

ENVIRONMENT AND ECONOMIC DEVELOPMENT – COMPROMISE OR CONCURRENCE?

Manasa Acharya

Abstract: Ecological economics views the economic system as a subset of the ecosystem, and environmental economics uses the environment as a means of fulfilling economic gains and thus, sees the economy as larger than the environment. The world today is growing more and more concerned with the problem of climate change and degradation of natural resources caused by economic activities of man. This is because, as ecological economics suggests, the economy is but a subset of the ecosystem which means that its welfare or the lack of it, directly affects or limits human's capacity of utilizing resources for their survival, needs or greed. There exists a disagreement between countries in different stages of growth on this issue. This is due to the differences in the ecological footprints of different countries as well as in the opportunity costs paid by them.

HYPOTHESIS AND OBJECTIVES:

Hypothesis:

Environmental degradation is directly proportional to socioeconomic development

Objectives:

1. To observe the importance of environmental economics through different stages of development
2. To understand the reasons for the hypothesized relationship between the two on the basis of the results observed
3. To understand the impact of environmental regulations on countries in different stages of development
4. To find the most effective way of promotion of environmental economics in the least environmentally-evolved economy

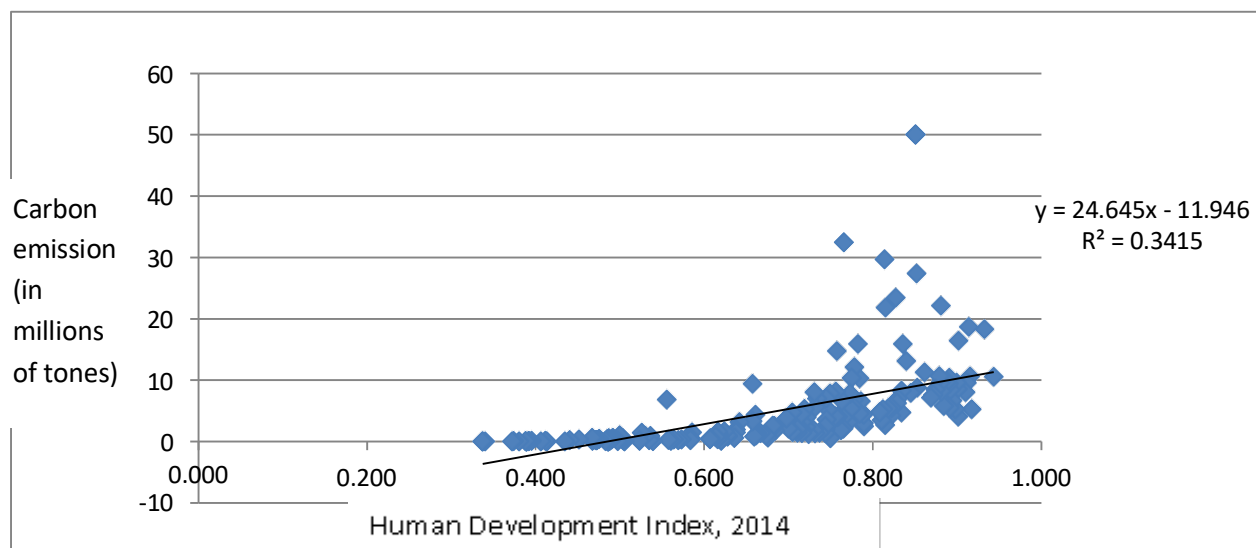
METHODOLOGY:

Quantitative i.e. regression analysis as well as qualitative analysis i.e. literature review and analysis has been used simultaneously to meet the objectives specified above. The paper uses regression analysis of Environmental Performance Index (EPI) on Human Development Index (HDI). "The Environmental Performance Index ranks how well countries perform on high priority environmental issues in two policy areas: protection of human health from environmental harm and protection of ecosystems." (Yale University) It ranks countries on the basis of their environmental policies and their proximity to global goals. HDI given by Amartya Sen and Mahboob Al Haq, is a composite measure as well, of average achievement in attainment of a long and healthy life, literacy and standard of living.

These indicators have been used in this paper in order to observe environmental welfare in different types of economies. Since the evolution here doesn't refer to evolution over a period of time, but one over different economic stages using multiple case studies, time series regression has not been used; rather, the data of a particular year (2014) for multiple economies in different stages of evolution have been used for linear regression.

ANALYSIS

The faster growing economies have always believed to be the fastest polluters in the world. Just as growth and pollution have a positive relationship (Growth and Pollution Convergence hypothesis), the emission of carbon dioxide per capita also increases as people of a nation develop, that is increase in HDI (refer graph).

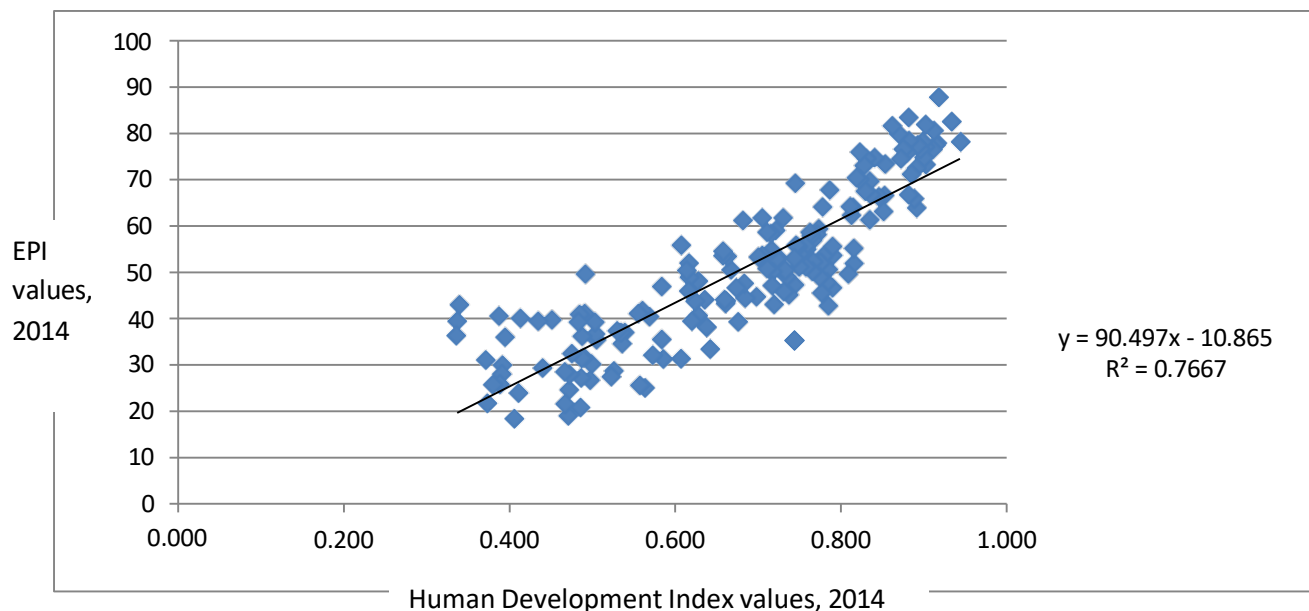


This is due to higher level of industrialization in developed nations (Refer appendix A) and thus the existence of more polluting manufacturing units than in countries that haven't reached the 'take-off' stage as illustrated by Rostow, post which the economy is characterized by mass consumption and boom of secondary and tertiary sectors. (Refer appendix B)

However, using CO₂ emissions as a proxy for measurement of environmental degradation level of a country is insufficient. Though it gives us an idea of the air pollution levels, it does not take into account various other environmental factors such as deforestation, pollution of rivers, marine life sustainability, effluents, waste disposal and a plethora of factors that shape our surroundings due to human actions. The Environmental Performance Indicator (given by Yale University as a substitute for Environmental Sustainability Index) is a comparatively comprehensive index as it takes into account 20 proxy indicators (Child Mortality, Particulate Matter, Indoor Air Pollution, Access to Sanitation, Access to Drinking Water, SO₂ per Capita, SO₂ per \$ GDP, Biome Protection, Change in Water Quantity, Critical Habitat Protection, Marine Protected Areas, Agricultural Subsidies, Pesticide Regulation, Forest Growing Stock, Change in

Forest Cover, Forest Loss, Coastal Shelf Fishing Pressure, Fish Stocks Overexploited, CO₂per Capita, CO₂per \$ GDP, CO₂per KWH, Renewable Electricity) in order to measure ecosystem vitality and environmental public health (health of the citizens that depends on environment quality). The EPI has been chosen as a proxy to determine the performance of countries in their efforts to control environmental degradation.

The regression of EPI on HDI and corresponding high r squared (Refer graph) illustrates the strong positive impact of development on the quality of the environment with a variation of only 24% (refer graph), implying that 76% of a country's ecological state was determined by its level of human development, thus proving the hypothesis.



This implies that a highly developed country performs better in framing, implementing and reaching the targets of environmental policies aimed towards the betterment of the environment than a country with lower levels of human development. A similar phenomenon can be explained by the Environmental Kuznets Curve (EKC) as well. The EKC is a hypothesised relationship between income per capita and various indicators of environmental degradation. In the early stages of economic growth degradation and pollution increase, but beyond some level of income per capita (which will vary for different indicators) the trend reverses, so that at high-income levels economic growth leads to environmental improvement. This implies that the environmental impact indicator is an inverted U-shaped function of income per capita. Though the EKC has been termed as obsolete by most researchers, Shafik and Bandyopadhyay's study in World Development Report, 1992 estimated EKC for 10 indicators and found empirical data that proves that the state of clean water and urban sanitation and air pollution follow EKC (though waste production, carbon emission, deforestation do not).

A few possible causes for the positive relationship between HDI and EPI can be enumerated as follows:

1. Environmental development targets may be a low-priority area of concern as compared to human development goals for less developed countries, whereas developed countries, by virtue of their abundance of resources and human development are able to give the required 'big push' to environmental factors i.e make the critical minimum effort as defined by Leibenstein in environmental research and conservation that poorer countries cannot afford i.e. the income elasticity for a better environment is lower for countries with lower HDI.
2. Also, since high HDI are countries that are already industrialized in the past, and are mainly in the third stage of growth, they have undergone structural change and entered the next cleaner stage of service-led industries (structural change hypothesis). This is also explained through the Environmental Kuznets Curve. Thus, LDCs pollution levels are continuously rising till they reach an inflection point, if not peak (the EKC has been criticized for its extreme fall stage), where the rate of pollution changes due to affordability or usability for better technology at a larger scale of production.
3. The poorer EPI of poor countries can be blamed on the act of outsourcing of 'dirty' industries (through Foreign Direct Investment in poorer, populated nations), effluents and hazardous waste products to these countries by the ones at the top. While developed countries ensure clean environment in their own space, they have no qualms in harming the ecology of other countries For example, the United Nations confirmed that millions of tonnes of hazardous e-waste is dumped in landfills of poor countries in Africa and Asia under false pretenses of 'used goods' by Europe and USA (The Guardian, Dec 14, 2013). This creates dangerous and almost in humane living conditions for the people living around the dumping grounds and this not only deters human development but is also a case of human right violation.
4. Some goals of HDI are secured by the presence of a cleaner environment. Better performance in environmental measures of EPI like access to drinking water and sanitation, clean air devoid of particulate matter and green house gases, infant mortality levels are indicative of better life expectancy as well. Thus, the higher HDI might be a result of high EPI, and vice versa.

APPLICATION

A problem that follows the differences in the performance of developed and developing is that of framing international laws, limits and conventions.

During the period 1965-1988, World Bank researchers Low and Yeats found that for pollution intensive industries, the Revealed Comparative Advantage (=the share of an industry in a country's total exports, relative to the industry's share of total world exports of manufactures) of developing countries grows relatively faster than those of industrial countries (1992). Similar results were obtained by Lucas et al. Mani and Wheeler (1998). Thus, the opportunity cost of regulating emissions, which affects inversely manufacturing productivity, is higher for those which are yet to expand the manufacturing sector, depriving them of reaching the level of the developed nations. This can be summed up in the following model:

Regulations	Developed Countries Do Not Agree	Developing Countries Do Not Agree
Developed Countries Agree	-	(0,2)
Developing Countries Agree	(-1, 2)	-

Where

-1 = Fall in NIGR

0 = Status quo maintained

1 = Improvement in NIGR

2 = Greater improvement in NIGR

Thus, the paper proposes that the regulation elasticity of growth (proportional decrease in GDP growth rate to an increase in regulation) for nations with an undeveloped manufacturing sector is extremely high as compared to that of industrialized nations. Thus, for primary sector economies,

$$E = \frac{\Delta NIGR}{NIGR} \times \frac{Regulation}{\Delta Regulation} > 1$$

(Inverse relationship; thus will have minus sign.)

The argument of the LDCs is that they, too, should be allowed to evolve and develop their economy as the developed countries have. It is on this principle of equality of opportunity that the much disputed policy of 'Common but Differentiated Responsibilities' in terms of cutting down on carbon emissions of most authoritative environmental regulatory bodies, mainly the UNFCCC is based. This regulation abides by the Pigouvian principle of 'Polluter Pays', as emissions by industrialized nations are higher and it is but logical to penalize them.

However, the rates of carbon dioxide emissions are fast increasing in developing countries due to rapid urbanization and industrialization. Thus there exists some opposition on the grounds that domestic industries in the developed world will take a hit on the international competitiveness level. Likewise, there are apprehensions among them that the less developed countries, with more emphasis on economic development than environmental protection will develop a competitive advantage- shift economic and political power or forces in pollution intensive industries where the developed countries have regulations to follow (i.e. the manifestation of pollution haven hypothesis: trade amongst nations, having stringent and lax environmental regulations respectively may lead to stronger development of pollution intensive industries creating greater environmental externalities in other country) and thus they do not abide by them (The Guardian, Dec 13, 2011).

Moreover, the developing countries are unregulated and are not obligated to improve in spite of their poorer performance. Though this might be logical in the case of carbon emissions, the EPI values reflect

their indifference toward usage of all natural resources by virtue of their need for opportunity to develop. Thus, they must be held responsible for their actions that have adverse impacts on the environment.

CONCLUSION

It cannot be ignored that there exists an impactful effect of environmental performance, and particularly sanitation and natural resource pollution on human development. Thus, it is a two way relationship and choosing one at the cost of the other is unwise. Moreover, overall development in living standards leads to relatively higher demand for cleaner environment due to its high income elasticity. This in turn encourages people to devise strategies for betterment of their surroundings (Dinda, 2004).

The justice of regulating poorer countries is much debated upon. Stringency resulting in the creation of pollution-havens in less regulated countries would only create further problems for countries in all stages and ultimately, fail to curb degradation. In other words, forceful regulations can hamper the economy and slow down the emergence of green economy. Policy makers and academics (Pethig, 1976; McGuire, 1982; Jenkins, 1998) recognize the weaker competitiveness of dirty industries in developed nations (higher abatement costs > higher costs of production) in the presence of these regulations and the 'resource curse' that befalls the developing ones.

However, Porter and Van derLinde (1995), Poppetal (2010) and Jaffe et al (2002) suggest that a country with relatively stringent environmental regulations can benefit from developing new production process in the environmentally sensitive industries with the required resourcefulness. It encourages technological advancements and process innovations that lower the cost of regulation abidance. Regression of Research and Development expenditures on perceived environmental stringency from 1974-1991 indicated a positive relationship that was statistically significant ($r^2 = 0.878$) (Jaffe and Palmer, 1997).

Changes in three parameters affect the environment – scale, composition and technique (Gen Grossman and Alan Krueger). In the case of developing countries, interference in scale or composition of industries might have adverse effects on the economy. Thus, technique transformations should be attempted. For one, increasing costs of polluting factors of production can induce companies and entire industries to shift to other cost-effective means of production (Hicks, 1932). This shift can easily be done by nations that have reached high levels of human development, but might have serious repercussions on livelihoods in primary and secondary sector economies. The worldwide solution to this can be furthered by developed nations themselves by providing LDC economies with less polluting and cleaner technologies, developed by the better-off nations, in order to reduce their environmental degradation without negatively impacting their opportunities (technology transfer). Thus, even though certain industries may be eliminated or regulated in the process, simultaneously, emphasis must be placed on creation and sharing of newer, cleaner, more responsive ones with equal levels of employment creation. Countries that are successful in reducing their ecological footprint (of the country as a whole, and not

just the aggregate of its peoples') can be rewarded by way of subsidies on better technology by bodies like the United Nations.

LIMITATIONS OF THE PAPER AND SCOPE FOR FURTHER RESEARCH:

1. The Environmental Public Health component of EPI is directly related to the development of human health and hence, life expectancy. This might lead to multi-collinearity, and thus result in bias. The extent of multi-collinearity between EPI and HDI can be found to estimate whether their relation is unbiased or not.
2. The Game theory model is extremely intuitive and only skims the surface. It does not explore real historical consequences. Thus, a detailed model of Game Theory can be developed in order to explain empirical consequences of decisions of countries in acceptance of regulations.
3. The reason for different results shown by carbon dioxide levels and EPI in different economies can be examined.

BIBLIOGRAPHY

1. Chen, W. (2007) *Economic Growth and the Environment in China – An Empirical Test of the Environmental Kuznets Curve Using Provincial Panel Data*. Xiamen University, China. Retrieved from http://www.policyinnovations.org/ideas/policy_library/data/01447/res/id=sa_File1/paper.pdf
2. Copeland B.R., Taylor. (2004) *Trade, growth, and the environment*. Journal of Economic Literature.
3. Environmental Performance Indicator website. www.epi.yale.edu
4. Gallagher, K. Ackerman. (2000) *Trade Liberalization and Pollution Intensive Industry in Developing Countries: A Partial Equilibrium Approach*. Global development and environment institute. Medford, USA.
5. Hicks, J.R. (1932) *The Theory of Wages*. Macmillan. London.
6. Human Development Report, United Nations Development Program website. www.hdr.undp.org
7. Jaffe A.B., Newell, Stavins (2002) *Environmental policy and technological change*. Environmental and Resource Economics Journal.
8. Jaffe A.B., Palmer (1997) *Environmental regulation and innovation: a panel data study*. The Review of Economics and Statistics.
9. Jaffe A.B., Peterson, Portney, Stavins (1995) *Environmental regulation and the competitiveness of U.S. manufacturing: What does the evidence tell us?* Journal of Economic Literature.
10. Lima Proposal. (2014) Retrieved from the United Nations Framework Convention on Climate Change website. http://unfccc.int/files/meetings/lima_dec_2014/application/pdf/auv_cop20_lima_call_for_climate_action.pdf
11. Milani, S. (2014) *The impact of environmental policy stringency on industrial R&D conditional on pollution intensity and relocation costs*. University of Wisconsin - Milwaukee.
12. Popp D (2002) *Induced innovation and energy prices*. The American Economic Review.
13. Popp D (2005) *Lessons from patents: Using patents to measure technological change in environmental models*. Journal of Ecological Economics
14. Popp D (2006) *International innovation and diffusion of air pollution control technologies: the effects of nix and SO₂ regulation in the US, Japan, and Germany*. Journal of Environmental Economics and Management.
15. Popp D, Newell. (2012) *Where does energy R&D come from? Examining crowding out from energy R&D*. Journal of Energy Economics.
16. Popp D, Newell, Jaffe. (2010) *Energy, the environment, and technological change*. Handbook of the Economics of Innovation Vol II. Academic Press. Burlington.
17. Shafik, N. and Bandopadhyay. (1992) World Development Report. International Bank for Reconstruction and Development. USA.
18. Skaza, J. and Blais. (2013) *The Relationship between Economic Growth and Environmental Degradation: Exploring Models and Questioning the Existence of an Environmental Kuznets Curve* (Working Paper). Smithfield. <http://web.bryant.edu/~bblais/pdf/SSRN-id2346173.pdf>
19. The Guardian. (Dec 13, 2011) *Canada pulls out of Kyoto Protocol*. Retrieved from www.theguardian.com/environment/2011/dec/13/canada-pulls-out-kyoto-protocol

20. The Guardian. (Dec 14, 2013) *Toxic 'e-waste' dumped in poor nations, says United Nations*. Retrieved from www.theguardian.com/global-development/2013/dec/14/toxic-ewaste-illegal-dumping-developing-countries
21. United Nations Framework Convention on Climate Change website. <http://unfccc.int/2860.php#decisions>
22. World Bank website. www.data.worldbank.org