FDI, Economic Growth and Ecological Balance: Some linkages in the Indian Context

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ABSTRACT

In the era of globalisation, FDI has been instrumental to economic growth by augmenting capital, employment and productivity in a capital-starved economy; while it also creates ecological complexities via lax environmental regulation and sector-specific performance. Although, this idea has been questioned by authorities like Simon Kuznet who believes a positive income elasticity of demand for the environment followed by an increase in income of the nation compels the government to invest in environmental protection. Against this backdrop, this paper studies the dynamics of co-integration between GDP, FDI and ecology in the context of India by utilising data from 1960 to 2015. Our findings confirm the existence of a causal relationship between FDI and ecological imbalance in the host country. And therefore, warns about the urgency of taking initiatives such as (a) proper coexistence of environmental and economic policies (b) incorporation of stringent rules and regulations (c) investment in clean energy to cater for the need of environmental sustainability in the host country.

Keywords: FDI-environment linkage, Economic Growth and FDI, Ecology and Economy

JEL Classification Codes: F6, Q5, Q56, Q57

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I. INTRODUCTION

Role of capital in economic growth has been widely appreciated by economists globally. Traditional growth models like Harrod – Domar and Solow models consider capital as an engine of economic growth via technology and productive capacity of labour (Mankiw, 2004). But there are certain countries (newly independent and underdeveloped countries) endowed with scarcity of capital and thus lower investment. However, the underlying premise for the well-functioning of capital rests on absorptive capacity of the economy in the form of availability of skilled personnel and technology (Hsing, 1958). In this regard, FDI; being a non-debt financial capital (among other forms of capital such as bilateral and multilateral aids, grants, loans, portfolio investments etc.) is the most preferred way of capital inflow in any economy (Pattayat, 2016) considering its ability to be a catalyst for new technology, new investment and means to increase productivity of labours (Lee, 2013). However, while admiring the role of FDI in economic growth, its environmental implications can hardly be ignored. Economic growth, being dependent on the use of natural resources and their relative interactions with the bio-physical world has certain implications for the environment. The relation between growth and environment has been highlighted through the trade-off between economic growth and better environmental quality although authorities like Simon Kuznet treats such linkage as only temporary. According to Kuznet, in the initial stages of development, growth is coupled with environmental degradation and later, new information combined with willingness to enhance environmental quality through cleaner technology improves the environmental conditions (Lee, 2013). Technically, though there is hardly any relationship between FDI and ecological balance an indirect relationship can surely be ascertained considering the effects of FDI on environmental sustainability through (i) the overall economic growth and (ii) through the sectoral impacts in which FDI is allowed. Therefore, the link between FDI and environmental degradation is widely acknowledged and still, a debatable one among academicians.

II. MOTIVATION

The agenda for sustainable development goals provides a blueprint to attain prosperity of people as well as preserving the planet by undertaking urgent call to protect bio diversity and incentivise growth process simultaneously. However, while striving to attain these goals, sustainable future of India is threatened by increasing economic activities (incentivised by FDI) undertaken to attain economic growth over the years. Several instances of natural calamities and man- made disasters in the pretext of economic growth have ignited interest among academicians to revisit the relationship between FDI, economic growth and ecology. Present paper attempts to re-examine the linkage in context of India.

III.   REVIEW OF LITERATURE

The subject matter of inter- relationship between FDI, economic growth and environment has been explained in different studies, indicating at a possible linkage among above mentioned variables and the factors responsible for establishing the same. There are two broad stand points regarding the relationship between FDI and economic growth.

FDI- to- Growth relationship

Borensztenia et. al., (1998) appreciate the role of FDI in technology diffusion and thus, economic growth in the developing countries. Other supporters of FDI led growth idea (Gupta and Garg, 2015; Hayat, 2014; Acharya, 2009) explain that foreign capital have a favourable effect on economic efficiency and growth. Moreover, a time lag of three years have been proposed by Gupta and Garg (2015) to access the utmost impact of FDI on economic growth. While admiring the role of FDI, the importance of other factors like absorptive capacity of human capital, developed financial market have been duly recognised (Hayat, 2014; Borensztenia et. al., 1998). There are also some literatures (Kaur, 2014; Herzer and Klsen, 2007) find no significant relationship between FDI and economic growth.

Growth- to- FDI relationship

Studies like (Chakroborty and Basu, 2002; Dua and Rasid, 1998) express FDI-growth relationship in a reverse order. Considering the post liberalisation scenario, they find a growth- to- FDI relationship rather than FDI- to- growth relationship in India e.g. it is economic growth of the host country that plays a significant role in attracting FDI and not the vice- versa. Besides GDP, role of other macro-economic factors such as exchange rate, domestic return, domestic output, infrastructure, credit worthiness and trade openness has been highly appreciated in contributing to the inflow of FDI (Dua and Garg, 2015; Reenu and Sharma, 2015; Pattayat, 2016. Sultana (2016) has highlighted the role of exchange rate, trade openness and GDP as important determinants of FDI. Reenu and Sharma (2015), using OLS method and correlation technique in their study find market size and infrastructure as most crucial variables in making India attractive to foreign investors while trade openness has a negative impact on FDI flows. Dua and Garg (2015), using co- integration test, granger causality, impulse response analysis and dealing with data from 1997-2011, find exchange rate, higher domestic return, higher domestic output, better infrastructure, and credit worthiness are conducive to FDI flows to India while reverse is the case in trade openness.

Literatures (Zheng, 2013; Kumar, 1998; Basin, 2016; Sultana, 2016) examining the trend and pattern of FDI in India, find economic liberalisation of 1991 as a major incident after which inflow of capital to India has increased considerably. Zheng (2013) tries to detect the variation in Indian inward FDI patterns from the home country as well as the host country perspective over 18 years (1991-2008) by using log liner model and observes cheap labour as the driving force for attracting FDI from developed economies while FDI from developing economies are stimulated by growing market of India. He also concludes that FDI inflows from East are relied on Indian expanded market and cheap labour, while FDI from West depends on labour and language proximity.

FDI – Environment linkage and 'Environmental Kuznet Hypothesis'

FDI- environment nexus in various literatures broadly cover two things

Recent developments in literatures of *'pollution heaven hypothesis'* or simply known as PHH (a case where industrialised countries prefer to establish their industries in less developed countries because of lax environmental regulations) explore that FDI is attracted into the countries that have relatively lax environmental regulations or lower environmental taxes (Acharya, 2009). Aliyu

(2005) examines the validity of PHH and discovers environmental stringency as the main reason of FDI outflow from Organisation for Economic Co-operation and Development (OECD) countries to non- OECD countries. He believes that stringency is more likely to affect new investment decision than relocation. He also highlights the nexus between FDI, energy use and CO_2 emission (using panel data regression) where he finds a significant relation between FDI and CO_2 which is reverse in case of FDI and energy use in host country.

Supporters of PHH (Beak and Koo, 2009; Aliyu, 2005; Jorgenson et. al., 2007) consider FDI as a major source of CO_2 emission and thus environmental degradation in host countries. Jorgenson et. al. (2007) articulate the potential environmental consequence of foreign investment dependence through Ecostructural Theory (which explains the potential environmental implications of collective human activities, particularly in the context of the control, organization and location of transnational and global production processes) where they conclude that high dependence on FDI in manufacturing sector attributes to noxious gas emission.

However, some literatures (Kawashima, 2015; Lee, 2013) refute this hypothesis on the basis of absence of any significant relationship between FDI and CO_2 emission. Kawashima (2015) studies environmental effect of FDI in developing countries through Ecological Unequal Exchange Hypothesis (i.e. higher the level of FDI intensity, higher the level of CO_2 emission and lower the level of environmental consumption in the host country) and by using OLS method from 1997-2007, discovers FDI neither as a contributor to CO_2 emission nor to environmental consumption in host countries. Considering a case of G20 countries and applying co- integration technique and fixed effect model, Lee (2013) studies the contribution of FDI in clean energy use and carbon emission and concludes discarding the role of FDI neither in energy use nor CO_2 emission in host countries.

In recent past, there are much literatures (Khed, 2016; Shina and Bhatt, 2014; Marguc, 2017) analysing the relationship between environment and economic growth from the prospective of '*Environmental Kuznet Hypothesis*' or EKH (a situation where environmental degradation increases with increase in income initially and after a turning point starts declining). Studies like (Khed, 2016; Marguc, 2014) find no evidence of existence of Environment Kuznet Hypothesis (EKH) in case of India where as Shina and Bhatt (2016) highlight the applicability of EKH in case of India temporarily analysing the data from 1970-2014 by using cubic and quadratic regression in their study. He finds the existence of inverse N shaped relationship in case of India i.e. after a certain point, reduction in CO_2 emission is associated with increase in GDP but at latter stage as GDP increases CO_2 emission increases further. Marguc (2014) has examined the relation between greenhouse gas emissions and economic growth of developing countries such as India and China by using Ordinary Least Squares (OLS), fixed effects and random effects model from 1960-2011 and finds a negative relationship between economic growth and greenhouse gas emission even in the long run. Concept of sustainable FDI (i.e. attaining economic growth through FDI without compromising environment) has been analysed by Nifadker and Dongre (2013) where they suggest India to adopt stringent screening of FDI with regard to Environmental Sustainable Goal (ESG) standards. While analysing the scenario of India and steps taken to attain sustainable

development, they find a dismal picture in terms of irresponsible attitude of government, investors as well as companies. They suggest the ways to attain sustainable investment by providing tax incentive to companies for better performance as well as making Corporate Social Responsibility (CSR) mandatory in order to attain long term, inclusive and sustainable growth patterns.

IV. METHODOLOGY

Sources of data and description of variables

For this study, data has been collected over 56 years (1960-2015) from World Bank data source (World Development Indicators) and variables are chosen considering their relative contribution in understanding the issue at hand. The variables are as follows.

Capital requirement from non-domestic sources (current US $ bn)- Capital requirement from non-domestic sources (current US $ bn) is taken as a proxy for FDI inflow because data on FDI is not available before 1978. Capital inflow from non-domestic sources is the sum of all capital inflows in the form of FDI, external debt stocks and net official developmental assistance.

GDP (current US$) – In this study, GDP (current US $ bn) is undertaken as a proxy for economic activity.

Ecological balance - A group of variables are considered to derive a suitable proxy for ecological balance considering their contribution to environmental sustainability. Another reason of selecting these variables is that they are directly associated to economic activities of a country. So growth – environment nexus can be clearly be reflected through the changes in performance of these variables over the years. The variables are forest area (% of land area), urban population (% of total), CO_2 emission per person (tonne), CO_2 emission per GDP (current US $ bn), CO_2 intensity (kg per kg of oil equivalent energy use), fossil fuel energy consumption (% of total), final consumption expenditure (current US$ bn), industry, value added (current US$ bn) and services, value added (current US$ bn).

Empirical Strategy- Correlation technique (Karl Pearson correlation coefficient) is used in this study in order to derive the degree of association among variables such as GDP, Capital requirement from non-domestic sources and Ecological (im)balance. Besides that, Principal Component Analysis (PCA) has been used to derive an appropriate proxy for ecological balance considering a number of variables having environmental implications. Ordinary Least Squares (OLS) method has been used in order to find causal relationship between capital from non-domestic sources (FDI) and economic activity (GDP) where economic activity is undertaken as the dependent variable and capital requirement from non-domestic sources as independent variable. Similarly, relationship between economic activity and ecological balance is determined by using same Ordinary Least Squares (OLS) method, considering ecological imbalance as dependent variable and economic activity as independent variable.

The equations are as below.

$$GDP = \alpha_0 + \beta_0 CRNS + \mu_0 \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (1)$$

Where, CRNS = Capital Requirement from Non domestic Sources; α_0 = Intercept coefficient; β_O = Slope coefficient; μ_O = Error term

$$EI = \alpha_1 + \beta_1 GDP + \mu_1 \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Where, EI = Ecological Imbalance; GDP = Economic Activity; α_1 = Intercept coefficient; β_1 = Slope coefficient; μ_1 = Error term

Relationship between all the three indicators such as FDI, economic activity and ecological balance can be assessed through Karl Pearson's correlation coefficient.

V. ANALYSIS AND RESULTS

Trends of Variables

Trends of certain selected variables and its performance over the years have been highlighted in order to get an idea about its association to economic activities and ecological disruption in India.

Figure–1: Trend of GDP (current US$ bn)
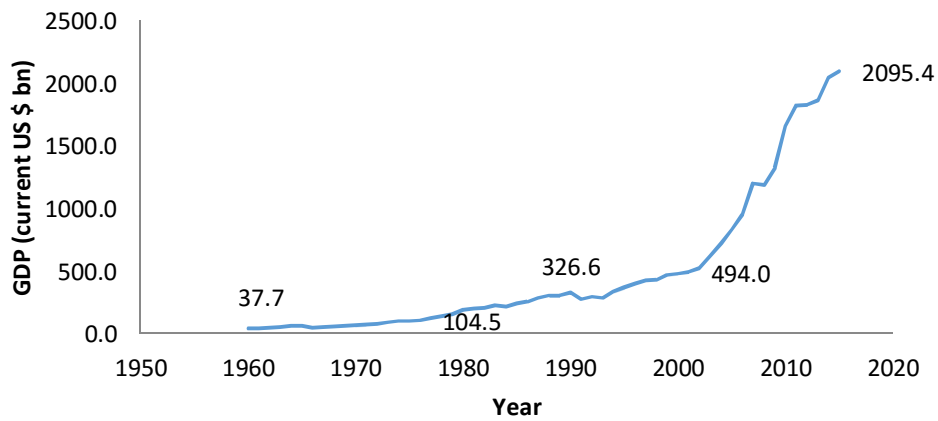
Source: WDI

After a dismal growth performance with an average annual growth rate of 3.5% during 1950-80 (famously termed as *Hindu rate of growth*), Indian economy experienced an acceleration in growth since 1980. The reasons are (1) reform in both product and labour market (2) pro- business attitude of the government (3) encouraging private sectors into market as a part of trade openness. Another major structural break found in 1991 probably because of liberalisation of Indian economy. Large number of reforms were undertaken in the form of abolition of licensing requirements, allowing Foreign Direct Investment, withdrawal of protectionist measures like tariff and quota etc. Though, no major economic reform took place post 2002, a boost in economic activities were pronounced may be due to remarkable performance of manufacturing and service sectors accompanied with stable prices and a modest current account deficit in balance of payments (Kapila, 2008-09; Dholakia, 2014).

Figure–2: Trend of capital requirement from non-domestic sources (current US $ bn)
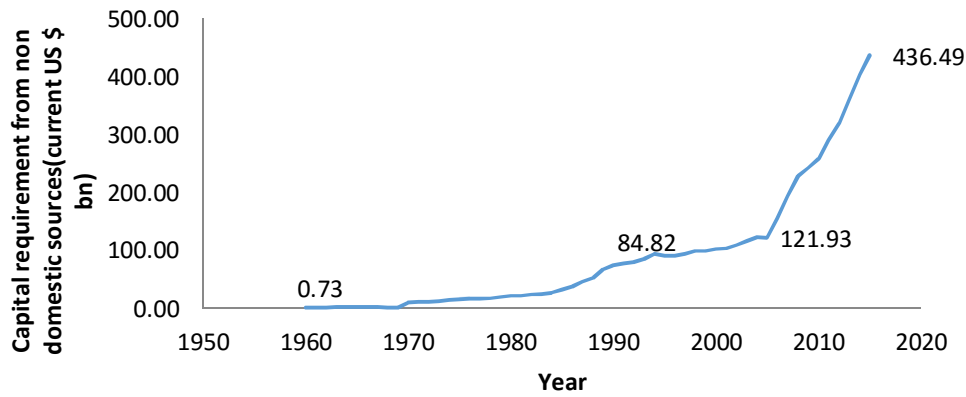
Source: WDI

There is an increase in the trend of capital inflows from external sources in the early 1980s because of increased capital requirement in the initiation of free trade era (demand side phenomenon). Towards the end of 1970s, competition inefficiency among Indian industries and adverse balance of payment situation because of two global oil crisis (during 1973 and 1979) forced Indian government to revise the foreign policy, allowing FDI and thus MNCs (Multi-National Corporations) to operate in India (Kumar, 1998). And these reforms accelerated in 1991 witnessing a surge in capital inflow to the country. Another significant increase in foreign capital inflow after 2008 is because of increase in investor's confidence owing to India's resilience in the wake of global financial crisis (supply side phenomenon) (Sultana, 2016).

**Figure–3: Trend of forest area (% of land area)**
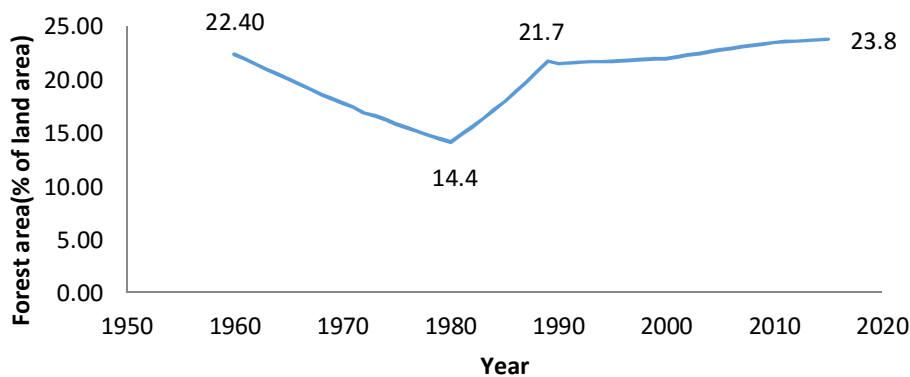
Source: WDI

Early British period witnessed a reduction in forest area because of increased demand for timber owing to ship building industries in England and expansion of railway networks in India (Prakash, 2015). This declining trend continued even after independence due to nature of Indian economy (a closed one) where

high import tariff on forest products led to an increase in domestic consumption and a massive reduction in forest area (Foster and Rosenzweig, 2003; Ahmed, 1997). However, later, forest area increased after relaxation of import tariff due to trade liberalisation as well as public intervention in *Joint Forest Management Programme* (Foster and Rosenzweig, 2003; Ministry of Environment, Forest and Climate Change, Govt. of India).

Figure–4: Trend of urban population (% of total)
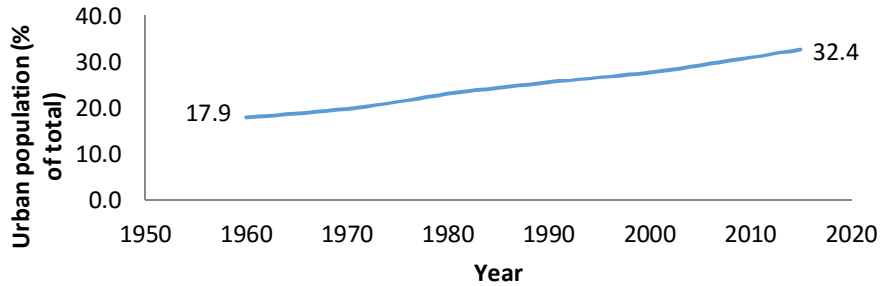
Source: WDI

A smooth increase in urbanisation from 1960 to 2015 can be noticed due to increased employment opportunities owing to economic reforms in 1980s and 1991. Another reason of increased urbanisation is better availability of educational facilities and prospects of better standard of living (in terms of transportation, communication, better health care followed by increasing public expenditure in physical and social overheads) leading to rural-to- urban migration over the years (Nath, 1986; Banerjee, 1969; Bhagat, 2011).

**Figure–5: Trend of final consumption expenditure (current US$ bn)**
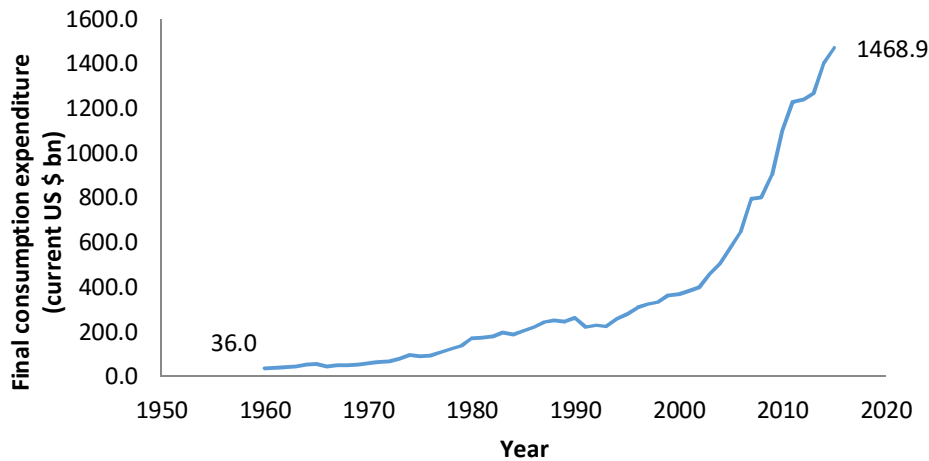
Source: WDI

There is a marginal increase in final consumption expenditure (household+ govt. expenditure) which gains momentum after liberalisation in India. An increase in

government expenditure is followed by increase in both developmental and non-developmental expenditure. Unlike developmental expenditure (i.e. investment in agriculture, industry, transport, health, education etc.), although non-developmental expenditures (which includes general administration, defence, tax collection, grant- in – aids etc.) have less potential in creating employment opportunities, it is said to have a favourable bearing on income distribution through money flow approach. There is a surge in private consumption expenditure, mostly after economic reforms in 1991 because of rise in income of both rural and urban households due to increase in employment opportunities and introduction of various flagship programmes ensuring cash transfer to the families (Gupta, 1977; Fan et. al., 2000)

Figure–6: Trend of services, etc., value added (current US $ bn)
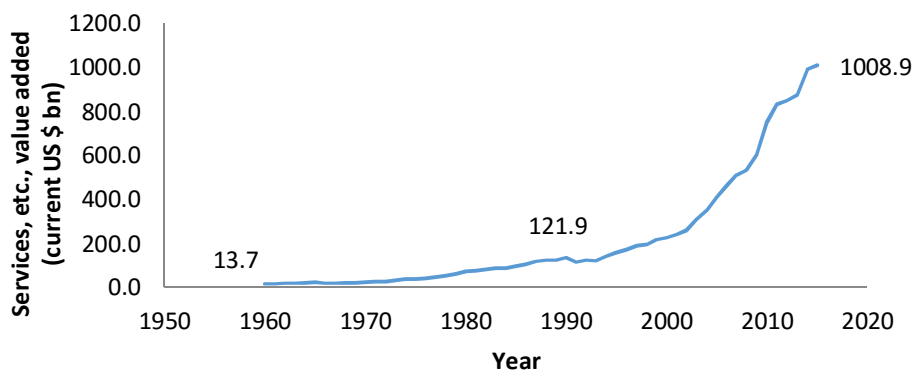
Source: WDI

In India, growth of service sector started in 1980 with the initiation of reform and accelerated in 1990s with economic liberalisation. A major change in the pattern can be observed in service sector after 1990s due to (i) greater income elasticity of demand for services i.e. the final demand for services grows faster than the rise in income (ii) increased demand for India's service export (Kapila, 2008-09).

**Figure–7: Trend of industry, value added (current US $ bn)**

Source: WDI

Sahoo & Mohanty (2022)   **JSDC**
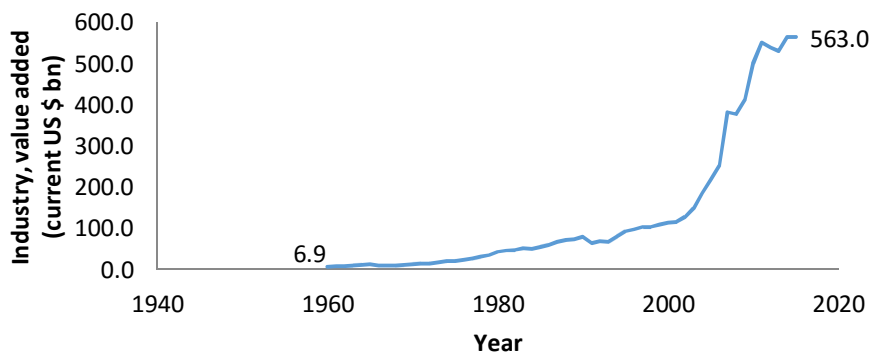
The pace of industrialisation started in India during second five year plan. The dismal performance of industrial sector continued till 1980 due to low growth of manufacturing sector as well as decline in production of capital goods owing to slowdown of public investment, poor management of infrastructure and restrictive industrial and trade policies. A major change is observed in industry after 1990s due to Industrial Policy, 1991 which laid emphasis on removal of entry barrier and revision of foreign investment policy. However, Indian economy again experienced an industrial slowdown in 2002 which was recovered later owing to increase in production of both capital and consumer goods followed by healthy performance of manufacturing sector (Kapila, 2008-09).

Graph – 8: Trend of CO2 emission per GDP (current US $ bn)
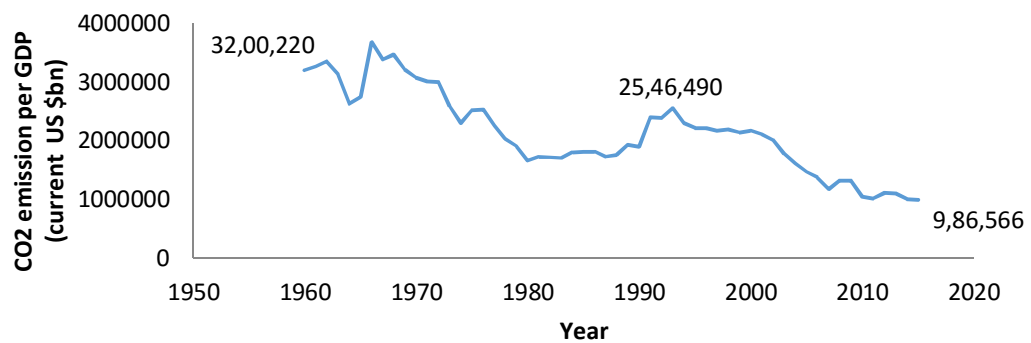
Source: WDI

There is a reduction in CO2 emission per GDP in billion USD over the years because increase in GDP is more than increase in CO2 emission.

Graph – 9: Trend of CO2 emission per person (tonne)
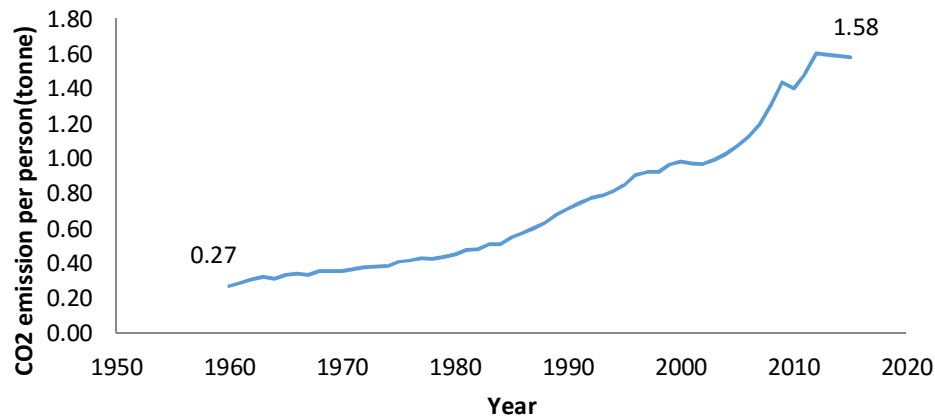
Source: WDI

There is a significant rise in CO2 emission per person due to increased economic activities and urbanisation over the years (Azam, 2016). Use of fossil fuel, being a prerequisite for energy production and transportation is mostly responsible for

this emission. Increase in CO2 emission post 1980 was duly recognised because of increased economic activities owing to trade openness.

Table – 1: Correlation matrix among component variables

Variables used	V_1	V_2	V_3	V_4	V_5	V_6	V_7	V_8	V_9
V1	1.00	0.62	0.72	**-0.02**	0.69	0.71	0.63	0.63	0.61
V_2		1.00	0.96	**-0.27**	0.99	0.98	0.86	0.83	0.81
V_3			1.00	**-0.18**	0.96	0.96	0.95	0.93	0.89
V_4				1.00	**-0.25**	**-0.26**	**-0.07**	**-0.10**	**-0.47**
V_5					1.00	1.00	0.83	0.80	0.78
V_6						1.00	0.84	0.80	0.79
V_7							1.00	0.99	0.89
V_8								1.00	0.91
V_9									1.00

Source: Author's calculation

Here, V_1 - Forest area (% of land area), V_2 - Urban population (% of total), V_3 - CO2 emission per person (tonne), V_4 - CO2 emission per GDP (current US $ bn), V_5 - CO2 intensity (kg per kg of oil equivalent energy use), V_6 - Fossil fuel energy consumption (% of total), V_7 - Final consumption expenditure (current US$ bn), V_8 - Industry, value added (current US$ bn), V_9 - Services, etc., value added (current US$ bn)

Table–2: Total Variance in the Data Explained

| Component	Initial Eigen values			Extraction Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	6.94	77.06	77.06	6.94	77.06	77.06
2	1.09	12.12	89.18	1.09	12.12	89.18
3	0.52	5.80	94.97			
4	0.42	4.69	99.66			
5	0.02	0.17	99.83			
6	0.01	0.10	99.93			
7	0.00	0.03	99.96			
8	0.00	0.03	99.99			
9	0.00	0.02	100.00			

Source: Author's calculation

It is clear from the correlation matrix that CO2 emission per GDP (current US $ bn) is negatively associated with all other variables in the data. A strong relationship can be ascertained among other specified variables except forest area (% of land area), undertaken to describe ecological balance.

It is clear from table-2 that PCA1explains highest variation (77%) in total data followed by PCA2 which explains only 12% variation in total data set. So PCA1 can be considered as the proxy for ecological balance.

Figure–10: Scree plot to determine the importance of specific components
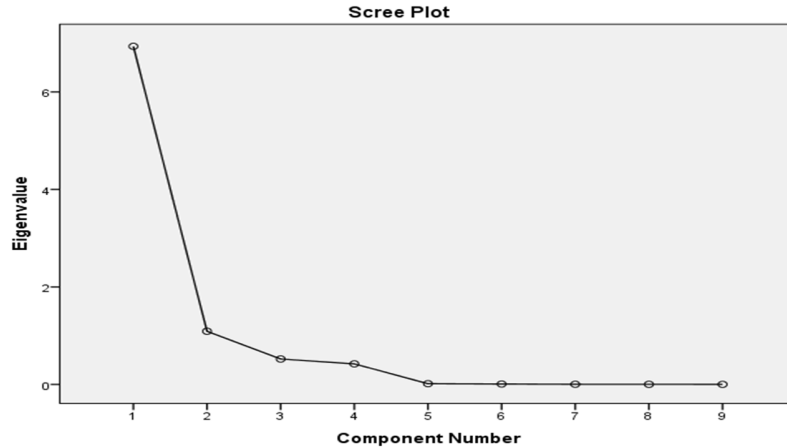
Scree plot is another method to determine the principal component to be considered as a proxy of concerned variables. It is clear from the scree plot that PCA1 out of nine components explains most variation in the data. The rest components i.e. subsequent three components describe little variation in data followed by no variation by last four components. So PCA1 is considered as the proxy for ecological balance.

Table–3: Correlation matrix among FDI, Capital requirement from non-domestic sources and Ecological imbalance

Variables	Ecological balance(C1)	Capital requirement from non-domestic sources(current US $ bn)	GDP(current US $ bn)
Ecological balance(C1)	1		
Capital requirement from non-domestic sources(US $ bn)	.925**	1	
GDP(current US $ bn)	.930**	.985**	1

** Correlation is significant at 0.01 level.
 Source: Author's calculation

It is clear from the above table that there is a positive and significant correlation among above specified variables. However, the existence of correlation does not authenticate the possibility of causal relationship between the pairs. So, in order to know the causal relationship between the variables Ordinary Least Squares (OLS) method has been used.

Table–4: Regression analysis between GDP and Capital requirement from non-domestic sources

Dependent variable	Independent variable
GDP(Current US $ bn)	Capital requirement from non-domestic sources(current US bn)
Method used	OLS
DF	56
Adjusted R square	0.970
Co efficient(standardised)	0.985
T score	42.473
D-W statistic	0.419

* Regression is significant 0.05 level.
Source: Author's calculation

The result from regression model suggests that association between GDP and capital requirement from non-domestic sources is robust. Value of coefficient is significantly different from 0 (which is 0.985) with relevant T value. It means that a 1% increase in capital requirement from non-domestic sources gives rise to 0.98% increase in GDP. And 97% variation in dependent variable (GDP) is explained by variation in independent variable (capital requirement from non-domestic sources) which is clear from value of adjusted R square (0.97). It means foreign capital plays an important role in the economic growth of a country.

Table-5: Regression analysis between GDP and Ecological Imbalance

Independent variable	Dependent variable
GDP(Current US $ bn)	Ecological imbalance
Method used	OLS
DF	56
Adjusted R square	0.862
Co efficient(standardised)	0.930
T score	18.597
D-W statistic	0.422

**Regression is significant at 0.05 level.

Source: Author's calculation

A significant relationship between ecological imbalance and GDP can be noticed from the above table where Adjusted R square of 0.862 means 86% variation in ecological imbalance is explained by variation in GDP. And the value of coefficient (0.930) suggests that the prospect of economic activities has remarkable bearing on ecological complexities of the host country.

Relationship between Capital requirement from non-domestic sources and Ecological Imbalance

Though, technically, there is no causal relationship between capital requirement from non-domestic sources and ecological imbalance, through transitive property (if A> B and B> C then A> C), a relationship between these two

variables can be established i.e. role of foreign capital in disrupting ecological equilibrium of the host country can be acknowledged.

VI. CONCLUSION

The paper enhances our understanding on the role of FDI with respect to economic growth as well as ecological disequilibrium in the host country. It is clear from the above discussion that technology diffusion and transmission of capital are critical to India's economic growth (in terms of FDI) but also disrupts bio diversity and ecosystem as well.   So, the decoupling of growth and environment can be ensured through active policy interventions in terms of (a) integration of economic and environment policies (b) phasing out of environmentally harmful subsidies (c) imposition of policy instruments for internalising environmental externalities (through provision of carbon tax) (d) investing in research and innovation to promote use of cleaner technology and (e) introduction of proper screening while allowing FDI into various sectors of the economy.

VII. LIMITATIONS

We end this paper by citing certain limitations. (i) as data on FDI is not available before 1978, capital inflow from non-domestic sources is taken as a proxy for FDI (ii) data on a suitable indicator for ecological (im)balance are not available. So PCA has been undertaken to find out an appropriate proxy for ecological (im)balance (iii) analytical understanding on the linkages studied are non-conclusive in available literatures i.e. FDI, economic growth and ecology linkage has been described by different scholars differently (iv) an experiment with different methodological tools for dealing with non-stationary data could have been interesting which could not be undertaken because of data availability issues. Moreover, this study has some future relevance as it gives an impetus for a cross country panel data analysis on related variables with different tools to draw further conclusion and policy suggestion.

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