

# Impact of Climate Change on Global Economics

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**Abstract**—This paper examines the effects of global climate change and environmental activities on economic variables such as productivity, unemployment, GDP growth, per capita income, income inequalities, agriculture, and so on. In addition, the research attempts to investigate the effects of climate or environmental changes on international trade, export-import barriers, and socio-economic development indicators.

The reverse cycle, i.e., how international commerce might help reduce the consequences of climate change, will also be touched upon, establishing a link between economies and natural/climatic forces that exist around us.

Climate variables are linked to various economic sectors (primary, secondary, and tertiary) and recurrent industrial operations that are an intrinsic element of the manufacturing process. Shifts in crop yields, loss of land and labor productivity, and capital damages have all been proved to be a result of climatic changes in the past, rather than just administrative and management variables. Similarly, ice sheet melting has resulted in massive oil leaks. Because oil is a commodity with global demand and is such an essential need for nations around the world, spills can result in significant economic losses and trade opportunities for countries. In recent years, countries have developed solutions to this problem, focusing on climate-resistant infrastructure and policies that reduce the negative impact of climate change on critical components such as the real exchange rate, income effect, international spillovers, and other general economic factors.

## I. INTRODUCTION

Today, sustainability has become the mantra for all businesses and global economies worldwide. Climate change is a major influencing factor in achieving the goal of sustainability. Controlling climatic variations and ensuring profitable returns through sustainable practices, on the other hand, is a difficult task. Given the diverse nature of different countries' economies, trade practices, government expenses, stock markets, and rates of GDP/inflation variation, developing a common policy or solution to a problem as diverse as

climate change is an extremely difficult task.

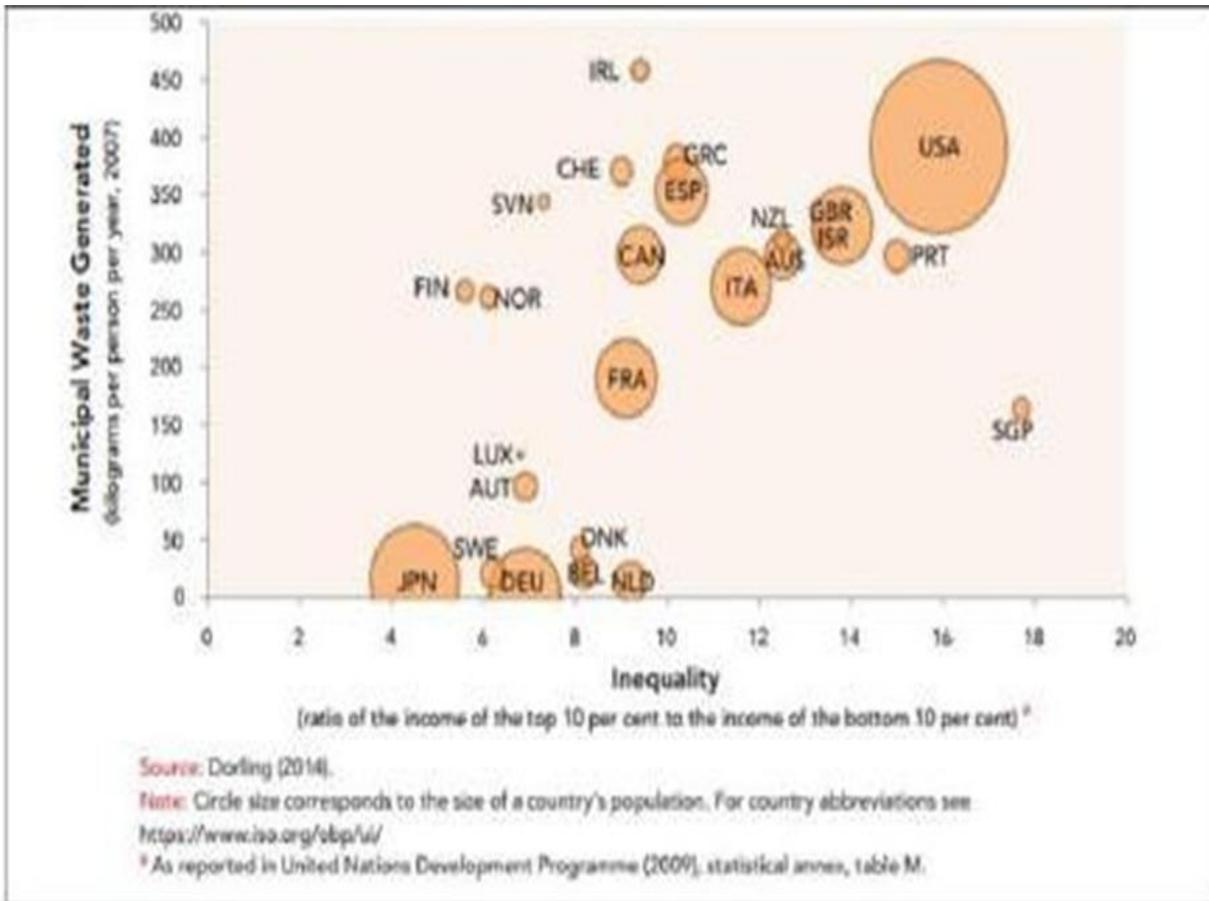
The task becomes even more difficult when future statistics are considered, which reveal projections of a rapid increase in not only greenhouse gases (GHGs), but also radiations and chemicals, which can have a disastrous impact on economic growth. Climate change is characterized not only by temperature increases, but also by natural disasters such as droughts, famines, and torrential rains, which impede industrial and manufacturing activities, as well as other variables such as labor productivity, balance of payments, and employment ratios. However, if appropriate research and action is taken on controllable variables such as monetary policy formulations, budgetary expense management, and so on, a solution that can benefit all economies around the world may be devised in the future.

## II. INCOME INEQUALITY V/S CLIMATE CHANGE

According to United Nations data on OECD countries, countries with higher levels of income inequality generate more waste per capita. The generation of waste is a characteristic of such societies. Social inequalities frequently sow the seeds of ecological crisis because the wealthier segments of behavior with higher per capita income levels and consumption power) avoid any social, economic, or ecological responsibility that they should bear. The income disparity between sections of society is so great that the average income of the top 10% of rich people in OECD countries today is approximately 9.5 times that of the poorest 10%. In general, income inequality refers to a certain number of people in a country consuming more resources than the rest (due to their higher purchasing power), but this consumption leads to overconsumption, increased resource usage, and waste generation. Per capita water consumption, for example, rises from 3.2 cubic metres in Japan (where the top 10% of earners earn 4.5 times the rest of the

population) to 6.8 cubic metres in the United States (where the income of the top 10 percent earning people is 16 times the rest of the population). To begin, the figure below depicts a comparison of per-person waste generation (municipality waste generation) with income inequality ratios in their respective countries. The United States and Japan are at opposite ends of this spectrum, with the United

States having one of the highest income inequality ratios and per capita waste generation, whereas Japan has the lowest income disparities and per capita waste generation. This establishes a trend in which the greater the income disparities, the greater the per capita waste generation, which exerts greater pressure on environmental resources and thus affects climatic variables.



Source: Dorling 2014.

Figure 1. Inequality and municipal waste generated across countries

Waste generation/accumulation, either in the form of landfills, air impurities, sewage waste, contamination of water bodies (lakes, rivers, oceans, etc), and so on can result in hazardous outcomes for humanity worldwide (fall in Air Quality Index (AQI)/Water Quality Index (WQI)). According to statistics reported by the United Nations Development Programme (UNDP) in 2009, around the

beginning of the twenty-first century, an analysis of income inequality ratios (top 10% earning people to bottom 10% earning people) to per person per day water consumption was conducted, and the results revealed that countries such as the United States, Great Britain, and others (Advanced and Developed Economies) had higher incidences of income inequality.

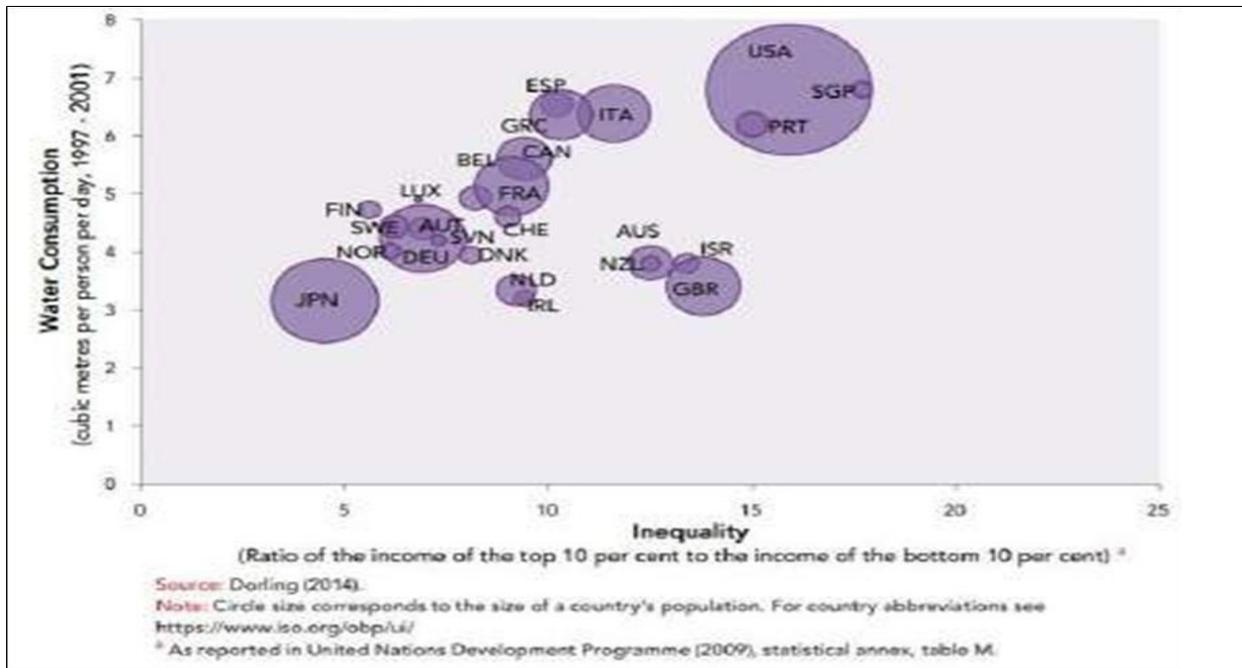


Figure 2. Inequality and consumption of water across countries, 1997-2001

However, income inequality cannot be the only factor influencing consumption patterns and environmental balance (indirectly). The graph above demonstrates that, despite having lower levels of income inequality, Japan consumes less water per person per day than the United Kingdom, where the income distribution is far more unequal in comparison to Japan. European nations were also confronted with similar challenges, and as a result, the EU Sixth Environmental Reduction Plan (2002-2012) identified waste reduction as one of its top priorities. For more than a decade, EU policies have promoted sanitary landfills and waste recovery.

Another way to measure the impact of inequalities on environmental sustainability is through the influence on household behavior. Inter-country variations in income distributions across a country can be used to track household behavior. Data on some Canadian households suggest that ecological footprints (impact of one person/community on the environment) vary with the level of income (According to sources, the top 10% of Canadian households have a per capita ecological footprint of more than 12.4 hectares, which is 66% greater than the national average of 7.5 hectares.). Food, housing, mobility, goods, and services are all subcategories of the ecological footprint and play a role in shaping up the climatic variables around us.

### III. PRODUCTIVITY OF LABOR WITH RISING TEMPERATURES

Climate change is a phenomenon that is directly related to the severity of heat stress, which influences the productivity of labor employed in an industry, particularly unskilled physical labor. Labor and production efficiency are inextricably linked, and if labor quality deteriorates due to climatic variables, not only will production suffer, but it will also contribute to the ever-present problem of poverty, raising the level of global poverty.

Regional heat exposure is higher in equatorial areas than in subtropical and temperate areas. Despite polar amplification of temperature rises, lower high-latitude temperatures and increased humidity in tropical areas result in significant increases in heat exposure. When global temperatures rise 1.5 degrees Celsius above pre-industrial levels, some areas experience over 300 K-days of total heat exposure due to a combination of high temperature and high humidity. This emphasizes the unequal distribution of climate change impacts around the world, as well as the potential for severe regional heat exposure in the near future. However, it becomes a question of comprehension as to how and since when the surface temperatures on the earth are rising.

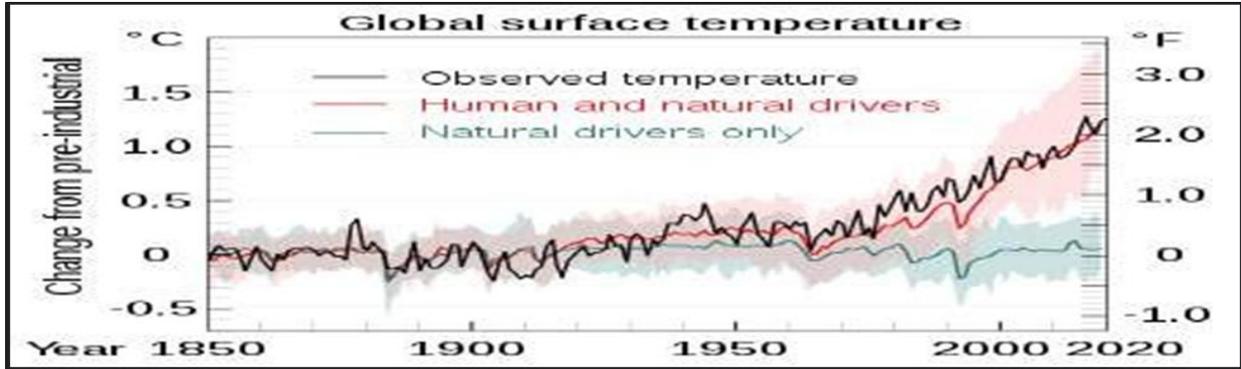


Figure 3. Observed global average temperature change since the pre-industrial era.

Source: Global Surface Temperature Change - Hansen - 2010 - Reviews of Geophysics - Wiley Online Library

Global surface temperatures<sup>1</sup> have been on a rise since the pre-industrial era and post industrialization, trends have only gone upwards. Temperature changes can be brought about both due to natural processes happening in the surroundings as well as human activities, however, as depicted in the graph above, the role of natural drivers has gone down and human and other external factors have played a bigger part during the 21st century so far (2000- 2020)

Records from the World Bank suggest that per degree increase in temperature (above room temperature) results in a -2% decline of labor efficiency and if the recent trends of global warming are anything to go by,

the socio-economic prospects of the future world aren't very promising.

To study the same, annual labor productivity loss was measured against heat exposure on the scale of GDP per capita loss (after dividing people into classes-based income levels). Black curve was a measure of global impact and subsequently curves of different colors had been plotted to study the impact on different nations as per their income levels.

<sup>1</sup> The average of the temperature at the sea surface and the temperature of the air over land is defined as the global surface temperature.

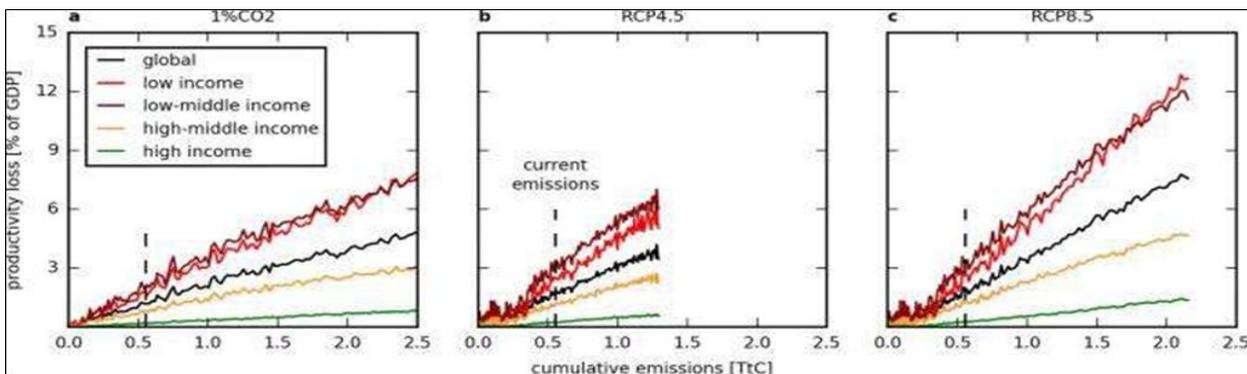


Figure 4. Relationship between carbon emissions and productivity loss

Climate change has had the greatest impact on countries with lower per capita income (9 times more than middle- and higher-income countries). The obvious reasons for this are that the majority of developing and underdeveloped countries (lower-middle income) not only lack adequate resources and technological means to mitigate the effects of climate change, but also because these countries are more

"labor intensive nations", i.e., most of the industrial activities and productive ventures in these countries rely on physical labor (mostly) over other capital or technological means, meaning that the quality of human capital serving in their nations is of utmost priority but given the impact of environmental variables, many of these nations lose out on quality labor. As per statistics, around 153 billion hours of

labor had been lost in 2017 as a result of heat exposure. High-middle-income countries have generally experienced productivity/GDP losses that are comparable to the global average. Productivity losses in terms of GDP decline have generally remained between 0.1 percent and 6 percent, with higher and middle-income countries facing GDP declines of between 0.1 percent and 5 percent, and lower- and middle-income countries facing GDP losses of more than 6 percent.

Keeping in perspective only the economic and financial terminologies, lower income countries are

impacted the most by global climatic variations but keeping in perspective the current environmental scenarios and the prevailing socio-economic trends, middle income nations like India which are currently investing heavily in infrastructural activities and industrial growth (in competence with developed nations) coupled with the irregular monsoons and heat waves occurring in these parts of the world, these nations are on the verge of facing substantial challenges in the form of destructive sea level rise, high rates of population growth and fragile food security.

IV. GLOBAL ECONOMIC GROWTH AND CLIMATE CHANGE INDICATORS

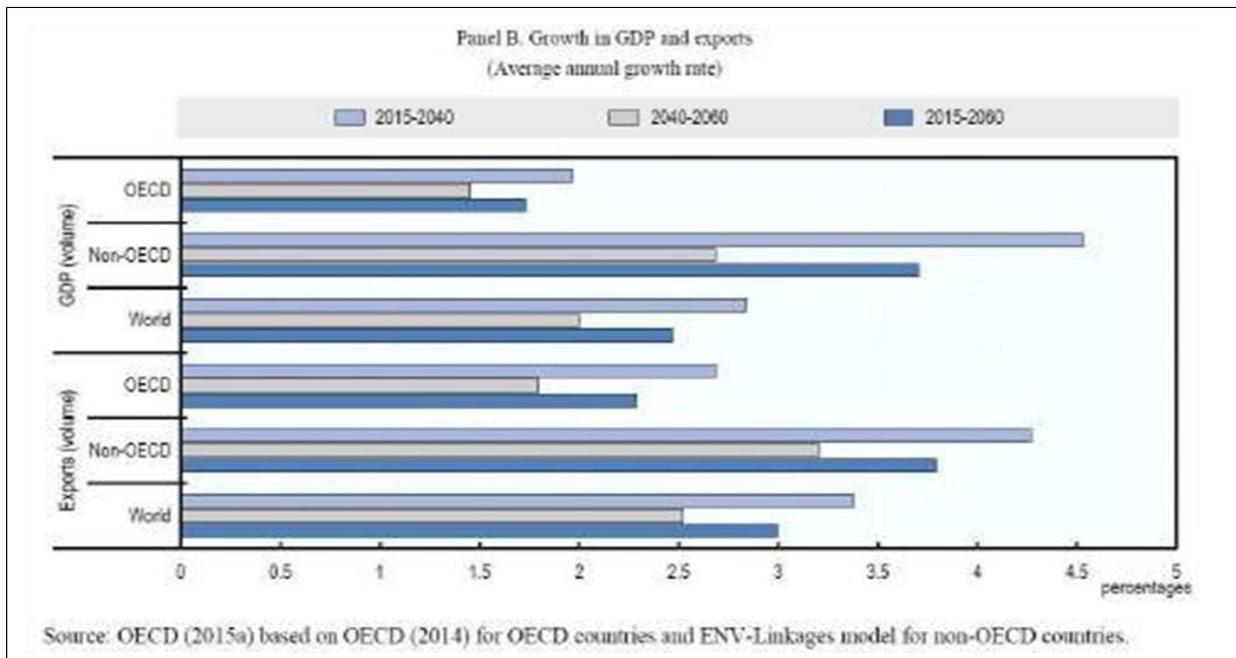


Figure 5. Export growth rate: a comparison between OECD and non-OECD nations

World GDP is expected to grow at a 2.5 percent annual rate for the next 50 years, though the trend is expected to slow slightly in the latter 20 years. The OECD regions' GDP growth rate, on the other hand, is expected to be only 1.8 percent until 2060, as growth rates in emerging economies outpace those in OECD countries. Furthermore, with nations such as Africa experiencing periods of rapid economic growth, the combined GDP share of non- OECD countries is expected to be around 70% of global GDP in the coming decades, up from 50% in 2015. However, such developments have had an equal impact on the environment as the shifting of economic importance to

emerging and developing economies in the absence of trade laws and climate policies. Unabated, uncontrolled, and excessive use of non-renewable/non-environmentally friendly assets such as fossil fuels has resulted in a massive increase in the emission of Greenhouse Gases (GHGs)<sup>2</sup>. Nations' development has come at an alarming cost in the form of increased reliance on coal for industrial, manufacturing processes, and meeting the nation's energy needs. The same can be justified by the graphs below, which show the impact of climate change indicators in the past, present, and future.

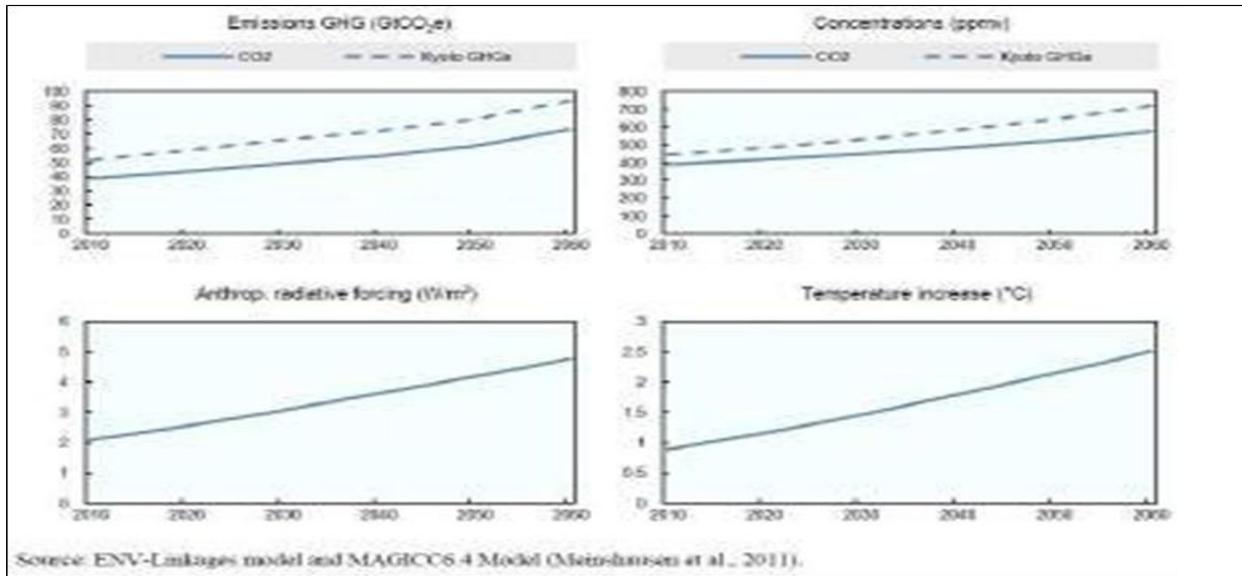


Figure 6. Indicators of rapid increase in the emission of greenhouse gases, temperature and radiations

The global economy today has insatiable hunger for the consumption of natural resources and with the growing population rates in the past decades, the hunger has only increased manifold. Humans are currently extracting over 70 billion tons of virgin materials, which is almost 80% higher than what it was 3 decades back causing severe environmental pressures on the planet's ecosystem along with crossing innumerable ecological boundaries.

CO<sub>2</sub> is a gas that absorbs and releases radiant energy in the thermal infrared spectrum, resulting in the greenhouse effect.

Industrialized countries are already consuming at high per capita income and emerging economies also are following a similar trend. This emergence has however resulted in billions of people suffering from acute poverty and not even meeting basic survival needs.

Today, economies over the globe extract 40% more economic value from each tonne of raw material than before, leading to an economic growth of 150% but what this has also meant is "greater resource consumption". More resource consumption means more pressure on the environment, further failing the motive of ensuring absolute reduction of resource use.

#### V. INCURRING OF HEALTH EXPENDITURE BY ECONOMIES

The greatest impact climate change can lead to is a trigger in diseases. Particularly, diseases like asthma,

aerosol, and the likes of other respiratory diseases are most likely to see a surge. Consequently, public expenditure on health would also have to be increased to cope up with the negative implications of climate on the human health/lifestyle.

"The complex nature of climate change and its environmental and social manifestations result in diverse risks to human health" (McMichael, 2013)

We are all aware that humans have evolved over time, and by evolution, we mean not only changes in human mechanics and lives, but also adaptation to the surrounding environment/climatic variables. Even minor changes in our environment can have a significant impact on humanity's survival on this planet. As a result, policymakers must be aware of the current and anticipated (future) consequences of climate change, as well as have strong measures in place to ensure optimal adaptation to natural changes. Some actions, such as emergency response, disaster recovery, warning information systems, and health-care infrastructure upgrades, are now required for every nation/economy.

Therefore, planners need to understand the costs of inaction, action, and residual damage. This entails taking into account the many stakeholders' costs and benefits, as well as their interests, relationships, and resource movement among them.

<b>Health damage costs</b>
<ul style="list-style-type: none"> <li>• Total national annual cost of climate change-induced health effects</li> </ul>
<ul style="list-style-type: none"> <li>• Total national annual cost of climate change-induced health effects as a percentage of GDP (damage cost + total GDP)</li> </ul>
<ul style="list-style-type: none"> <li>• Annual cost per capita of climate change-induced health impacts, for example:</li> </ul>
<ul style="list-style-type: none"> <li>• Total costs associated with climate-attributed health effects as a proportion of total damage costs associated with all health risks to society, requires data from studies of overall damage costs</li> <li>• Evolution over time to estimate the changing importance of health effects due to climate change</li> </ul>
<ul style="list-style-type: none"> <li>• Annual projected additional cases of climate change-induced injuries, diseases and resulting disability-adjusted life-years (DALYS)</li> </ul>
<b>Health adaptation costs</b>
<ul style="list-style-type: none"> <li>• Annual costs to (partially) reduce climate change-induced health effects:                             <ul style="list-style-type: none"> <li>- by disease grouping</li> <li>- by financing agency and line ministry</li> </ul> </li> </ul>
<ul style="list-style-type: none"> <li>• Annual health adaptation costs as a percentage of annual budget</li> <li>• Evolution of the above over time (to estimate changing adaptation costs)</li> </ul>
<b>Efficiency ratios</b>
<ul style="list-style-type: none"> <li>• Health damage costs averted by spending a unit of money on adaptation measures</li> <li>• Cost spent per health unit gained</li> </ul>

Source: euro. Who

As shown in the table above, the burden on national expenditures, particularly in the health sector, caused by climate change-related problems is divided into three categories: health damage costs, health adaptation costs, and efficiency ratios. The costs incurred by the government as a percentage of their GDP are referred to as health damage costs. These costs cover all potential health risks that a society may face, such as injuries, diseases, and disability-adjusted life years (DALYs).

Statistics indicate that heat waves will become more frequent and intense in the future, causing distress as

well as imbalance in the biological mechanisms of both plants and animals. Similarly, extreme or prolonged periods of high/low temperatures can be extremely damaging to crop production in various parts of the world. However, the situation is exacerbated if such heat waves arrive during the flowering season, when crop disruption can potentially result in plant seed generation capacity loss. When it comes to animals, drastic temperature/climatic variations weaken their immune systems, resulting in lower productivity and fertility rates.

<b>Box 1. Interests of different stakeholders in knowing health and adaptation costs</b>
<ul style="list-style-type: none"> <li>- <i>International climate change financiers:</i> comparison of costs and returns of increased health spending on different programmes or in different countries</li> <li>- <i>Ministries of finance:</i> overview of the budget impact or additional budget requirements of all government sectors for informed resource allocation per sector or line ministry</li> <li>- <i>Line ministries:</i> budgetary and resource deployment of a ministry and working with other ministries or the private sector to mobilize support for programmes</li> <li>- <i>Households:</i> expected cash outlays, other resource investments and use of cheaper or subsidized services or products</li> <li>- <i>Private sector providers:</i> business opportunities for the supply of goods and services</li> </ul>

Source: euro.who

Every country holds annual or bi-annual budgetary sessions in which different sectors, ministries, or departments are allotted a portion of the budget. It is indeed a quandary, especially with the emergence of

climatic disruptions and the COVID-19 virus, to justify and ensure that the health sector receives adequate funding.

Similarly, the presence of various trade laws and

barriers in nations enforced by nations in the name of environmental protection forces private sector parties to develop profitable and long-term business opportunities.

When studying health costs that are solely caused by climatic variations, health costs can be broadly divided into two categories: health adaptation costs and health damage costs. Health damage costs have a negative impact on a country's GDP growth rate, whereas health adaptation costs, while again a financial burden for the country, are required for every country to combat climate change-induced health effects. Health damage costs can be significantly reduced if health adaptation costs are appropriately incurred.

However, everything planned does not always go as smoothly as planned when economic and financial variables are not taken into account. To deal with imminent health threats, it will be critical that both public and private funds are well utilized, as has been the case for many sectoral activities in the past. Another critical factor is to spend wisely and efficiently on adaptation measures to combat the risks

and opportunities posed by climate change. The preceding table provides a stable starting point for the same in terms of areas such as health damage costs, health expenditure costs, and efficiency ratios

### VI. SPECIFICATIONS THROUGH EKC HYPOTHESIS

However, making generalized specifications about the impact of heat waves is a difficult task, and the impact caused is generally non-uniform in nature, with less developed countries generally facing fewer negative consequences, contrary to the EKC Hypothesis, which states that low-income countries' activities are a source of environmental pollution and damage.

However, the EKC Hypothesis provides another intriguing inference, according to which once a certain level of income (industrial economy) is reached, the trends reverse and industrial development no longer has a relationship with environmental/climatic degradation.

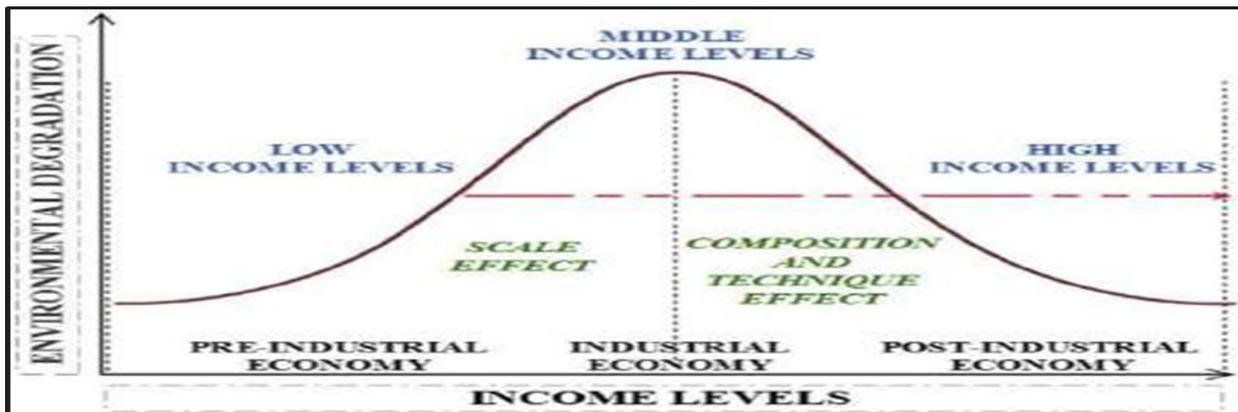


Figure 5. Environmental degradation across economies

Source: SpringerLink

However, heat waves are not the only cause of climate disruption. Large changes in rainfall patterns can also have a negative impact on a country's economy and spending. Drought, torrential rainfall, and excessive flooding can result in severe losses of not only agricultural land but also industrial and manufacturing processes as extraction of minerals, raw materials, fossil fuels, and so on will be severely hampered either due to resource exhaustion (potentially wiped out due to natural disasters) or a lack of energy and manpower

for the firm's operations. Apart from these direct implications, extreme climatic conditions can also lead to development of favorable conditions at optimal temperatures for pests, viruses, microbes and other forms of bacteria to develop and spread diseases for both crops and animals. To deal with a problem of such a magnitude, it becomes essential to develop a strong international riposte to food shortages, change in irrigation practices and cultivation techniques, sowing and harvesting time periods, etc.

VII. IMPACT ON UNEMPLOYMENT

Around one third of jobs in the G20 countries rely directly on the effective management and sustainability of a healthy environment. Climate change and other forms of environmental degradation have already caused net negative impacts on jobs and work productivity, and these impacts are expected to become more pronounced in the coming decades. temperature increases can, for example, make heat stress more widespread, thus reducing the total number of work-hours. The effects of climate change also have specific implications for women and, in particular, for the challenge of achieving gender equality in the world of work. Differences in social and economic roles and responsibilities exacerbate the vulnerability of women, migrants, youth, indigenous and tribal peoples, people in poverty and people with disabilities, all of who tend to have lower access to resources for climate change adaptation, including land, credit, agricultural inputs, the support of decision-making bodies, technology, social insurance and training. For the majority of such individuals working in the informal economy and i small enterprises, it is especially difficult to recover from the effects of environmental disasters. Quantitative simulations indicate that climate change mitigation has the potential to keep future adaptation costs down and bring net employment benefits through, inter alia, a substantial reallocation of labour. However,

whatever mitigation efforts are undertaken, the impacts of climate change are already making themselves felt and they are not expected to diminish in the near future. Thus, adaptation measures are called for and it is worth emphasizing that these can also lead to employment creation. Adaptation measures include, but are not restricted to, the development of natural and built infrastructures to project individuals and communities against natural hazards. Depending on their design, such infrastructure can generate employment opportunities far beyond the construction sector. Adaptation measures should be designed so as to take into account gender equity concerns. Furthermore, community participation and social dialogue in the design and implementation of such measures can help reinforce local development and employment creation. Special protection and skills development policies increase adaptive capabilities and can project individuals and communities faced with natural hazards against income and food insecurity. They can also help displaced workers and workers directly affected by climate-related hazards. More generally, the labour regulatory framework can support adaptation policies by offering solutions to cope with environmentally induced stress at work, environmentally induced migration, and the challenge of providing compensation and protection for workers in the sectors affected, as well as by making tools available for the diversification of economies.

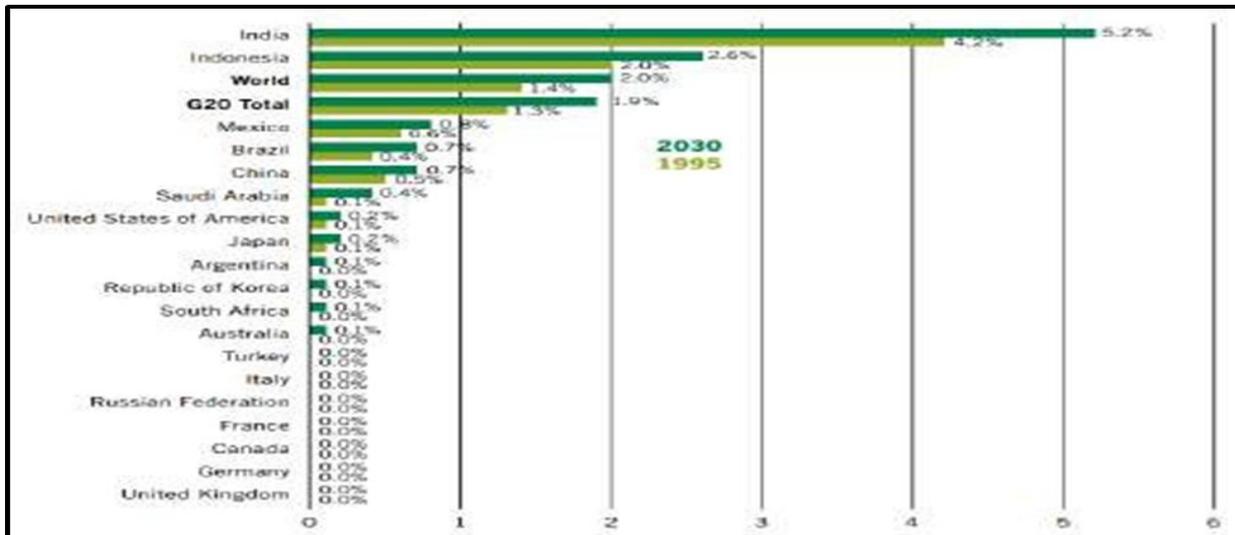


Figure 6. Percentage of work-hours lost owing to heat stress under a 1.5°C scenario, 1995 -2030

Source: International Labour Organization Report

This data can be interpreted in two ways. One could argue that developed countries, with higher levels of technological and infrastructural development, are better equipped to deal with climatic variations and other unexpected extremes, whereas middle-income and developing countries lag behind in terms of having the right kind of technology, policies, and means to resist climatic variations. However, the same can be interpreted in terms of industrial activities in both developing and developed countries. Developing countries, such as India, rely more on primary and secondary sector production to boost economic

growth, whereas developed countries employ the majority of their workforce in the tertiary sector, primarily in IT-related activities. Primary sector activities such as agriculture have a high demand for physical labor activities, and the nature of the job requires people to commute to work and work in the open field, increasing their rate of exposure to higher/lower degrees of temperature. Therefore, this results in rapid increase in the heat stress on the people which lowers the level of productivity as justified from above.

**Table 1. Proportion of jobs relying on ecosystem services, selected G20 countries, 2014**

Country	Number of jobs relying on ecosystem services (thousands)	Total number of jobs (thousands)	Proportion of jobs relying on ecosystem services (%)
Argentina (urban)*	926*	11 047*	8*
Australia	989	10 839	9
Brazil	20 290	89 368	23
Canada	1 275	17 269	7
China	325 145	653 843	50
European Union	71 084	434 445	16
France	2 128	27 100	8
Germany	2 768	42 674	6
India	193 727	375 559	52
Indonesia	47 549	114 839	41
Italy	2 427	22 577	11
Japan	4 814	53 152	9
Korea, Republic of	2 953	25,797	11
Mexico	11 882	51 158	23
Russian Federation	8 713	63 624	14
South Africa	1 374	12 468	11
Turkey	7 813	24 562	32
United Kingdom	1 611	31 363	5
United States of America	10 396	149 415	7
G20	708 929	2 087 385	34
World	1 231 684	3 114 301	40

Source: International Labour Organization Report

The same can be justified from the data above as India has the highest proportion of jobs (52%) dependent on ecosystem services which is far higher than the world average (40%). The solution to this lies mostly in the policy formulations, technological advancements and budget allocations that the government provides to different nations for their industrial activities.

### VIII. CLIMATE CHANGE AND MONETARY POLICY

Climate change may affect the balance sheets of financial intermediaries, asset valuations and the expectations of economic agents. As a consequence, transmission channels of monetary policy may be impaired by the rise in stranded assets and increased credit risks amid more intense climate-related developments. Moreover, as the financial system is at the core of the transmission mechanism, an abrupt repricing of assets potentially triggered by transition measures could put pressure on banks' balance sheets and constrain their ability to provide credit to the economy. Beyond these channels, the expectation channel could also be distorted as climate change intensifies.

Investigating the effect of temperature shocks on inflation has important policy relevance. Central banks can easily manage demand-side shocks---because they

are benign in nature. For example, expansionary demand shocks tend to push prices up as well as output. Because the price level and output are moving in the same magnitude, it is easier to stabilize one without compromising the other. For example, the central bank can reduce inflation and at the same time insulate output from these demand shocks (Mankiw 2005). This situation is often referred to as 'divine coincidence' because these shocks pull inflation, output, and employment in the same direction. In contrast, central banks tend to struggle vis-a-vis supply-side shocks such as temperature shocks. Indeed, unlike demand-side shocks, supply-side shocks tend to pull prices, output, and employment in opposite directions thereby requiring from monetary authorities a trade-off between price stability and output stability. This is exacerbated in the context of climate-related variables (e.g., temperature shocks) where inflation is expected to increase and output reduced. Consequently, for a central bank following a pure inflation targeting, this would mean any attempt to forcefully bring down inflation will further reduce output because of the trade-off. Even considering a central bank that is not involved in an inflation targeting, attempts to reduce inflation induced by supply shocks, such as climate-related shocks, could be done at the cost of increasing the output gap.

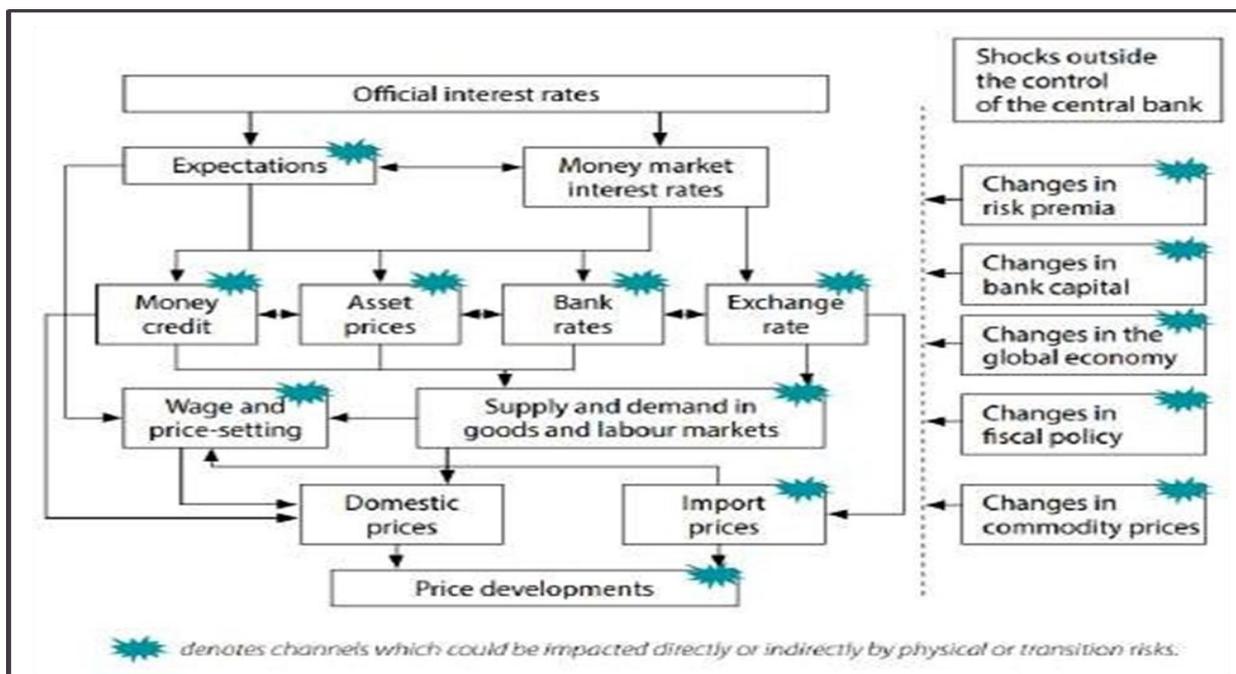


Figure 9. Impact of climate risks on monetary policy transmission channels

Beyond its effect on the financial sector, climate change could have a fairly direct impact on central banks' ability to stabilise inflation. Policies aimed at promoting the transition towards a carbon-neutral economy such as carbon taxes are likely to affect the volatility of headline inflation, which includes energy prices. Most inflation-targeting central banks, including the RBI, target headline inflation, because it is more representative of the citizens' consumer basket than other notions of inflation. In any case, the RBI's medium-term orientation of our price stability

objective provides us with some leeway to see through transitory energy-driven increases in headline inflation.

One of the common climatic variations, as already mentioned above, is the presence of hot summer weather shocks and its impact on inflation and its components. Following are the graphs which show variation in the consumer price index of different food related and other times with rise in temperature. The indexes have been derived separately for emerging and developed economies.

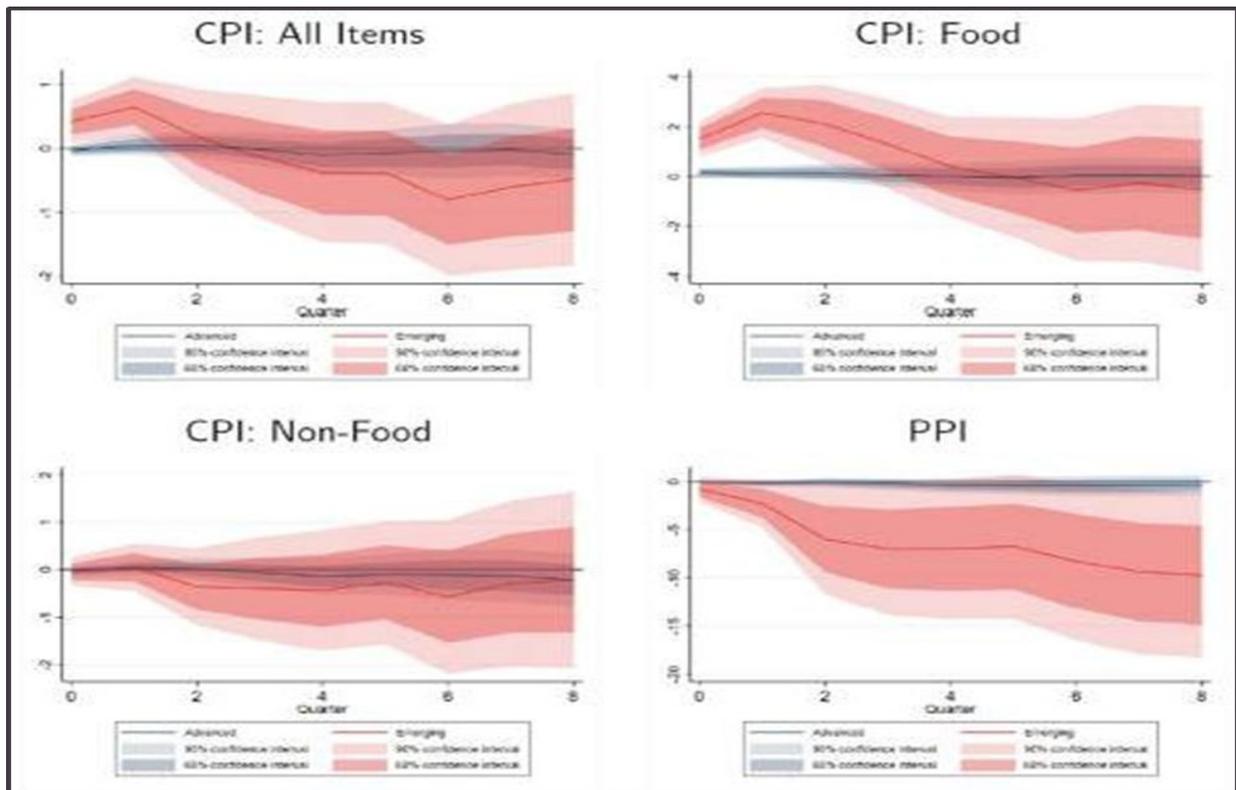


Figure 10. Impact of climate risks on monetary policy transmission channels

Source: vox.eu.org

While it is true that there has been significant movement toward the ideology of Net Zero Carbon Emission<sup>3</sup>, this has resulted in sharp increases in carbon prices, which have subsequently impacted consumer prices for electricity consumption, gas and petrol prices, as well as indirect costs in numerous sectors due to increased production costs.

As the graphs above show, incidences of negative inflation have been mostly observed in emerging economies. Deflation<sup>4</sup> generally occurs when the supply of money is reduced or the supply of credit is

reduced, both of which inhibit consumer spending. However, the cause of deflation from the standpoint of climate change can be interpreted as the fact that because the majority of developing economies frequently face short-term supply disruptions, primarily in the agricultural sector, there is long-term downward pressure exerted on public demand, resulting in negative inflation. Another thing to note here is that the PPI index has a more negative trend than the CPI indices.

IX. WORKING OF CAPITAL MARKETS WITH ENVIRONMENTAL CHANGES

The negative impact on the capital markets can take place in two ways. Here, it is assumed that the investment in the capital markets are done from the savings from income of the people. Firstly, when due to a labour shift and a slowdown in the economy, the wage income falls, the investment in the capital markets fall. This happens because at a given autonomous consumption expenditure, a fall in income would lead to lower savings and hence a lower amount of money invested in the capital markets. Secondly, at a given level of income, due to the health hazards posed by air pollution, the expenditure of healthcare rises which pushes down the savings, as a corollary of which the investment in the capital markets also falls. If the two reasons are combined, there will be a fall in income coupled with an increase in expenditure which would be doubly bad for the level of saving in the economy and doubly bad for the capital markets. The countries which will be majorly hit by

3 Net Zero Carbon Emission: Carbon emissions (or

release of any other harmful fumes/gases) nullified by absorption of an equal amount by the atmosphere.

4 Decline in the general price level of goods and services in the economy.

this will be the countries which rely heavily on labour as the productivity shock will be greatest for them, for example China. It's interesting to note, however, that India, although a majorly labour dependent country, will not have its capital markets hurt much. This is because the average Marginal Propensity to Save and the investment from these savings in India is so low, that lower savings will not lead to a significant impact on the capital markets. This is opposed to a country like China which has a high Marginal Propensity to Save and Invest and whose capital markets will be one of the most severely affected ones in the world.

Air pollution also leads to lower investor Elasticity of Inter-temporal substitution (EIS). Low EIS means low willingness substitute. Today's consumption with future consumption so investors prefer to consume more in present thereby lowing the demand for investment today and ultimately leading towards falling stock prices.

Table 2.

Stock index		One day lagged pollution				Same day pollution			
		Good	Unhealthy	UMG	p-value	Good	Unhealthy	UMG	p-value
<i>Kallio</i>									
OMX Helsinki	0.030	-0.661	-0.691***	0.002	0.008	-0.004	-0.012	0.940	
OMXH25	0.033	-0.499	-0.532***	0.003	0.013	0.052	0.040	0.767	
Basic Materials	0.020	-0.308	-0.328*	0.086	0.005	0.042	0.037	0.845	
Financial	0.045	-0.293	-0.337*	0.095	0.027	0.018	-0.009	0.958	
Industrials	0.044	-0.153	-0.197	0.148	0.029	0.203	0.174	0.111	
Consumer Goods	0.043	0.022	-0.021	0.865	0.039	0.066	0.027	0.796	
Oil & Gas	0.053	-0.750	-0.803***	0.009	0.028	0.130	0.103	0.760	
<i>Mannerheimintie</i>									
OMX Helsinki	0.027	-0.037	-0.064	0.568	0.117	-0.010	-0.128	0.690	
OMXH25	0.042	-0.051	-0.093	0.405	0.116	0.032	-0.084	0.945	
Basic Materials	0.033	-0.101	-0.134	0.357	0.092	-0.104	-0.196	0.250	
Financial	0.038	0.107	0.069	0.639	0.137	0.130	-0.007	0.496	
Industrials	0.057	0.033	-0.024	0.832	0.171	0.089	-0.083	0.704	
Consumer Goods	0.047	-0.055	-0.102	0.343	0.082	-0.017	-0.099	0.523	
Oil & Gas	0.057	-0.133	-0.190	0.287	0.615	0.119	-0.496	0.613	
<i>Hong Kong</i>									
Hong Seng	0.023	-0.100	-0.123	0.301	-0.031	-0.111	-0.142	0.307	
Utilities	0.035	-0.052	-0.087	0.235	0.021	-0.054	-0.033	0.205	
Financial	0.026	-0.107	-0.134	0.266	0.021	-0.145	-0.124	0.197	
Commercial & Industrial	0.022	-0.060	-0.082	0.548	-0.044	-0.089	-0.133	0.460	
Consumer goods	0.029	-0.057	-0.085	0.464	-0.277	0.118	-0.158	0.383	
Oil & Gas (CALC)	0.216	0.337	0.121	0.482	0.211	0.366	0.577	0.406	
Oil & Gas (HS)	-0.024	0.084	0.061	0.555	-0.016	-0.190	-0.206	0.345	

Notes: The time period covered is 2000-2016. However, due to data availability Mannerheimintie sample begins from 2005. Similarly, the index start dates vary slightly. Refer to Table 2 for specific periods. UMG denotes the Unhealthy minus Good return difference. Kallio and Hong Kong (Central) are background stations, whereas Mannerheimintie is a traffic station. P-value for Model 4 is reported and \* denotes statistical significance of 10%, \*\*denotes statistical significance of 5% and \*\*\*denotes statistical significance of 1%.

Source: [Forsti, A. (2017) The Stock Market Effect of Air Pollution: Evidence from Finland and Hong Kong.]

The chart above also shows the effect of various pollutants on the stock market index of Helsinki and Hong Kong, OMX Helsinki 25 and Hang Seng respectively, on a one-day lagged effect and on the same day. The results show a mostly negative effect of the increase in pollution to the returns across various market indices.

Over the previous decade, utility companies that have invested in renewable energy sources have significantly reduced carbon intensity in their production processes, which is a positive step toward establishing a "green economy". For this reason, utility firms have transitioned to more sustainable business models, reduced emissions from operations, and boosted investments in green assets. For instance, Walmart has shifted to 100% utilization of renewable energy sources for its operations. On the same lines, Coca Cola too had narrowed down to 3 major environmental goals in sustainable packaging, water stewardship and climate & energy protection in their common business practices. According to IHS Markit, global renewable energy capital investment is expected to rise by 14% over the next five years.

The above statistics taken from BSR (Business for a Better World) are a positive sign, having major corporations around the globe stepping up to take initiatives and strike a balance between climate stability and profit making.

X. BALANCE OF PAYMENTS

A large deal of economic growth is dependent on foreign trade. With the major economies such as China, India, the European Union and the return of the USA being part of the Paris Agreement, a major challenge erupts to balance out trade liberalization goals, contemporary trade agreements and commitments to the Nationally Determined Contributions (NDC). It is a fact that the bigger economies have displayed a lack of ambition, whether explicitly or covertly towards the implementation of United Nations Framework Convention on Climate Change (UNFCCC) So, there often arises contradictions when it comes to policies on climate change and policies on trade. If we take taxations as an example, multiple countries have implemented carbon taxes on industries to salvage its emission. Such taxes transform to duties on imports from carbonated products from other nations. On the contrary, subsidizing sustainable and eco-friendly products often gets subsidized by the governments. This should be further promoted by reducing duties on sustainable products.

Policy domain	in NDC	Country
 Tax	Carbon taxes	Brunei Darussalam
	Tax reductions for energy efficient appliances	Armenia, Chile, India, South Africa
 Import bans	Vehicles older than 3 years	Gabonese Republic
	Incandescent bulbs and inefficient devices	Venezuela
 Subsidies	Renewables energy	Burkina Faso, Guatemala
	Retrofits	Rwanda
	Removal of fossil fuel subsidies	Ethiopia, Ghana
 Market-based mechanisms	Introduction or expansion of domestic carbon emissions trading schemes	China, Costa Rica, Dominica, Egypt, Gabon
 Green procurement	Greening public transport to improve fuel efficiency or encourage alternative fuels	Costa Rica, Monaco, UAE

Source: The Economist Intelligence Unit.

Removing tariffs on environmental goods and services can support the global expansion of renewable energy, recycling, organic agriculture, and other green activities. A 2017 World Bank study estimated that eliminating tariffs and NTBs on certain clean energy technologies and energy efficiency products could

increase their trade volume by 14% and 60%, respectively.<sup>61</sup> For consumers, lower tariffs reduce prices, while for exporters they open up new markets and increase access to more innovative and cost effective suppliers.



Investment liberalisation agreements, which can be incorporated into trade deals or signed as standalone agreements, have also been invoked to contest climate and environment policies. For example, the governments of Germany, Canada and the US have faced legal action from companies for environment-related regulatory changes and decisions on water pollution, hydraulic fracturing, and an oil pipeline, respectively

**XI. AGRICULTURAL TRENDS**

Farming and agriculture play a very vital role in ensuring the sustenance and longevity of life present on earth. However, there are also many agricultural practices and trends causing a negative influence on the environment around us as well as inhibiting a nation’s economic growth.

Agriculture significantly contributes to the production

of greenhouse gases, resulting in the greenhouse effect and climatic adversity. Some farm techniques, such as stubble burning, involve burning off the straw stubble that remains in farms after harvesting crops like rice and wheat in order to prepare the land for the next harvest season. While this method aids in the conservation of mineral and nutrient content in the soil, the impact on the surrounding ecosystem is disastrous. Despite being on the books, rules and regulations prohibiting such activities in the Indian state of Punjab, for example, have not been strictly enforced. Despite

the fact that rice straw burning is prohibited under section 144 of the CrPC, over 50,000 incidents of stubble burning were detected in Punjab in 2021, with severe consequences on the Air Quality Index (AQI), and no FIR was filed against the activity. The following statistics show that the problem has previously existed in Punjab:

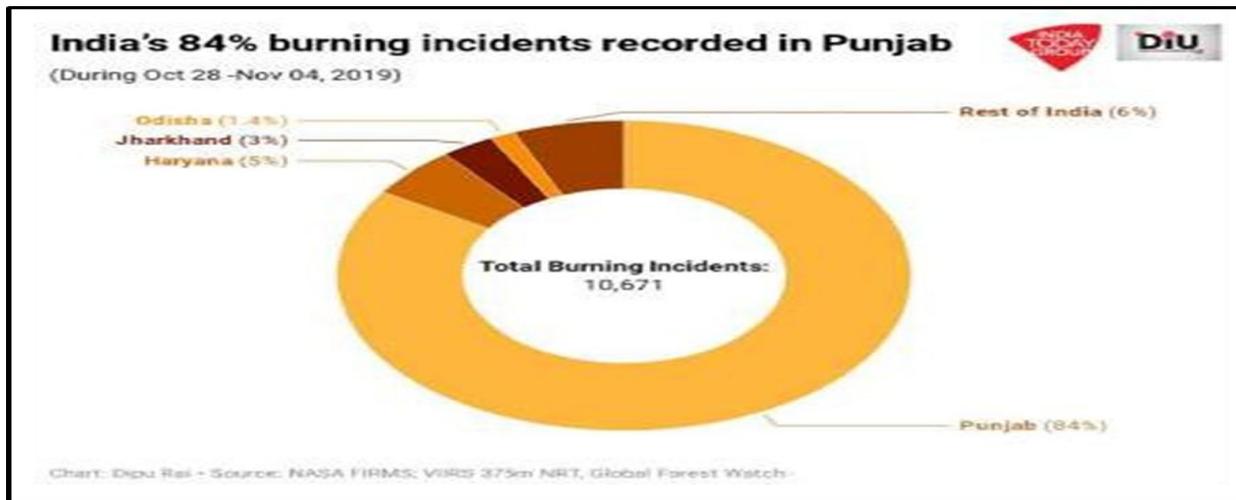


Figure 11. Punjab accounts for over 84% stubble/crop burning incidents

However, it is well known that the agricultural sector is more or less the backbone of several national economies, and thus a solution that neither affects the output efficiency of the agro sector nor complements the objectives of sustainability and ensuring environmental balance around the localities must be considered. To achieve this dual objective, it was vital to realize that global food security was achievable only by ensuring both “sufficient food production” and “sufficient food access”. Climate change is expected to exacerbate food insecurity by raising food prices and reducing food production. Food may become more expensive as energy prices rise as a result of climate change mitigation measures. Water essential for food production may become scarce due to rising crop water demand and drought. Competition for land

may increase as certain locations become climatically unsuitable for production. Furthermore, catastrophic weather events associated with climate change may result in abrupt decreases in agricultural productivity, resulting in rapid price increases. For example, in the summer of 2010, heat waves caused output losses in key production areas such as Russia, Ukraine, and Kazakhstan, contributing to a sharp spike in the price of staple commodities. These increased prices pushed an increasing proportion of locals into poverty, demonstrating how climate change can lead to food insecurity. Below is the analysis by IPCC (Intergovernmental Panel on Climate Change) that projects percentage change in yield or production in the coming decades.

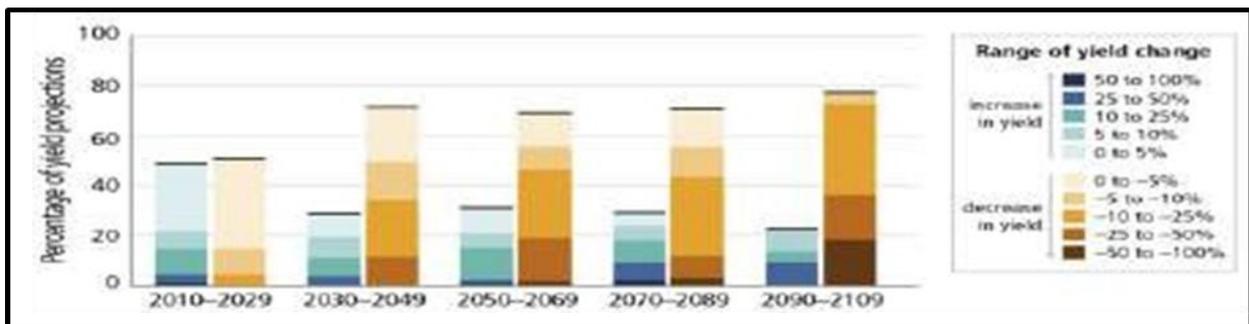


Figure 12.

Figure SPM.9 | Summary of projected changes in crop yields, due to climate change over the 21st century. The figure includes projections for different emission scenarios, for tropical and temperate regions, and for adaptation and no-adaptation cases combined. Relatively few studies have considered impacts on cropping systems for scenarios where global mean temperatures increase by 4°C or more. For five timeframes in the near term and long term, data (n=1090) are plotted in the 20-year period on the horizontal axis that includes the midpoint of each future projection period. Changes in crop yields are relative to late-20th-century levels. Data for each timeframe sum to 100%. © IPCC, 2014, 5th assessment

## XII. CONCLUDING NOTE

All forms of environmental degradation have a direct and negative impact on the world of economics. The degradation of the environment jeopardises the provision of ecosystem services and the jobs that rely on them. Despite the fact that mitigation strategies can help to decrease future adaption costs, climate change adaptation is a matter of urgency that must be addressed without delay. daptation measures can result in employment gains and prevent job losses. Investment in adaptation infrastructure is projected to have positive employment effects by increasing demand for construction work in projects aimed at

lowering costs. Trade must be a central part of the solution. The WTO must also take decisive action. Its Committee on Trade and Environment should strengthen its day-to-day coordination with the UNFCCC, and its national Trade Policy Reviews should examine whether a country’s trade policies are supporting, or hindering, its climate commitments. More positively, India’s NDC targets include an emissions reduction of 33 –35% by 2030 compared with 2005 levels, and an increase in the share of non-fossil-fuel- based energy to 40% by 2030, earning it a rating of “2°C-compatible” by CAT. Indeed, if India abandons plans to build new coal-fired power plants, curtails the expansion of fossil fuel production and

fully implements its Draft Electricity Plan, it could achieve the 40% target a decade earlier. Supporting climate-friendly FTAs and introducing a climate waiver would be a pivotal step in aligning the global trade architecture with climatic realities. It would position trade as a solution to climate challenges, rather than a driver.

### XIII. APPENDIX 1

#### List of Abbreviations

°C	Degree Celsius
CAT	Climate Action Tracker
CETA	Comprehensive Economic and Trade Agreement
CO <sub>2</sub>	Carbon dioxide
COP	Conference of the Parties
CPTPP	Comprehensive and Progressive Agreement for Trans-Pacific Partnership
ECT	Energy Charter Treaty
ETS	Emission trading scheme
FTA	Free trade agreement
GATT	General Agreement on Tariffs and Trade
GDP	Gross domestic product
GHG	Greenhouse gas
IEA	International Energy Agency
IPCC	Intergovernmental Panel on Climate Change
MEA	Multilateral environmental agreement
NAFTA	North American Free Trade Agreement
NDC	Nationally Determined Contributions
NTB	non-tariff barrier
OECD	Organisation for Economic Co-operation and Development
PPM	Producing and Processing methods
UNCTAD	United Nations Conference on Trade and Development
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
WTO	World Trade Organization

### REFERENCES

- [1] This is How Climate Change Could Impact the Global Economy | World Economic Forum (weforum.org)
- [2] Economics of Climate Change | US EPA
- [3] <https://www.brookings.edu/research/ten-facts-about-the-economics-of-climate-change-and-climate-policy/>

- [4] [https://www.un.org/esa/desa/papers/2015/wp145\\_2015.pdf](https://www.un.org/esa/desa/papers/2015/wp145_2015.pdf)
- [5] [https://www.unido.org/sites/default/files/2013-04/GREENBOOK\\_0.pdf](https://www.unido.org/sites/default/files/2013-04/GREENBOOK_0.pdf)
- [6] [https://www.un.org/esa/desa/papers/2017/wp152\\_2017.pdf](https://www.un.org/esa/desa/papers/2017/wp152_2017.pdf)
- [7] <https://www.futurelearn.com/info/courses/climate-smart-agriculture/0/steps/26565>
- [8] The employment impact of climate change adaptation Input Document for the G20 Climate Sustainability Working Group (ilo.org)
- [9] <https://www.icaew.com/technical/financial-services/2021/will-acting-on-climate-change-push-up-inflation-or-would-not-acting-be-worse>
- [10] [icc-report-trade-and-climate-change.pdf \(iccwbo.org\)](https://www.oecd.org/finance/Financial-Markets-and-Climate-Transition-Opportunities-Challenges-and-Policy-Implications.pdf)
- [11] [https://www.bsr.org/reports/2017\\_BSR\\_Sustainable-Business-Survey.pdf](https://www.bsr.org/reports/2017_BSR_Sustainable-Business-Survey.pdf)
- [12] <https://www.oecd.org/finance/Financial-Markets-and-Climate-Transition-Opportunities-Challenges-and-Policy-Implications.pdf>
- [13] <http://www4.unfccc.int/ndcregistry/Pages/Home.aspx> <http://cait.wri.org/indc/#/>
- [14] [https://wedocs.unep.org/bitstream/handle/20.500.11822/22070/EGR\\_2017.pdf?isAllowed=y&sequence=1](https://wedocs.unep.org/bitstream/handle/20.500.11822/22070/EGR_2017.pdf?isAllowed=y&sequence=1)
- [15] The Economic Consequences of Outdoor Air Pollution, OECD Publishing, Paris. Retrieved from: [https://read.oecd-ilibrary.org/environment/the-economic-consequences-of-outdoor-airpollution\\_9789264257474-en#page](https://read.oecd-ilibrary.org/environment/the-economic-consequences-of-outdoor-airpollution_9789264257474-en#page)