



STUDY ON THE ECONOMIC AND SOCIAL DIMENSIONS OF CLIMATE CHANGE IN INDIA

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Abstract

The effects of climate change on the global economy and society are already evident. Climate change is one of the most pressing environmental issues facing the globe today. India is dealing with a number of difficulties. Climate change is related with a variety of negative effects on agriculture, water resources, forests and biodiversity, health, coastal management, and temperature rise. Climate change's primary impact on India is a decline in agricultural productivity. Agriculture supports the bulk of the people, either directly or indirectly. Climate change would add to the burden on natural and social systems that are already under enormous strain as a result of rapid industrialization, urbanisation, and economic expansion. Climate change has a substantial impact on Indian society and the economy, including the need to adapt to climate change and reduce greenhouse gas (GHG) emissions. Incorporating these elements into development planning promotes the sustainability of planning and investments, as well as the competitiveness of the Indian economy.

This research examines the influence of climate change and its varied components in Indian contexts. Some of the important discoveries in the present literature have assisted us in deciding which of the numerous such consequences to focus on. The study emphasises the importance of policies in climate decision-making processes for building resilient communities.

Key words: *Climate change, Economic development, Greenhouse gas, Global warming, Poverty.*

Introduction

Climate change is one of the world's most serious dangers, with far-reaching consequences for society, countries, and economies. Climate change's potential influence on the world is unrivalled, ranging from unpredictable weather patterns to extreme climate events such as floods, droughts, and cyclones, as well as rising sea levels. Climate change refers to historically unusual changes in many climatic factors caused by human activities. Climate change manifests itself as abnormal increases in average temperature, shifting rainfall patterns, increases in the frequency and intensity of extreme events such as cyclones, and sea level rise caused by glacier melting. It has a negative influence on humans, ranging from sudden disruptions in everyday life to a progressive decline in standard of living. The contribution of the environment to the economy is a multifaceted phenomenon that includes many channels through which the environment aids the operation of an economy. As a result, throughout the last few decades, various economists have attempted to decipher the nature and magnitude of the effects of environmental change in general, and climate change in particular, on the functioning of economies and overall human well-being. Climate change is one of the most pressing global environmental issues confronting humanity, having ramifications for food production, natural ecosystems, freshwater supply, health, and more.



According to the most recent scientific assessment, the earth's climate system has clearly changed on both global and regional scales from the pre-industrial era. According to recent estimates from a NASA-led study, if greenhouse gas emissions (GHG) continue at their current rate, Greenland and Antarctica's ice sheets could collectively contribute more than 15 inches (38 centimeters) of global sea level rise, which exceeds the amount already set in motion by Earth's warming climate. Thus, it is clear that climate change, exacerbated by anthropogenic emissions, is raising global temperatures, changing weather patterns, and increasing the frequency and severity of extreme weather events. While extreme weather events are the most visible and immediate consequences of climate change, rising mean temperatures are a more intense, long-term, and equally dangerous effect. The Intergovernmental Panel on Climate Change (IPCC)'s annual assessment reports unequivocally support the role of anthropogenic processes in driving the observed warming of the Earth's surface by around 1oC over the past 150 years. Climate change and global warming are well understood to have the potential to substantially disrupt economies if appropriate action is not taken in a timely manner. Climate change's grave repercussions will not only have an impact on important natural capital, infrastructure, human health, and productivity, but will also harm industries such as agriculture, forestry, fisheries, ecosystems, and tourism, to mention a few.

As a result, climate change has both direct and indirect consequences that can have a domino effect on the rise or fall of any economy in the globe. Climate change's impact will not be uniform over the world, and developing countries are more exposed to the negative effects of global warming. The question of whether economic growth can be sustained while addressing climate change and adhering to broader environmental restrictions remains open. Different points of view range from believing that economic growth is unconstrained by environmental constraints to believing that sustained economic growth is simply incompatible with environmental constraints. The well-documented catastrophic physical and social repercussions of failing to address climate change would have a growing negative impact on economic growth and development. Therefore, when considering the different views in this debate, it is important to take action on climate change as the starting point and to evaluate the extent to which economic growth is compatible with that objective, rather than the other way around.

Review of Literature

This section reviews the various empirical and theoretical studies outlining the potential channels through which climate impact the economy.

The effects of climate change on sectors such as agriculture, animal husbandry, and tourism, which have a share in economic growth, have been the subject of research in many studies (Seo et al., 2005; Allison et al., 2009; Iglesias et al., 2009; Lee et al., 2012; Steiger et al., 2019; Tullo et al., 2019). Also, in some studies, the effects of climate change on economic growth are discussed globally or regionally (Fankhauser and Tol, 2005; Mendelsohn, 2005; Mendelsohn et al., 2006; Stern, 2006; Eboli et al., 2010; Victor, 2012; Kolev et al., 2012; Dell et al., 2012; Bosello et al., 2012; Abidoye and Odusola, 2015; Alagidede et al., 2016; Moore and Diaz, 2015; Tol, 2018). Dell et al. (2012) have tried to determine the effects of fluctuations in temperature in countries on total economic results. As a result of the study, they have argued that high temperatures significantly reduced economic growth in poor countries, while higher temperatures reduced not only output levels but also growth rates. They have also highlighted that high temperatures had far-reaching effects that reduced agricultural production, industrial production, and political stability. Fankhauser and Toll (2005) have investigated the dynamic effects that link both climate change and economic growth both theoretically and numerically. They have claimed that the main dynamic effect was through the accumulation of capital.



They have stated that a second dynamic effect was related to savings. As a result of their work, they have explained that climate change does not affect growth only through effects on savings and capital accumulation. Sequeira et al. (2018) have stated that their study is based on an assessment of the impact of climate change (i.e., long-term changes in temperature and precipitation) on economic and industrial outputs. Tol (2018), has found that climate change effects on the total economic are negative, but tolerable on average. Kahn et al. (2019) have examined the long-term impact of climate change on economic activity in 174 countries for the 1960-2014 period. Their study used a stochastic growth model and a panel data set (temperature and precipitation). As a result, the authors have found that the real output growth per capita is adversely affected by permanent changes in temperature above or below its historical norm and precipitation causes no statistically significant effect. Taher (2019) has examined the relationship between climate change and economic growth in Lebanon. According to the OLS technique, the author has used a time series analysis for the 1990-2013 period. He has explained climate change by using climate factors such as precipitation, forest areas, and carbon emissions. Henseler and Schumacher (2019) have investigated the impact of weather on countries' GDP and their main components of production, namely total factor productivity, capital stock, and employment. Their study has included 101 country-wide services for 1961-2010 of the panel data set. They showed that the main effects of weather are caused by temperature and trigger growth in GDP. They have also found that poorer countries are affected by higher temperature levels more than rich countries.

Objectives of the Study

The objective of this research of Economic Analysis is to provide systematic analyses of some of the key economic impacts of climate change. In determining which of myriad such impacts to focus on, we have been guided by some of the significant findings in the current literature. The study emphasizes the need for policies in climate decision-making processes to build resilient communities.

Research Methodology

The Data required for the study has been collected from secondary sources. This paper is basically descriptive and analytical in nature. In this paper an attempt has been taken to analyze the economic development in an era of climate change. The data required for the study is mainly collected from secondary source such as newspapers, magazines, journals, articles, annual reports, periodicals, Government reports, regulatory publications and related planning documents, websites etc.

The Geography of Global Warming

The nature of the global warming phenomenon determines the elements of our assessment model. Global carbon emissions affect local temperatures around the world, so we want a model of the world economy. Because these effects are extremely heterogeneous across regions, even within countries, we want a model with local geographic detail where temperatures affect both productivity and the living amenities from residing in particular locations. In recent research, we have shifted our focus from sea level rise to global warming, employing a more extensive and sophisticated evaluation model. We enable variations in local temperatures to affect three local attributes. First, temperature fluctuations have an impact on local productivity, the magnitude of which varies depending on the location's baseline temperature. Second, temperature variations have an impact on a location's appeal as a place to live, often known as its amenities. Third, temperature can affect the disparity in birth and mortality rates. Migration is expensive, thus where a person was born is important. Furthermore, we take into account the option to utilise how much energy in production, the intensity with which fossil fuels are used to generate energy, and the consequent CO emissions from these local choices. When combined



with a normal carbon cycle model, this results in a framework in which economic behaviour influences climatic predictions and vice versa. Incorporating this two-way feedback between local economy and climate is critical for a model to be effective in evaluating climate policy.

The Green House Effect

The greenhouse effect occurs when heat is trapped near the Earth's surface by chemicals known as 'greenhouse gases.' Consider these gases to be a cost blanket that envelops our globe, allowing it to stay warmer than it would otherwise. Greenhouse gases include carbon dioxide, methane, ozone, nitrous oxide, chlorofluorocarbons, and water vapour. Water vapour, which reacts to temperature changes, is known as 'feedback' because it magnifies the influence of the primary causes of warming. Scientists have determined that carbon dioxide is critical to preserving the stability of the Earth's atmosphere. If carbon dioxide were withdrawn, the terrestrial greenhouse effect would fail, and the Earth's surface temperature would decline by about 33°C (59°F). Greenhouse gases are part of Earth's atmosphere. This is why Earth is known as the 'Goldilocks' planet: its temperatures are just right, neither too hot nor too cold, allowing life to thrive. Part of what makes Earth so hospitable is its natural greenhouse effect, which keeps the average temperature at 15 °C (59 °F). However, over the last century, human activities, especially the combustion of fossil fuels, which has resulted in the release of carbon dioxide and other greenhouse gases into the atmosphere, have upset Earth's energy balance. This has resulted in a rise in carbon dioxide in the atmosphere and seas. Carbon dioxide levels in the Earth's atmosphere have been steadily increasing for decades, trapping excess heat near the surface and driving temperatures to climb.

Economic Growth

A growth rate is merely the (proportional) rate of change of a variable. When assessing the extent to which economic growth can coexist with measures to combat climate change, it is critical to first define it correctly. Economic growth is often assessed as the rate of change in output, or more specifically, real GDP. Real GDP is a measure of the market value of all final products and services produced in the economy in a given year, adjusted for inflation, and are used to assess a country's material living standards. However, these metrics leave out the value of the natural environment to humans, as well as other components of human wellbeing that are difficult to quantify, prompting the development of alternative measures of wellbeing. Friedman (2005) also argues that economic growth provides broader welfare benefits, in that it fosters 'moral societies' characterized by social and political liberalization, manifested in increased opportunity, tolerance, economic and social mobility, fairness and democracy.

Economic Growth from Greenhouse Gas Emissions

Since the Industrial Revolution, economic expansion has generally been associated with rising greenhouse gas emissions. Switching from fossil fuel-based to low-carbon energy sources can help maintain or increase production while lowering emissions, allowing growth to be decoupled from emissions. General technological development can also assist decouple growth from emissions by lowering the amount of energy or other materials needed for manufacturing in the first place. The increasing digital revolution of the economy, facilitated by the advancement of information and communication technology (ICT), may potentially have a favourable effect on decoupling.

Climate and the Economy

Climate change has the potential to cause enormous economic damage and offer serious long-term hazards. It is a global externality; one country's emissions affect all countries by increasing the stock of heat-raising gases in the earth's atmosphere, which causes warming. Climate change is expected to



have a considerable economic impact on many countries, with lower-income countries particularly vulnerable. Macroeconomic policies in these countries will need to be adjusted to account for increasingly frequent weather shocks, including creating policy flexibility to respond to shocks. Infrastructure upgrades will be required to improve economic resilience. In addition, climate change can pose considerable hazards to macroeconomic stability. Climate damage and stranded assets, such as coal deposits, that become uneconomic with carbon pricing pose hazards to nonfinancial corporate sectors, and the disruption could have an impact on company balance sheets.

The Relevance of Climate Change to the Indian Economy

1. India's climate varies greatly, from the Himalayas to the flat beaches, resulting in substantial climate transitions.
 - a. The climate ranges from frigid temperatures in the Himalayas to tropical conditions in Southern India.
 - b. The North-Eastern states received the most rainfall, while the North-Western states experienced drought, resulting in the Thar and Great Indian Deserts.
2. India's diverse climate has historically been advantageous. India has one of the world's largest economic densities, and a huge portion of the population depends on natural resources for a living, with a high reliance on rainfall.
3. Climate change can lead to unpredictable weather patterns. These unpredictable weather patterns might make it challenging to sustain and produce crops. Climate change has a direct influence on India's agricultural sector, which relies heavily on rainfall.

Effects of Climate Change in India

1. **Extreme heat:** India's climate is already warming. Unusual and unprecedented heat periods are predicted to occur more frequently and across a broader area. Under 4°C warming, the west coast and southern India are expected to transition to new, high-temperature climatic regimes, with considerable agricultural implications.
2. **Changing Rainfall Patterns:** Monsoon rainfall has decreased since the 1950s, indicating changing patterns. A 2°C increase in global average temperatures will make India's summer monsoon extremely unpredictable. At 4°C of warming, a highly rainy monsoon, which currently occurs only once every 100 years, is expected to occur every ten years by the end of the century. Wet years are projected to be wetter, while dry years will be drier.
3. **Droughts:** Since the 1970s, South Asia has experienced more droughts. Droughts have significant repercussions. Droughts devastated more than half of India's cropland in 1987 and 2002-2003, resulting in a significant drop in crop production. Droughts are projected to become increasingly common in certain regions, particularly in northwestern India, Jharkhand, Orissa, and Chhattisgarh. By the 2040s, excessive heat is anticipated to significantly reduce crop output.
4. **Groundwater:** Despite climate change, 15% of India's groundwater supplies are overexploited. Falling water tables are predicted to fall even farther as a larger population, more affluent lifestyles, and the services and industry sectors all want more water.
5. **Glacier Melt:** Over the past century, most Himalayan glaciers have retreated. Melting glaciers and the loss of snow cover over the Himalayas are predicted to endanger the stability and reliability of northern India's glacier-fed rivers at 2.5°C of warming. Changes in the flows of the Indus, Ganges, and Brahmaputra rivers might greatly effect irrigation, impacting the amount of food that can be produced in their basins and the livelihoods of millions of people.



6. **Sea level Rise:** Due to India's proximity to the equator, sea levels on the subcontinent are expected to rise significantly faster than higher latitudes. Sea-level rise and storm surges will cause saltwater intrusion in coastal areas, affecting agriculture, reducing groundwater quality, contaminating drinking water, and perhaps increasing diarrhoea cases and cholera epidemics, as the cholera bacterium survives longer in saline water. The densely populated cities of Kolkata and Mumbai are especially vulnerable to the effects of sea-level rise, tropical storms, and riverine flooding.

Apart from this, food and energy security are key problems. Water scarcity, widespread health risks, migration, and political strife are all predicted to worsen.

Impacts of Climate Change on the Indian Economy

1. **Reduced Labour Workforce:** Heat stress caused by climate change impairs cognitive function and work hours for jobs that involve a lot of outside activity, such as construction. It will have a negative influence on employee productivity. Thus, excessive heat stress will reduce industrial yields, decrease exports, diminish national GDP, and have an indirect impact on global trade.
2. **Energy Crisis:** According to a projection from the International Energy Agency (IEA), India's energy consumption would quadruple by 2030. Rising temperatures will increase demand for energy to help mitigate the heat effects. Furthermore, expanding energy demands frequently clash with climate-change plans, as energy and climate change have a unique relationship.
3. **Impact on Infrastructure:** Increased natural disasters caused by climate change will have a significant impact on a country's infrastructure and economy. For example, floods caused \$3 billion in economic damage in India during the last decade, accounting for 10% of worldwide economic loss.
4. **Lower Crop Yield:** Climate change is causing unexpected weather patterns. Weather uncertainties influence farmers' decisions regarding which crops to grow and when, limiting productivity. Furthermore, early seasonal snowmelt and glacier depletion as temperatures rise would diminish the river flow required for irrigation.
5. **Impact on Livestock:** India has the world's biggest livestock population. Climate change-induced heat stress lowers feed and fodder while increasing disease-prone circumstances. It will mostly effect marginalised farmers.
6. **Exacerbation of Inequality:** Climate change adaptation potential in India varies by state, geography, and socioeconomic class. Low-income families are particularly exposed to climate change-induced economic losses. As a result, for individuals with limited resources to adapt to climate change, increased government spending and slow economic growth may be required.
7. **Impact on Drainage System:** India's breadbasket region, the Indo-Gangetic Plain, withdraws 34% of its available water. Rising temperatures and increased seasonal unpredictability are causing Himalayan glaciers, considered the Earth's third pole, to melt at an increasing rate. If the melting pace accelerates, glacial lakes may overflow, creating flooding in river valleys supplied by these glaciers. It will be followed by a reduction in water flows, resulting in water scarcity.

Conclusion and Suggestions

In conclusion, climate change is not a distant threat, but an imminent and pervasive challenge that demands prompt and coordinated response. India, with its diversified geographical and socioeconomic structure, must prioritise sustainable practices, invest in renewable energy sources, and develop adaptation measures to prevent the negative effects of climate change.



Global cooperation is also required to address the underlying problems and collaboratively construct a resilient future. Governments, communities, and individuals share responsibilities for protecting the environment and ensuring a sustainable future. Only by working together can we hope to reduce the impact of climate change and ensure a habitable planet for future generations.

This study seeks to define the nexus strategy required to address climate change and its economic consequences, with the cooperation of important stakeholders, in order to create a sustainable future. Investment in infrastructure can mitigate future environmental hazards to economic growth by lowering the amount of environmental risk encountered by the economy and enhancing the economy's resistance to such risks. This necessitates both public and private infrastructure that is designed to meet long-term environmental demands and problems. For example, more robust water infrastructure and stronger flood defences are required to sustain expansion in the face of climate change. Economic development and investment in climate change adaptation and mitigation are either incompatible or mutually exclusive. Furthermore, they complement one another and provide a broader range of options for the change of Serbian society throughout the ongoing transition period.

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