laws and regulation are bound to have a comparative advantage in the production of polluting goods.

As seen above both arguments are strong and supported by many theories and researches which put the role of FDI in intense debate. This debate cannot be left alone without discussion on the puzzling dimension of environment and FDI. Therefore, before, going into rigorous econometric exercise a detailed analysis of literature will give theoretical support to the two sides of FDI. The upcoming section will analyze in detail the positive and negative impact of FDI in India with the support of previous researches.

2. Literature Review

While analyzing the huge literature on the topic, it was found that studies conducted previously have ignored the endogenous nature and the possibility of a causal relationship between economic growth (FDI) and the quality of environment. Very few studies have analyzed the dynamic movements of the relationship between Foreign Direct Investment and environmental quality hence in this section of the paper will draw attention to analyze the relationship between GDP, trade, FDI and environment (CO₂ and Energy Use) by different academicians and researchers. The relationship between economic growth and foreign direct investment has been intensively analyzed empirically over the past two decades, some studies found positive impacts and some detect negative relationship between the variables. Like in a study by Zarsky and Gallagher (2008), they stated that multinational enterprises are very particular about environment and operates with company-wide environmental standards. Hence when FDI flows from a country with higher environmental standards to countries with lower environmental standards, the net impact emanating for them is green. In another study, Mukhopadhyaya and Chakraborty (2005) developed an index for trade in India in terms of pollution. The results showed that India is producing more environment friendly goods than the goods it is importing. OECD (2005) also favored FDI inflows and stated that trade liberalization and market opening in environmental services has potential to yield important economic and environmental benefits. In a research by Mihci et al. (2005), measures the relationship between FDI and environment by creating a model based on an integrated approach. The finding of Eskeland and Harrison (1997) also strengthen that in developing countries FDI is able to reduce pollution by using eco friendly production techniques that they say are "significantly more energy efficient and use cleaner types of energy than local firms". Aliyu (2005) found similar results as Eskeland and Harrison (1997) found in their study. The study reveals that FDI helps in reducing the pollution levels of the developing countries because of the use of more environmental friendly techniques brought in as part of the

foreign investment. The study also opposes the Pollution Havens Hypothesis (PHH), since Latin America did not see any specialization in pollution intensive sectors because of FDI. The study further concludes PHH occurs only for closed economies but in the case for free economies FDI always accompanies more efficient environmental techniques that help reduce pollution and exploitation of resources. Agreeing with this line of thought, Copeland and Taylor (2003) make a case that rigorous environmental laws are not appropriate instrument to see the effects and the direction of FDI. They added pollution havens effect may be possible (temporary) but the hypothesis may not be entirely true. They have performed another research with Antweiler in 2001, in which they investigated the relative strength of the three effects (scale, composition, and technique effect) and concluded that free trade has a net positive impact on the environment. The Technique Effect is used to "measure the change in aggregate pollution or environmental degradation arising from a switch to more environmentally sustainable production technique such as constant Scale and Composition effects". This explains tendency for higher income nations to place a huge importance on cleaner environments. At a global level to the increase in free trade is linked to an increase in world income, which further pushes up the demand for a better environment.

On the contrary, studies which found FDI negative for environment of the host economy are many like, study conducted by Pao and Tsai (2011) by using panel co integration techniques found negative effect of FDI on CO₂ emissions for Russia, Brazil, India and China during 1980-2007. The results enforce the PHH by demonstrating a positive relationship between FDI and CO₂ emissions. There research also conducted further a Granger causality test showing the bi-directional relationship between FDI and CO₂. In another research by Joyshri Acharyya (2009), effects of carbon emission caused by FDI induced growth in case of India were examined. The results of the study indicate that CO₂ emissions are amplified because of output growth. The study also demonstrates the weakness in PHH as it was unable to explain the rise of FDI in 1990s. She also added the fact that the outcomes could be slightly different if different pollutants were used. Similarly, Dean (2002) estimated the impact of trade liberalized on the levels of water pollution in Chinese provinces. Dean's research used a simultaneous equation system to prove that trade worsens pollution through improved terms of trade but cancels it via income growth. Furthermore, Xing and Kolstad (2002) also examined the impact of the FDI originating from USA on the quality of environment in both the developing and developed countries. They discovered that the developing countries usually deploy relaxed environmental regulations in order to attract trade from the pollution intensive industries located in the developed economies. Furthermore, Levinson and Keller (2001) estimated the impact of the change in environmental standards by looking at FDI to the United States of America and the differences in the cost of pollution abatement all across the various states. Following the patterns of international investment they found evidence that increasing costs of pollution have had a slightly detrimental effect on foreign investments. Jha et al. (2000) performed a study on China and found that due to strict environmental regulations in developed countries, some overseas enterprises have moved

to China, especially in the smelted products, leather goods, pharma and chemical industries. Jha was however unable to point to any specific evidence that fortified this assertion. Copeland and Taylor (1994) & Chichilinsky (1994) found that "more trade probably means more production, and that has historically meant more pollution. Moreover, as dirty industries have the tendency to migrate to countries with low wages and lax environmental standards, trade liberalization would have important consequences for the international distribution of polluting industries". In contrast, Grossman and Krueger (1993) have looked at how NAFTA (North American Free Trade Agreement) has impacted environment in North America. They could not find any evidence that Mexico had any comparative advantage because of its relaxed environmental laws.

Thus the above mentioned literatures are giving an overview of positive and negative impact of FDI on various economies. This shows that FDI on the positive side encouraged the use of environment friendly technologies, terms of trade, high environmental standards, bringing in new technologies, benefits economy and environment. While, the other side of the FDI against literature is equally strong as it claims FDI is encouraging pollution intensive trade, deteriorates environment of host country, creates pollution heavens, more pollution and carbon emissions. Thus drawing a conclusion at this level is not easy as both the arguments from literature review are strong enough and cannot draw a conclusion that whether FDI is good for economy or not? Hence an empirical analysis can be a useful tool to see the exact relationship between FDI and environment which is dealt in the upcoming section of the paper.

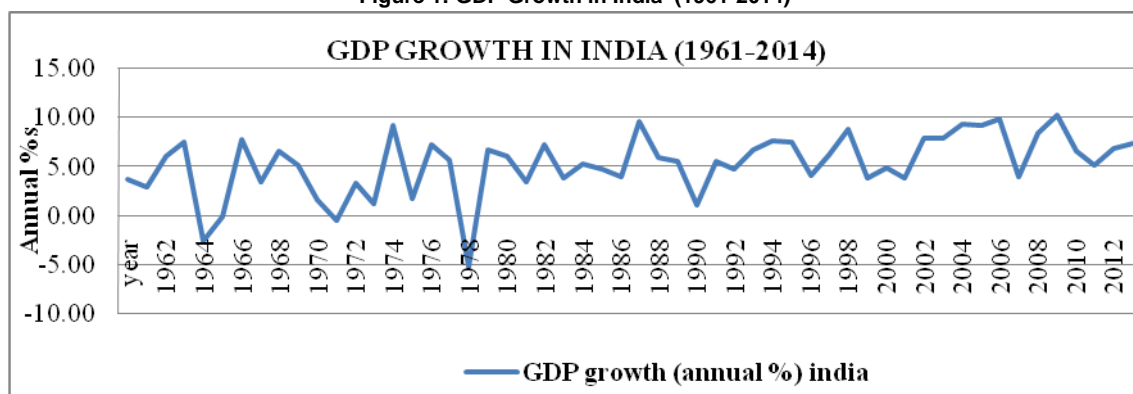
3. Background and Trend of Variables in India

This section will deal with the trends of variables (FDI, CO₂, Trade, energy and GDP) in India. India has adopted economic reforms in 1991 and the major change in the trends of these variables can be easily seen in the graphs before and after that. Beginning with GDP growth in India, Figure 1 shows the patterns of GDP (Gross Domestic Product) growth from 1961 to 2014. The curve clearly shows fluctuating trends since 1961. India got independence in 1947 and since then economic activities speeded up year to year. The graph showed rapid ups and down till the 1980s with few years such as 1965 (-2.64%) and 1979 (-5.24%) recording negative GDP growth as well. The reason of the negative GDP growth was the severe droughts of 1965-66 and 1979-80. The production process got

affected due to such natural calamities and end up with negative GDP. 1981 was the turning point as it recorded commendable increase in GDP to 6.01% per annum. This was the recovery phase of GDP growth and acceleration. In 1988 the GDP growth in India reached the highest level since 1961 of 9.63%. The Indian economy has shown strong recovery in agriculture production and sustained growth of industrial sector. Also this was the time when the key infrastructure sectors were also performing well, Wholesale price index (WPI) has also come down by 10% in 1988 and inflation rate in terms of consumer price index has also come down.

1991 was the year of adoption of economic reforms, before that trade, investment were restricted in India which resulted to slow economic growth. In 1991 GDP was recorded 1.06% that was also the time when India was quickly recovering from the 1991 crisis and the stabilization effort was followed. Furthermore, in 1996 it reached the growth of 7.55%. The 1990s was the decade when the overall economic environment in the global arena was favorable. Still India faced severe balance of payment crises, foreign exchange didn't last beyond two weeks. This has increased the vulnerability to external shocks. Year 1997-98 were slow GDP growth years because of fallout of Asian economic crisis. During year 2003-2007, India continued to maintain the GDP growth of approximately 7% and 9%. During year 2000-02, the worldwide bursting of the dotcom bubble and 9/11 incident took place which impacted GDP to some extent. Year 2008 is an important year to analyze as it was a year of global economic crisis and GDP reached 3.89%. The global crisis was due to collapse of Lehman Brothers (the World largest insurance company), affected India in the middle of its cyclical economic nadir. The collapse led to a withdrawal of foreign institutional investment (FIIs) in order to provide liquidity to the parent organizations in Europe and US. Year 2009 recorded 8.48% that was the time when the economy was recovering from global economic crisis and managed commendable growth. Year 2010 has reached the two digit value of 10.2% which is due to high growth in transport, communication sectors, financial sector grew and impressive agricultural growth. The trend of GDP shows decline of 6.64% in 2011 and in 7.4% 2014. The low of GDP of 2011-12 was due to the slowdown in construction and mining industries. The sustainable growth of GDP and GNP growth of India since 2008 has made India now "upper middle income country" instead of lower income country.

Figure 1: GDP Growth in India (1961-2014)

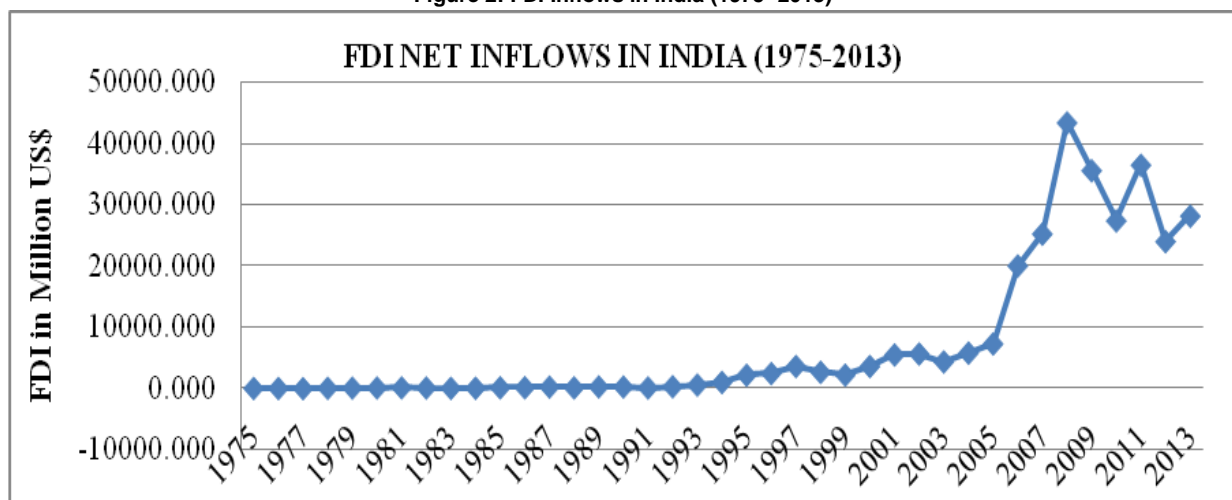


Source: Authors' Computation based on data from World Bank database.

Figure 2 reveals the trends of FDI inflows since 1975 to 2013. The FDI pattern reveals some volatility and this was due to the change in the major structural reforms along with the large scale liberalization of exchange rate and international trade. The graph also clearly shows a stagnant and slow growing trend of FDI till 1996. FDI was almost negligible till late 1980s due to restrictions in regulations for foreign investment in India. In 1991, India adopted liberalization policy along with significant liberalization of the international trade and exchange rate policies. The FDI inflow was recorded 276.51 Million US\$ just a year after the adoption of economic reforms. Since then a growing trend of FDI inflows can be easily observed in the graph. The share of FDI was much lower than the most of world countries before 1997. In 1997, FDI has made substantial growth of 3577 Million US\$ in 1997, due to the liberalized policy adopted by government towards FDI. RBI (Reserve Bank of India) removed the restrictions imposed on direct and portfolio-based investments. RBI also revamped the application and approval process for financial and technical collaborations and also provided automatic approvals to many industries in India. The upward rising trend of FDI continues

since 2003, while during 1998-2002 the FDI has gone through frequent ups and downs. In 2003, it was recorded 4322.74 Million US\$ which grows to 7269.40 Million US\$ in 2005. Various measures were taken to encourage FDI inflows including liberalization of equity capital, 100% FDI in tea industry, 100% liberalization in petroleum products marketing and many more. Year 2006 recorded speedy growth of 20229 Million US\$. The main reason of increase was approval of FDI in retail sector; which gave a sudden boost to the inflows. Year 2009 recorded 35581.37 Million US\$, that was the time when the economy was recovering from world economic crisis and managing to overcome from fragile foreign investments. India became a preferred investment destination of developed countries over the years still the slowdown of investment in recent years can be seen like 36498 Million US\$ in 2011 and further decline to 28153.0 Million US\$ in 2013. The reason of slowdown are not taking adequate steps to open few sectors for investments which hurt the sentiments of investors, limited availability of long term capital, higher inflation rates and interest rates leads to the deterioration in FDI.

Figure 2: FDI Inflows in India (1975- 2013)



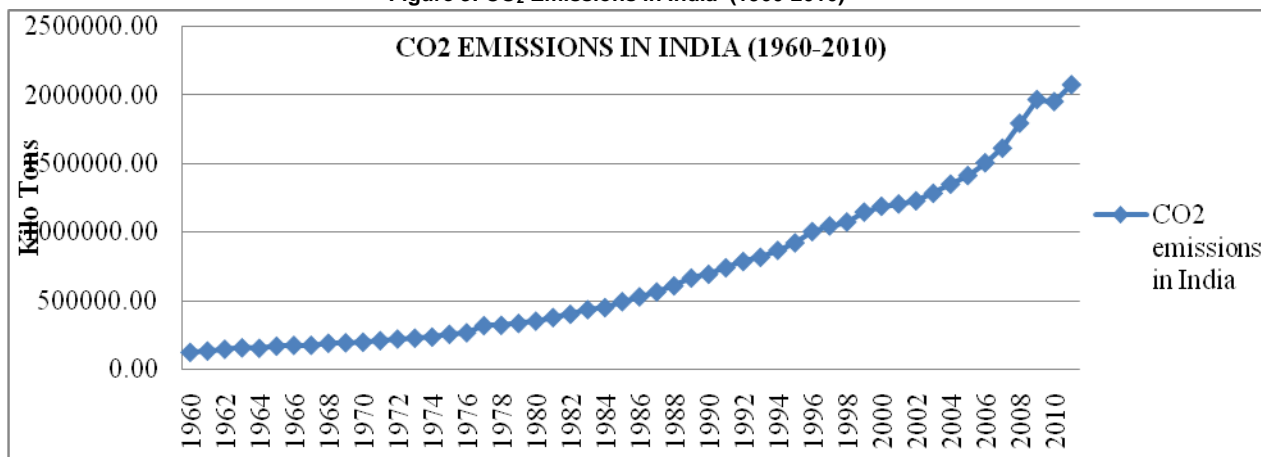
Source: Authors' Computation based on data from World Bank database.

The Figure 3 shows the Carbon emission trends since 1960s till 2010. The graph has an upward rising trend which first of all shows that CO₂ emission has rapidly increased in India and secondly, the emission has a steep rise to degrade the environment in India. India has experienced a multifold growth in emissions of CO₂ (average growth is 5.7%) and has become the third largest fossil fuel CO₂ emitting country. The data reveals that CO₂ emission increased very rapidly from just 120,581.98 Kt (Kilo Ton) in 1960 to 195,143 Kt. In 2000, the CO₂ emission was 1,186,663 Kt, which is just double of 348,581 Kt (1980) and to 690,576 Kt (1990). Since 1991, economic reforms has increased the economic activities in India in the form of production, distribution, investments, supply etc which consumes more energy and results in carbon

emission which has more than doubled and reached 7 digits levels.

The major source of emissions by fossil fuels in India is the burning of coal. India also happens to be the third largest coal producer in the world. According to BP Statistical Review, India closely follows US and China in emitting CO₂. In 2005 the emission intensity has increased by 35% and recorded 1411127.60 Kt. In 2010 India emits 2,008,823 Kt, which is again an exponential growth since 2000. Based on its heavy emissions, India has promised to the global forum that it would start generating 40% of its electricity from renewal and non fossil fuel sources such as solar, wind and nuclear by 2030. For this, India has asked for help from the developing countries.

Figure 3: CO₂ Emissions in India (1960-2010)

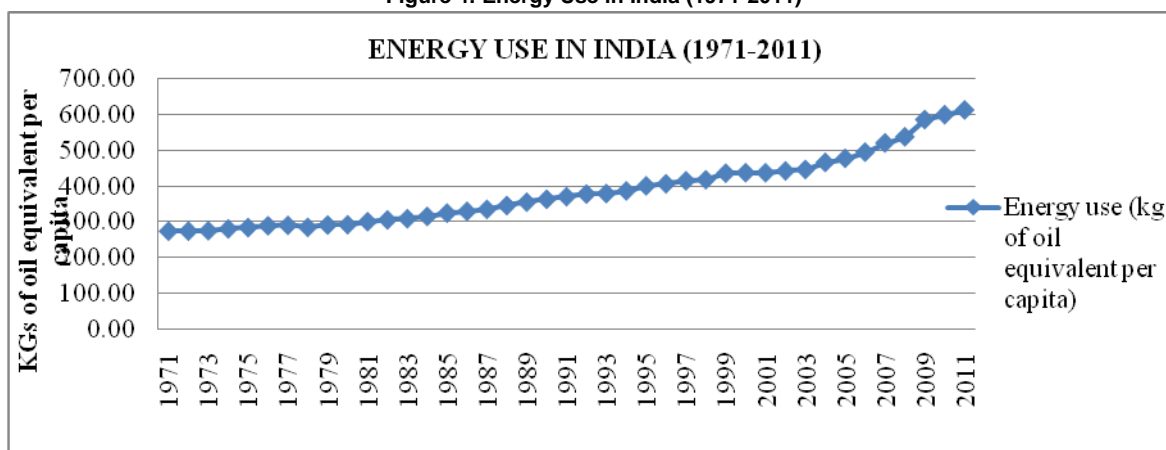


Source: Authors' Computation based on data from World Bank database.

Figure 4 shows the trends of energy consumption from 1971- 2011 and similar to carbon emission; energy consumption has seen a speedy upward rising trend. It was recorded at 275Kgs in 1971 and grew to 302Kgs in 1982. It is clear from the data that the consumption from 1977-1980 was increasing at slower rate while 1981 onwards the rate of consumption grew at much faster rate. Such pattern of energy consumption clearly shows that before 80's economic activities were not that massive as compare to 1990s onwards. A positive correlation can be seen between economic activities and energy consumption; higher the economic activities, greater will be the energy use in an economy and vice-versa. Hence in the 1990s when the economic reforms encouraged economic development, large-scale industrialization and

urbanization, rate of energy consumption rose to 371.74Kgs in 1991 to 402Kgs in 1995. Within 5 years of liberalization, energy consumption grew at a rate of 100%. Being a developing country India faces the drawback of less capital, less modern machinery, obsolete technology etc. which create a high propensity to consume energy. Year 2007 onwards the consumption level reached a different level of 200% increase and recorded 521.67Kgs, furthermore to 600.31Kgs in 2010 and 613.72Kgs in 2011. In recent years India has shown a keenness to improve the energy efficiency by diversifying its fuel types. With the growing population, demand for energy is increasing at geometric mean and it is assumed that if India will proceed with this path soon it will be most polluted country as well.

Figure 4: Energy Use in India (1971-2011)



Source: Authors' Computation based on data from World Bank database.

Figure 5 shows the trends of exports and imports in India since 1975 to 2010. The amount of exports and imports shows a rising trends. A sudden rise in the trade can be seen since 1991. India has also faced trade deficit in international trade since the beginning. Talking about exports first, India is a largest producer of petroleum, pearls, gold, Iron and steel, cotton fabrics, pharmaceuticals, aircraft space crafts and parts and exports to various countries of the world including USA, UAE, Hong Kong, China, Saudi Arabia, Singapore, UK, Germany and many more. The exports were recorded at 5560.86 Million US\$ in 1975 which further rose to 11439.61 Million US\$ in 1980. India's export sector has demonstrated

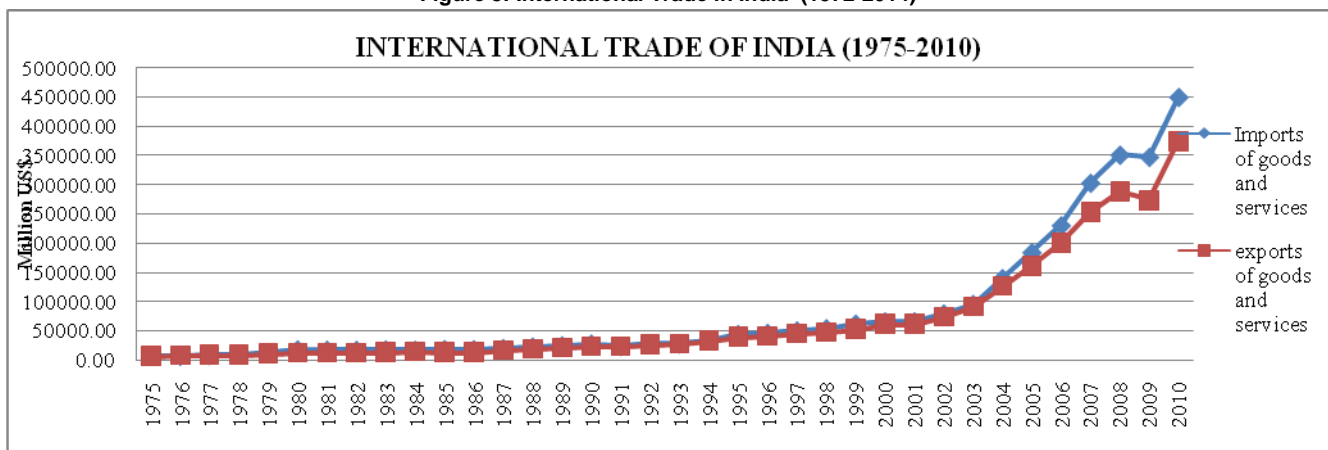
considerable growth in the past years and continues to do so. 1991 onwards exports geared up the pace and grew exponentially and recorded 22943.41 Million US\$ and further doubled in 1996 to 40802.99 Million US\$. The export performance of India is increasing over the years, which helps to reduce its dependency on other countries for goods and service. In year 2000, export earnings were recorded 60878.40 Million US\$ which grew to 288902.15 Million US\$ in 2008. 2008 was the year of economic crisis. In spite of the challenge to the export sector posed by the global meltdown, the merchandise exports were recorded at a respectable 375353.47 Million US\$ in 2010. IMF's World Economic Outlook

October, 2011 stated that "world trade recorded its largest ever annual increase in 2010". According to WTO International Trade Statistics (2010), India was ranked 20th among the largest exporter and 13th largest importer in the world with a share of 1.4% and 2.1% in 2010. Year 2011 was a troubling year for trade for many reasons like, Japan was affected by Tsunami, there were uprising in the oil producing countries in the Middle East, the US and European economies cooled down.

On the other side import is also an important variable of trade and the major importing countries are China, Saudi Arabia, UAE, Switzerland, USA, Indonesia, and South Korea etc. The major commodities of imports are mineral oils and fuels, telecom, peals and gold etc. The principle imports in India are classified as food and allied products, raw materials and intermediate manufacturers, capital goods and other

goods. The imports value was recorded 6545.39 Million US\$ in 1975 which grew to 17225.93 Million US\$ in 1980. In 1990 it was recorded 27132.07 Million US\$ and doubled in 1995 with the amount of 43318.36 Million US\$. The increased imports are due to the increasing oil prices and increasing demand in the country. The growing population creates higher spending on gold, gems, oil and petroleum, machinery etc. In 2001, imports of India reached to 65218.41 Million US\$. The main import commodity, fuels and mineral oil raised the imports amount heavily. It increased to 139310.17 Million US\$ in 2004 and further after six years to 449974.32 Million US\$ in 2010. During 2011-12, India created policies that were aimed at limiting the import of gold. In 2013-14, a decline in imports from the United States was attributed to the decline in gold and silver imports as well as the moderation in imports of machinery.

Figure 5: International Trade in India (1972-2014)



Source: Authors' Computation based on data from World Bank database.

4. FDI, Growth and the Environment: Empirical Evidences from India

In the light of theoretical background of the variables (GDP, FDI, Trade, CO₂ and Energy consumption) it is clear that the relationship between these variables cannot be neglected or passed over. The arguments show that both positive and negative effects exist and the picture will be clearer with the help of empirical analysis. The objective of this empirical analysis is to see the long run causal relationship among the variables (GDP, Trade, energy consumption, CO₂ and FDI inflows) since liberalization in India. For attaining the objective, there are few subsections. The first subsection above dealt with the time series trends of the variables. The upcoming section is based on empirical investigation of the variables with the help of an econometric model. The empirical analysis will help us in developing an understanding the real work implications of the adoption of liberalization and FDI inflows in India.

5. Data Sources and Methodology

For empirical analysis, six variables are chosen in India. The six variables are GDP, FDI inflows, CO₂ emission, Energy use, Exports and Imports and these variables are chosen as a proxy of different economic indicators. Like GDP is a proxy of Economic growth, Exports and imports are proxy of International Trade, FDI is used as a proxy of investment and

CO₂ and Energy use are the proxy of environment. The data for various indicators are kept the same and collected from World Bank development Indicators. The time frame chosen for the analysis is 1975-2010. The reasons of choosing the time frame are based firstly on the desire to study the long run relationship between the various variables over a considerable length of time. Secondly, this helps to analyze the relationship among the variables before and after liberalization.

The analysis involves checking the stationarity of the variables at different levels of significance by taking them in the log form. The Augmented Dickey Fuller tests are used to test the stationarity of the variables. The Dickey Fuller test checks whether the unit root is present in an autoregressive model or not. For further analysis all the variables should be stationary at similar levels otherwise it becomes difficult to carry out any meaningful econometric exercise. Once all the variables are stationary, Johansen co integration technique is used to establish long run relationship among the variables. Johansen co integration is a procedure of testing co integration of time series. Co integration is statistical property of a collection of time series variables. Last but not the least Granger Causality test is used between the variables to test the direction of causality. Granger (1969) proposed "a time series data based approach to determine the directions of the relationship among the variables". The different directions for these purposes are unidirectional, bidirectional and lack of causality. The causality

determines the direction of the relationship among variables (Like if x is a cause of y, then the value of x should be useful to forecast y). This test helps in forecasting. The ADF test performed is given in the following regression equation:

$$\Delta Y_{t-1} = \alpha_0 + \gamma Y_{t-1} + \alpha_2 t + \delta_1 \Delta Y_{t-1} + E_t$$

The above regression equation shows the existence of unit root of Y_t is in the logarithm format for the FDI and other variables at time t. Here, Y_{t-1} shows the first differences with p lags, E_t is the variable that adjusts the errors of autocorrelations, α_1 and the coefficients are the estimates and the null and alternative hypothesis is for the existence of unit root in variable Y_t is depicted as:

$$H_0: \delta_2 = 0 \quad H_c: \delta_2 < 0$$

The results of the ADF tests for FDI and its variables are explained and discussed in upcoming section with the trends for their logarithmic levels and differences.

6. Results and Discussions of Empirical Analysis

• Stationarity Results

The first and foremost step of the analysis is concerned with the stationarity of the variables. The Augmented Dickey-Fuller test (ADF Test) is conducted the variables to check the unit root of the variables. It is the first and foremost condition of Granger Causality that the series have to be covariance stationary (Danladi & Akomolafe 2013). The results of stationarity are presented in Table 1 of the appendix. The result shows that none of the variables are stationary at level. All of the variables became stationary at first difference. The MacKinnon (1996) one sided p-values for the Augmented Dickey-Fuller (ADF) test are 0.00 for CO₂ emissions, energy consumptions, FDI inflows, GDP, exports and import respectively at 1%, 5% and 10% significance level.

• Co-integration

To test the long run equilibrium relationship among the variables (GDP, FDI, imports, exports, CO₂ and energy use) requires a second round of analysis with the help of Johansen Co-integration test. The co-integration test is very significant; as it helps to determine if the variables under study have the tendency to move together (converge) in the long run. Table 2 in Appendix shows the results of Johansen co-integration test and explains that there exist three co-integration equations at 5% level of significance with the p-values of 0.0582 for $r \leq 3$. While at none, $r \leq 4$ and $r \leq 5$ the null hypotheses was rejected at 5% level of significance. The rejection of null hypotheses means that the co-integration equation exists and secondly there does not exist more than three co-integration equations among the variables. Thus the existence of co integration implies that there is a long run relationship among the three variables.

• Causality

After determining the stationarity and existence of the long run relationship among the variables through Johnson co integration, now the Granger causality test can be applied. According to Danladi & Akomolafe (2013), "If a set of variables are co-integrated, the effects of a shock to one variable spread to the others, possibly with time lags, so as to preserve a long-

run relationship between the variables". The Table 3 in Appendix shows the results of Granger Causality Tests. The results found clearly shows there are three causal relationships which exist. No causal relationship was found between exports from India and CO₂ emission. India is the largest producer of minerals, oils, pearls and precious gems, followed by pharmaceuticals, vehicles etc and exports mainly to developed countries like USA, UAE, Singapore, China, and Hong Kong etc. Similarly, no causal relationship was found between imports to India and CO₂ emission. India's biggest import partners are China, UAE, Saudi Arabia, USA, and Switzerland etc with products such as crude petrol, gold and silver, electronics, pearls and gems etc. The main importing countries are developed and take care of environmental norms during production, consumptions and distribution of the goods and service. The long run causal relationship between imports and CO₂, exports and CO₂ was assumed to be obvious but the result came negative. This clearly shows that India follows international standards that require low carbon emissions to attain high environmental standards in production and international trade. Furthermore, instead of using CO₂ emitting energy sources in long run, India is using other means of energy sources in production and consuming those sources of energy which are carbon free.

On the other side a bi-directional causal relationship is found between India's imports and energy use with 0.05 and 0.02 probabilities. This shows that India is importing energy, consuming goods and services such as crude oil, electronics etc; the manufacturing of which involves huge energy consumption (Oil, electricity, natural gases). The use of conventional sources of energy has declined and been taken over by renewable sources of energy such as natural gases, electricity etc. The situation works the other way round as well, which implies that energy consumption gives rise to imports in India; which is again justified. Greater the energy used, larger will be the production that takes place and will further give rise to demands in forms of imports by India from trading countries.

In the case of India, against the expected view that the causal relationship exist between FDI and economic growth, FDI and CO₂, FDI and energy use, no relationship was established within the given time frame in the analysis. This shows firstly, that the share of FDI in percentage of GDP is very little in case of India; it was recorded at just 1.7% in 2014, up from 1.31% in 2012, which grew from 0.02% in 1991. This little share of FDI in GDP became a crucial reason not to draw any long run relationship between the two variables. Secondly, the reason of this little share is India being an agrarian economy initially. The highest share to GDP was contributed by agriculture, followed by industries and then services for a long time. In India maximum FDI inflows takes place in services and this is the reason that also satisfies for no causality between FDI and CO₂. FDI in services is highest (41% share) followed by manufacturing (telecommunications, automobiles etc) with 23% which are less CO₂ emitting sectors comparatively and hence the long run causality is nil. Secondly, the inflow of foreign institutional investment in recent years has grown at a faster rate as compared to FDI inflows, which are a non-CO₂ emitting sector and thus no causality between CO₂ and FDI. No causality is found between FDI and CO₂ and this may be

another contradictory empirical result. Since it has been argued in academic and international debates that inflows of FDI deteriorates the environment in developing countries where environmental laws are less stringent. Similarly, no causal relationship was found between GDP and CO₂, GDP and exports and GDP and imports. No causality between GDP and CO₂ suggest that as the economic activities increases in the country (India), the rate of pollution (CO₂) does not increase. As mentioned in above paragraph, GDP in India is increasing and majorly in the non-polluting sectors in India. In India the production of goods and services helps in increasing the GDP without going causal with carbon emission level. The GDP found no causal relationship with trade (Imports and Exports) that is again a debatable result.

India's trade and economic reforms have produced positive results. Between 1990 and 2005 India's trade to GDP ratio has jumped to 35% of GDP from a mere 15 % at the beginning. Being an agrarian economy, the role of agriculture and industrial sector is much stronger than external sector (International Trade). Though the economic reforms were adopted, there are still restrictions like anti-dumping measures that are used as ways to protect trade. India has been one of the few countries remaining that disallowed FDI in retail trade for very long time. Although this policy has been somewhat relaxed recently, it remains considerably restrictive. Furthermore, no causality is found between FDI inflows and international trade (Exports and imports), FDI and energy use in India. The relationship between trade and investment is the result of globalization and liberalization policy of 1991. This has opened up the Indian economy for trade, yet the long relationship between FDI and trade does not exist. The relationship is complex and cannot be inferred only through theoretical arguments and thus econometric exercise was performed. The result of causality clearly shows that investment in India is not responsible for India's trade share in world and vice versa. India is not dependent on foreign investments to increase its international trade performance in long run. The case of India is supported by the United Nations Conference on Trade and Development (1996), definition which says that conceptual models of FDI and international trade have traditionally been developed separately. The Heckscher Ohlin-Samuelson model which suggests that "international trade can substitute for international movement of factors of production including FDI" supports the result. Thus as a result it can be said that in case of India both the variables (Trade and Investments) are growing separately. In case of FDI inflows and energy consumption, no causality is found which shows that FDI does not lead to energy consumption increase in long run. The following study supports the argument that says that there exists no causal relationship among the energy use and FDI inflows like, Sbia et al. (2014) found FDI reduces the energy use as there is a negative relationship between FDI and energy consumption. Similarly, Lee (2013), Omri and Kahouli (2014) & Dritsaki and Dritsaki (2014) found economic growth is not affected by FDI, energy and Carbon emission.

A unidirectional causal relationship was found between GDP and energy use with a 0.04 value. Energy is critical to the economy on the supply as well as the demand side. On the

supply side, energy is a key to production, labour and capital. On the demand side, consumers maximize energy usage to improve its utility. Thus energy plays a very important role in economic growth and the betterment of living standards. Thus in case of India it implies a causal relationship running from GDP to energy which concludes that India is energy dependent for growth. The argument was also supported by scholars such as Masih and Masih (1997) who believed that "if causality only runs from GDP to energy consumption, this implies that an economy is energy dependent". Thus, as observed by many others too, the government can implement energy conservation policies without worrying about any possible negative ramifications to employment and growth. Furthermore no causality was found between the other two sets of variables such as imports and exports, export and energy use. The trade balance of a country depends on the level of exports and imports. Thus these variables play a significant role in the country's economy. If exports and imports are not going hand in hand as was found in the results in Indian scenario, it can be said that there is trade deficit in International trade. The trade deficit for April-August 2015-16 was estimated at US \$57516.09 Million later, it has lowered down from US \$58218.04 Million during April-August, 2014-15. This results to no long run causality between the two. Similar was the case of exports and energy use, it is a very well known fact that production process involves energy use and if the two are not moving in one direction in long run that shows that energy consumptions for exported product is a short term process. While in long run energy consumption is either minimized by the producers or other renewable sources of energy will be used rather than the conventional one which will take exports and energy use hand in hand.

7. Conclusion, Recommendations and Policy Implications

India embarked on the policy of globalization, liberalization and privatization in year 1991. Initially FDI was permitted in a small number of sectors and later the policy with regard to FDI was liberalized and it has increased in all the sectors of the economy. FDI plays a crucial role in the development of Indian economy. It also helps in the growth of GDP of the country and has shown increasing trends since 1991. Economic reforms have created both positive and negative effects on the environment, geography and society. This paper has attempted to investigate both theoretically and empirical impact of FDI on Indian economy.

The result obtained from literature analysis clearly shows that FDI has both positive and negative effects on environment and society. The reasons for the positive effects of FDI are that it brings better and environmental friendly techniques to the economy along with raising the environmental standards. It has helped India to become more aware about economic and environmental benefits of FDI. On the other hand, it is argued that FDI is also seen to have negative impact on environment in India. The reasons supporting this argument are that FDI inflow displaces the dirty industries from developed countries to developing countries, causes environmental degradation and industrial pollution. It brings pollution intensive industry and deteriorates of environmental quality of the host economy. Hence the theoretical debate ends up concluding FDI brings better and environmental friendly technology in the form of FDI

to those countries where environmental laws are strict and societal awareness is strong. On the other hand economies with weak environmental laws attract pollution intensive FDI which then pollutes the environment.

After a theoretical analysis, an empirical exercise was also performed to find out the actual situation in India after liberalization. The empirical results showed that all variables are stationary at first difference and the empirical results of Co-integration analysis and Granger-Causality test showed that long run relationship and causality among the variables exists. However, there is no causality found between Energy and CO₂, Exports and CO₂, FDI and CO₂, GDP and CO₂, & Exports and CO₂. A long run unidirectional causal relationship between GDP and energy use exists. This unidirectional relationship has clearly shown that increasing economic activities in India are the major cause of energy consumption. The EKC hypothesis is also supported by the positive relationship between GDP and energy consumption in long run, which means that as income increases, consumption and pollution increases but after a threshold level of income and energy consumption begins to decline. In India with economic growth (GDP), with income increase, this also causes high level of energy consumption.

Another bi-directional relationship was found between Imports and energy use. This clearly shows that India is importing energy, consumer goods and services that in long run are energy dependent. This exercise also made it clear that in India, FDI is not causing emission in long run according to Granger causality. This means that the FDI inflows in India are not pollution intensive and government also taking strict actions to follow environmental laws for foreign investment. The other probable reason is that in India, inflows are more in the services (around 41%) than in the manufacturing sectors (around 23%). While the Services make up the majority of the non-polluting sectors of the economy, even the manufacturing sectors in which FDI inflows are prominent for India (telecom,

construction, automobile and metallurgical) are relatively less polluting industries. Hence, FDI in India is non-polluting. An important and interesting reason of no causality between FDI and environment is that in recent years FDI is replaced by FII's (Foreign institutional investments), which is again not a direct polluting agent to the economy. Hence, empirically India is at better place in South Asia in terms of dealing with the negative effects of FDI.

Thus all the above mentioned findings have important policy implications and thereby this paper suggests attention has been turned to the environment in India. Though the Indian government is actively involved in the process of environmental friendly policy for foreign investment and economic growth but due to the lack of implementations they are lacking behind. The attention to environmental regulation in India should be paid because the demand for environmental quality rises with income and the energy consumptions over the years. Now the India instead of focusing on the traditional approach to environmental regulations through permits consents, monitoring and enforcement has often been slow, contentious and costly shift to new approach of energy saver and environment up gradations. The new approaches to more effective pollution regulation like more proactively prevent pollution at the level of production, focusing on treatment and clean-up. There should also be need for regulation, environmental taxation for externalities, quality standards and clearly defined limits with respect to certain discharges, and improvements in process and management to reduce the volumes of pollution generated. India should design its production and distribution process in such a manner that it helps in increasing the GDP growth and upgrade the environmental standards by reducing the emission level and energy consumptions. Diversification of FDI inflows to the environmental friendly sectors, imports of green FDI, through carbon credit, etc can help the Indian economy to reach the sustainable development.

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APPENDIX

TABLE 1: RESULTS OF UNIT ROOT TEST

Results of Unit Root Test for CO₂ (Differences)

Null Hypothesis: D(LICO ₂) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, MAXLAG=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-6.147002	0.0000
Test critical values	1% level		-3.639407	
	5% level		-2.951125	
	10% level		-2.614300	

*MacKinnon (1996) one-sided p-values.

Results of Unit Root Test for Energy Use (Differences)

Null Hypothesis: D(LIEnergyuse) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, MAXLAG=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.424545	0.0001
Test critical values:	1% level		-3.639407	
	5% level		-2.951125	
	10% level		-2.614300	

*MacKinnon (1996) one-sided p-values.

Results of Unit Root Test for Exports (Differences)

Null Hypothesis: D(LIExport) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, MAXLAG=9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-3.948716	0.0045
Test critical values:	1% level		-3.639407	
	5% level		-2.951125	
	10% level		-2.614300	

*MacKinnon (1996) one-sided p-values.

Results of Unit Root Test for Imports (Differences)

Null Hypothesis: D(LIImport) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, MAXLAG =9)				
			t-Statistic	Prob.*

Augmented Dickey-Fuller test statistic			-4.574926	0.0008
Test critical values:	1% level		-3.639407	
	5% level		-2.951125	
	10% level		-2.614300	

*MacKinnon (1996) one-sided p-values.

Results of Unit Root Test for FDI (Differences)

Null Hypothesis: D(LIFDI) has a unit root				
Exogenous: Constant				
Lag Length: 5 (Automatic - based on SIC, MAXLAG =9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.470034	0.0001
Test critical values:	1% level		-3.679322	
	5% level		-2.967767	
	10% level		-2.622989	

*MacKinnon (1996) one-sided p-values.

Results of Unit Root Test for GDP (Differences)

Null Hypothesis: D(LIGDP) has a unit root				
Exogenous: Constant				
Lag Length: 0 (Automatic - based on SIC, MAXLAG =9)				
			t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic			-5.179331	0.0002
Test critical values:	1% level		-3.639407	
	5% level		-2.951125	
	10% level		-2.614300	

*MacKinnon (1996) one-sided p-values.

TABLE 2: RESULTS OF CO INTEGRATING RELATIONSHIPS BETWEEN EXPORTS, IMPORT, FDI, GDP, CO₂ AND ENERGY USE

Hypothesized No. of CE(s)	Eigen Value	Trace Statistic	5% critical value	Probability**
$r = 0^*$	0.817609	143.8121	95.75366	0.0000
$r \leq 1^*$	0.681754	87.65913	69.81889	0.0010
$r \leq 2^*$	0.465259	49.87638	47.85613	0.0319
$r \leq 3$	0.442331	29.21928	29.79707	0.0582

Trace test indicates 3 co integrating equation(s) at the 0.05 level.

denotes rejection of the hypothesis at the 0.05 level.

**MacKinnon-Haug-Michelis (1999) p-values.

TABLE 3: RESULT OF THE GRANGER CAUSALITY TEST

Dependent variable	Δ FDI	Δ LGDP	Δ LENERGY	Δ LCO ₂	Δ LEXPORTS	Δ LIMPORTS
Δ FDI	-----	1.24 (0.30)	0.32(0.72)	0.32(0.72)	2.35 (0.11)	0.04 (0.95)
Δ LGDP	0.16(08.4)	-----	3.14 (0.04)*	2.45 (0.10)	1.76(0.19)	0.05 (0.94)
Δ LCO ₂	0.38(0.68)	0.60(0.55)	0.61(0.54)	-----	0.19(0.82)	0.45(0.63)
Δ LENERGY	0.25(0.77)	1.35(0.27)	-----	1.62 (0.21)	1.97(0.15)	4.17 (0.02)**
Δ LEXPORTS	0.26 (0.76)	0.11(0.89)	1.25(0.30)	0.53(0.59)	-----	1.34 (0.27)
Δ LIMPORTS	0.96 (0.39)	0.23 (0.79)	2.64(0.04)**	0.72(0.49)	0.02(0.97)	-----

Note: ** Indicate the Rejection of the Null Hypothesis at 5% Level of Significance.