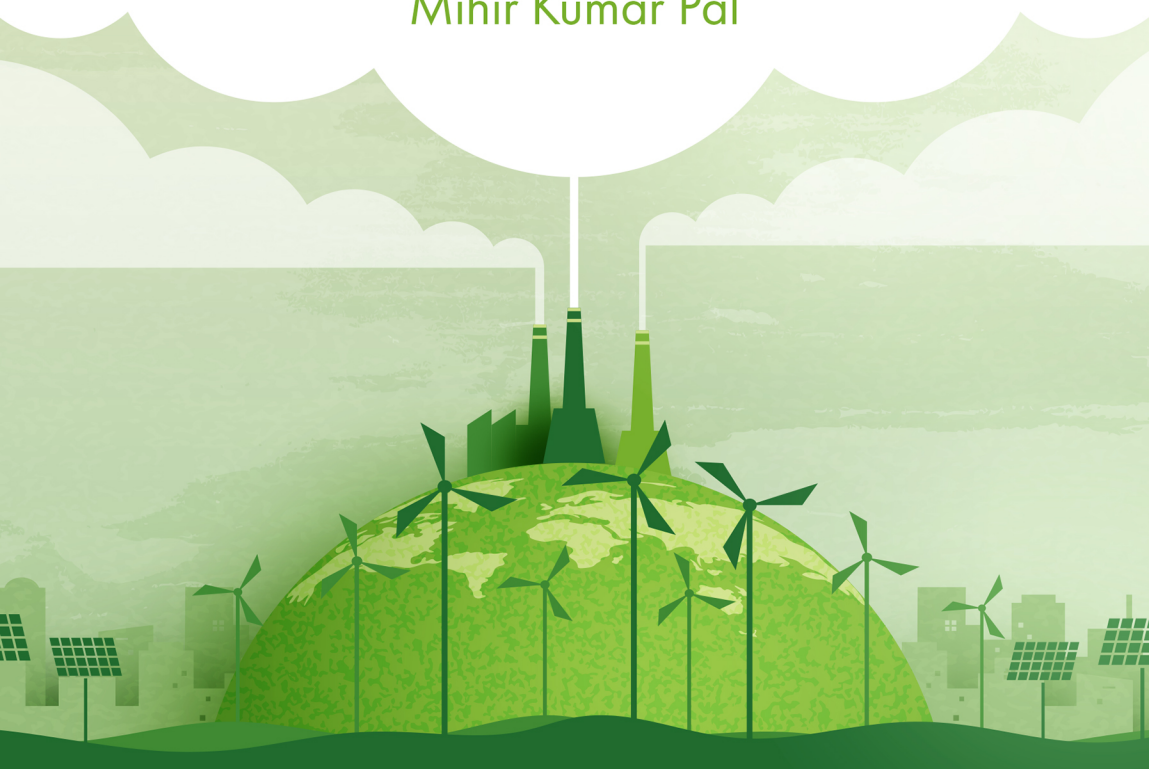


The Impact of Environmental Emissions and Aggregate Economic Activity on Industry

Theoretical and Empirical Perspectives

Edited by

Mihir Kumar Pal



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EDITED BY

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Vidyasagar University, India



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*Dedicated to
My Parents and Family*

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Foreword

The increasing impact of environmental emissions on the planet-wide climate change poses one of the most challenging causes of the hardest-hit global warming with asymmetrical consequences on the socio-ecology systems, economic growth among the regions, countries, industrial sectors, and communities. The environmental emission and its consequence the climate change challenge is also a sustainable development challenge that needs to address the issues related considering the asymmetries, dilemmas and paradoxes which must be solved by reaching a consensus of all involved.

Global warming as the cause of climate change is associated with unsustainable production and consumption patterns based on the use of carbon fossil fuels, unsustainable growth of industry and aggregate economic activities, the collapse of the socio-ecological systems, crisis on environmental services and unhealthy quality of life. Some negative effects of emissions are more pollution and deterioration of various natural capital, including non-renewable natural resources such as forest, water, and other environmental services.

This situation is leading towards an economics of climate change with those that have contributed the least to the global warming, given the low levels of greenhouse gas emissions and have the minor contributions to climate change, because their vulnerability to negative impacts, are being the hardest hit. There are specific economies, regions, industry sectors, communities, and socioeconomic groups whose production structures and consumption patterns are releasing a high level of emissions with a large carbon footprint causing damage to the most vulnerable by the adverse impacts of climate change, affecting their economic growth, social cohesion, and environmentally sustainable development.

Sensitive to these arguments, the book offers theoretical and empirical analysis concerning the impact of environmental emissions on various industry sectors and economic activities of emerging economies, South Asian economies, Asia-pacific economies, Jordan, and most of all from various industry sectors of India.

Environmental emissions have an impact on climate change that is ushering environmental constraints and challenges, which are an imperative to rework production and consumption patterns. Policy formulation and implementation is required by adapting to the new climate conditions and implement mitigating measures aimed to maintain and improve a more sustainable growth of industry and enhance the aggregated economic activities. The recognition of common responsibilities with differentiated capabilities shapes the transition towards the improvements of economic growth, the enhancement of social justice and

inclusiveness, and more ecological sustainable form of development that will preserve the natural resources to leave a legacy to future generations of more socially equal and inclusive, low carbon economic growth.

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Mihir Kumar Pal
Editor

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Introduction

In the global perspective, countries are aiming at increasing their GDP under any cost. This increase in GDP leads to increase in material and energy use and therefore to environmental unsustainability. Economic growth is often associated with environmental degradation. Increased consumption of Earth's resources and its negative environmental impact has led to unsustainability in economic growth. Rising consumption levels require corresponding extraction, transportation, processing of natural resources, followed by consumption and disposal of the final products.

Brock (1973) stated that 'received growth theory is biased because it neglects to take into account the pollution costs of economic growth'. This is because in an unregulated market the cost of pollution is not internalised. Pollution in this case is an unpaid factor of production, with production becoming more costly if less pollution is allowed. In this context, environment is used as a factor of production which is not fully compensated, and its use in the production process can be captured by introducing emissions as an input in an aggregate production function. Again, the energy intensive industries creates both air and water pollution to a large extent. This is the negative aspects of increasing production of energy intensive industries. So, in a sense we can't go on increasing the output of energy intensive industries in an unlimited manner. In other words, factor productivity or total factor productivity are affected negatively by the extent of pollution (industrial waste) generated by energy intensive industries. Hence, it would not be illogical to say that economic theory along with environmental studies is to be taken into account. Here in lies the interdisciplinary relevance of our research work.

With a special reference to the issue, the case of India can be addressed for further elaboration. At the present moment, India is experiencing huge pollution problem due to its rapid economic development based on highly polluting industries. As a consequence, India has become one of the world's largest Carbon dioxide (CO₂) emitters responsible for climate change. Production is impossible without creating pollution. So, pollution may be modelled either as an input or as an output of the production process. Modelling pollution as an output captures the idea that 'good' output cannot be produced unless pollution (bad output) is also produced.

Recent studies reveal that India ranks sixth in the total energy consumption and needs to accelerate the development of this sector to meet its growth aspiration.

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As theory postulates that more energy intensity leads to more polluting environment, thus there is a scope to find the scenario of productivity performance of energy intensive industries by considering the environmental pollution as a factor of production. Environmental pollution should be accounted for in total factor productivity growth (TFPG) measurement and deducted from residual. Earlier in the measurement of total factor productivity, environmental issues were not incorporated. In this edited volume, we have tried to attach high importance to environmental issues and incorporated it in the analysis of the measurement of total factor productivity growth and we want to examine how the use of the Carbon dioxide (CO₂) emission contributes respectively to the output and productivity growth by the energy intensive industries in India. Here in lies the potential contribution to knowledge.

Under the above backdrop, the present book departs from the literature in that the relationship between the environment and industrial growth is examined from another perspective; the effect of emissions on growth and not the other way around is investigated. With theoretical and empirical analysis by distinguished scholars from different parts of the globe have thrown light on impact of pollution on economic growth; Economics of environmental emission; Nexus between carbon emission, economic growth and development; green technology and international trade; emissions and sustainability; implication of pollution control acts & protocols and covid-19 on air quality; examining the long-run association of 'energy use to national output' and 'energy use to carbon emission'; sustainable resilience in urban land use; influence of energy consumption, industrialisation and corruption on carbon dioxide emissions; environmental emission and the growth of unorganised manufacturing enterprises; trade of between environmental emission and consumption; promoting climate-smart agriculture for growth and sustainability; people's awareness on improvement in environmental quality; role of nuclear energy to reduce carbon emission; air pollution and productivity, etc.

It has been structured into two sections. Section I covers the theoretical discussion on the related aspects and Section II covers the same issue empirically. Section I contains 6 chapters and Section II contains 17 chapters. The brief outlines of all the chapters are presented below.

Section I: Theoretical Perspectives

Chapter 1 aims to introduce carbon capturing smart construction industry model to foster green and sustainable total factor productivity growth of industries. This chapter investigates current and potential roles of construction industry, its sub-industries and their outputs in fostering other industries' growth through green and sustainable total factor productivity growth. It focusses on carbon capturing technologies and design at different levels (e.g. material; carbon capturing design strategies for industrial zones; carbon capturing supply chain; design of buildings, built environment, cities as well as cities relation with rural areas). Furthermore, this chapter provides recommendations for carbon capturing smart city policies and built environment. This chapter is expected to be useful to all

stakeholders of the construction industry, policy makers, and researchers in the relevant field.

Chapter 2 accounts the conflict between economic growth and sustainable development is foregone and there is prodigious literature examining the nature and causes of such trade-off. Keeping with this dispensation, the current chapter examines the dynamics of such trade-off in Ramsey–Cass–Koopmans (R-C-K) optimal growth theoretic lines. The study reveals potential trade-off between consumption and environmental emission quiet emphatically for the developed, developing and less developed countries, in both single-equilibrium and multiple equilibria case. Besides, the study examines the impact of rise in population growth and fuel price on the steady-state equilibrium with respect to per capita capital, relative intensity of energy usage, emission and consumption using comparative static exercise.

Chapter 3 reflects the correlations among the political determinants and the economic development and examines the issues that impede environmental sustainability. It explores how politics and economic development have driven environmental degradation and accelerated climate change. The chapter minimises the knowledge gaps in politics, development, and environment nexus by providing a comprehensive account of the dynamic interplay between different variables.

Chapter 4 throws light on the famous and very important issue of using eco-friendly, pollution free technology, named as ‘green technology’ or ‘green capital’ by developing economies in the sphere of environmental economics by using general equilibrium framework and tries to examine its impact on different polluting and non-polluting sectors of the economy. The present chapter has done so by using the concepts of ‘regime change’ and ‘endogenized green capital’ – these are the unique features of this work. Here, they have come across interesting outcomes – trade liberalisation in the form of international green capital immobility to international green capital mobility leads to an expansion of the sector that utilises it.

Chapter 5 considered Carbon emission as one of the most important problems of today. In this framework, it is important for countries to take the necessary actions to solve this problem. Energy use is one of the most important causes of carbon emissions. Choosing fossil fuels in this process increases the carbon emission problem. Therefore, it is understood that countries should be more sensitive about energy types. In this context, renewable energy sources are recommended by experts. However, due to some problems of these energy types, it does not seem possible to meet all energy needs from these sources. It is thought that nuclear energy will produce a permanent solution to the carbon emission problem. In this context, it is recommended that the use of nuclear energy be put on the agenda by countries.

Chapter 6 emphasises the importance of green and sustainable total factor productivity. This chapter aims to investigate interaction between industrial growth and climate change as well as their effects to Jordan’s water resources

and economy. Furthermore, this chapter investigates water scarcity problem and water policies in Jordan. This chapter provides recommendations for preventing environmental degradation and solving water scarcity problem of Jordan so that its industrial growth can be sustained and its economic growth can become more resilient to the climate change. This chapter is expected to be useful to academics, policy makers, and politics in the relevant field.

Section II: Empirical Perspectives

Chapter 7 examines the impact of energy consumption, economic growth, industrialisation and corruption on carbon dioxide emissions as well as finds out the causal relationship among them using panel data of 10 Asian economies over the period 1980–2019. Their empirical findings from Estimated Generalised Least Square (EGLS) model suggest that there exists an ongoing rising relationship between CO₂ emissions and economic growth both in the short-run and long-run which is opposing to what is claimed by the EKC hypothesis. Moreover, per capita CO₂ emissions rise positively with respect to increase in energy consumption, urbanisation, gradual industrialisation and growth in urban population in the long-run. The study also indicates the existence of unidirectional causalities running from carbon dioxide emission to energy consumption, from industrialisation and urban population growth to per capita CO₂ emissions, from industrialisation to GDP growth per capita and bidirectional causality between financial development and economic growth via GDP growth per capita.

Chapter 8 follows a solovian growth structure and assumes that the aggregate output, depends on the stock of physical as well as human capital and energy or power. The study finds that less developed countries failing to afford sufficient access to clean energy which in turn has deleterious impact on the human capital which cascades into low level of production, low saving and low per capita output forming a vicious loop.

Chapter 9 shows the existence of long-run relationship and short-run interplays between GDP efficiency of energy use (GEU) and carbon efficiency of energy use (CEU) in the panel of countries in the South Asian region for the period of 1971–2014. The results show that there is a long-run and short-run association between energy efficiency in output and carbon emission as respectively measured in GEU and CEU. When GEU is used as the independent variable in Vector Error Correction Model (VECM), the result reveals that any short-run disequilibrium from the long-run stable connection will be adjusted over time, and the long-run stable relationship will be restored.

Chapter 10, by applying Contingent Valuation Method, the author looked to capture how far people of two very renowned industrial belts in West Bengal, Howrah and Barrackpore, are willing to contribute to the reduction of such emission level by consuming eco-friendly products and paying the emitting producers to force them to adopt pollution free technology. He found the mean WTP is quite high which shows that people are very much willing to move towards using eco-friendly goods and technologies.

Chapter 11 makes a comparative analysis of the productivity growth of Indian pharmaceutical industry using production function approach and adopting two distinct measures of labour input and also explains whether the growth and productivity is eco-friendly or not. A remarkable growth in TFP is observed after the initiation of new economic policy for both the method used. So far as the environmental issues are concerned the industry seems to be polluting the environment, as per unit use of energy is increasing with time.

Chapter 12 empirically investigates the dynamic effects of globalisation on carbon emission in developing countries particularly in Asia-Pacific region which has experienced a high-speed engine of globalisation over last two decades. The robust difference Generalised Method of Moments (GMM) estimates imply that trade is more harmful for carbon emission as compared to FDI and economic expansion measured by per capita GDP growth. Moreover, digitalisation positively promotes globalisation but it does not impact the carbon emission in developing Asia-Pacific economies.

Chapter 13 attempt to provide comprehensive estimates of the major air pollutants and the linkage between of air pollution and labour productivity in case of Indian manufacturing sector.

Chapter 14 examines if climate-smart agriculture in the form of conservation agriculture can enhance adaptation and mitigation to climate change by improving resource utilisation efficiency in India. It is found that conservation agriculture can potentially make significant contribution to climate change adaptation, mitigation and food security, especially among the small and marginal farmers who are highly prone to environmental shocks. The chapter also proposes a change in the food system from climate-sensitive to climate-smart agriculture and appropriate mitigation strategy through integration of technologies, institutions and policy interventions.

Chapter 15 intends to explore the impact of environmental regulations on FDI inflows in emerging countries along with governance factors and the macro-economic fundamentals like per capita power consumption, trade openness, per capita GDP, etc. Results reveal that significant bonding realise between environmental regulations and FDI inflows in emerging countries. Based on the statistical evaluation however best our knowledge FDI is more attractive where lower regulations are established. Forsake of simplicity environmental regulations are crucial to the MNCs for investment.

Chapter 16 explains, sustainable development is a complex and subjective concept, considering the three dimension that define the phenomenon: economic, environmental and social. They have chosen subjective variables, which provide information on the perception of the 'sustainable development' in the European countries. To conduct the quantitative analysis, they have adopted a non-compensatory approach: MPI index. They place at the centre of the analysis variables deriving from the perceptive state of the different European populations, offering new hints to measure sustainable development on the basis of subjective assumptions.

Chapter 17 intends to make a comparative study between Bangladesh and Maldives regarding the impact of pollution on economic growth. The developmental process of these two countries has been interrogated due to the absence of implementing the plan of sustainable development properly. This chapter will delineate the effects of pollution on economic growth both in Bangladesh and Maldives. It will further shed light on application of environmental governance in Bangladesh and Maldives.

Chapter 18 estimates TFPG and its components of the 4-digit manufacturing industries of chemical and chemical products in India during 1998–1999 to 2017–2018, using frontier approaches, i.e. Data Envelop Analysis (DEA) and Stochastic Frontier Approach (SFA). The components of TFPG becomes technological progress (TP), technical efficiency change (TEC) and economic scale change (SC). It is found that the growth rates of TFP in most of the 4-digit industries of chemical and chemical products in India increased during the post-economic crises period (2008–2009 to 2017–2018) and the increase in TFPG of them during that period is mainly accounted for by the increase in TP of the same during that period. The TEC of almost all the industries of the same, however, declined during the post-economic crises (2008–2009 to 2017–2018) and SC of them, however, remain very low or even negative during the aforementioned study period.

Chapter 19 scrutinises the consequences of various pollution control acts and protocols signed by India to improve the air quality and then the study involves itself to investigate the aftermath of COVID-19 lockdown on the air quality of highly populated Mumbai city of India. The empirical analysis is facilitated by the application of Poirier's Spline function approach on the secondary data compiled from the Maharashtra Pollution Control Board. The corresponding structural shifting points are identified through the CUSUM of squares test. The empirical results disclose that Kyoto Protocol and lockdown have positively influenced the air quality. The study ends with suitable policy prescriptions.

Chapter 20 attempts to understand how the projects under the Smart City Mission have incorporated various ecological aspects to transform the cities into liveable and sustainable ones for the future generation. Using secondary data and carrying out a comparative analysis of selected smart city proposals, the chapter finds that there is still a lack of adequate emphasis on ecological sustainability in many smart city proposals. The paper suggests revisiting the smart city proposals, and initiatives should be made towards the development of urban areas in a sustainable way.

Chapter 21 tried to estimate and examine the relationship between energy intensity, capacity utilisation and total factor productivity of Indian Iron and steel industry for the time period 1980–1981 to 2016–2017. The study also takes into account the concept of adjusting TFPG by capacity utilisation. Again, Iron and Steel industry has become energy intensive over the time period taken up for the study. On the other hand, TFPG has declined in the liberalised era. The preliminary idea that we get from our result is that TFPG is negatively related to the extent of pollution generated by energy intensive nature of the Indian Iron and Steel industry, which is in line with reality.

Chapter 22 designed to determine the vertical floor wise air quality status of the city of Kolkata, India and the seasonal variation of the pollutants over the consecutive years from 2011 to 2017. It is demonstrated that the air pollution is the highest in the winter due to dry weather, second is festive season followed by winter due to heavily movement of vehicles and pedestrians for festival – shopping as well as pandel – hopping and then next is summer. But coming to the point of rainy season this is the lowest due to wetted air or wind of monsoon. This chapter attempts to understand the long-run trend of air pollution as the periodical average value suggests.

Chapter 23 attempts to estimate the CO₂ emission and emission intensity across Unorganised Manufacturing Enterprises (UMEs) on the basis of NSSO Unit Level data of 62nd (2005–2006), 67th (2010–2011) and 73rd (2015–2016) rounds. It also analyses the growth of UMEs in relation to CO₂ emission and emission intensity. The study found that firm-level characteristics like perennial nature, establishment type, urban location and expanding growth status are the major determinants of CO₂ emission intensity of UMEs. The capital intensive UMEs are polluting.

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