

Economic Activity and Climate Change Under the Spread of the Covid-19 Pandemic

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Abstract: Are there any connections between climatic changes, pandemics, and economical activities? The unexpected onset of the Covid-19 epidemic has hampered the progress of numerous environmental and economic initiatives, affecting millions of people throughout the world. As groups and individuals are investigating potential solutions for the pandemic, it is of great significance that people are aware of the deeper reasons why the pandemic has influenced the environment and economic activities and vice versa. By first analyzing the scientific literature estimating the consequences of global warming on infectious disease epidemics, this research explores the probable connections between climate change and the Covid-19 pandemic. Then, this paper analyzes the effects of a pandemic on air quality as an index of climate change and international trade as a representative of economic activities. This research paper identifies opportunities for future study, highlighting the importance of meticulous work that more clearly shows the linkages between global warming and covid, as well as the possible consequences for international trade which is a type of economic activity.

Keywords: Climate Change, Epidemics, International Trade, Economic Activity, Air Quality, Long-term Development.

1. Introduction

1.1 Background

The sudden strike of the Covid-19 pandemic has interrupted the progress of many environmental actions and economic activities and has therefore influenced millions of populations on the planet. Almost every single individual has been suffering from the consequences of lockdowns, losing jobs, or repeated infectious. This cannot be isolated if not to mention the general economic situation. Governments and individual groups have been looking for methods to stop the economic recession and at the same time, paying attention to maintaining the progress in the environment. Before seeking solutions, it's crucial to understand the implicit and explicit relationships between environment, pandemic, and economics. Scholars have already studied the interdependence among these three areas by analyzing the cases of the previous epidemic, which have an instructional significance in evaluating the relations between environment, pandemic, and economics. Meanwhile, investigating the relations of these three areas has underlying and fundamental importance in better understanding the most predominant reasons for all the consequences derived ever since the pandemic.

1.2 Related Research

Adda evaluates the relevance of policies minimizing interpersonal connections using new high-frequency data from France on the occurrence of a variety of viral infections through quasi-experimental variation. She discovers that expanding transportation networks has a large health cost in terms of increased viral dissemination, and that virus propagation rates are pro-cyclically sensitive to economic situations and rise with inter-regional commerce [1]. Fenichel analyzes social distancing incentives and results in two decision-making scenarios: decentralized, full control social planner and limited social planner, no health class-specific control. He believes, that limited social planner decision-making can be worse for society than decentralized decision-making. The welfare and health consequences of recovered and immune persons are dependent on their actions [2]. Holm and Price use data on individual time spent on activities that may expose them to crowds to quantify the effect of individual social distance on the transmission of the Novel Coronavirus. Their findings imply that

social distancing rules, at least in the United States, help reduce the spread of the Novel Coronavirus [3].

Archibong and Annan investigate the consequences of rapid exposure to epidemic diseases on human capital outcomes using data from the African meningitis belt. According to the findings, children born in meningitis shock zones during an epidemic year are 10% less stunted and underweight than their counterparts born in non-epidemic years [4]. Dang and Nguyn evaluate the effects of COVID-19 on gender inequality in these outcomes using data from a six-country study in varied geographical regions and economic levels. Their data show that women are more likely than males to lose their jobs permanently, with national variation in these gender disparities presumably related to differing infection rates and female labor force participation rates [5]. Carleton and Hsiang explain how climate change affects health, economics, conflict, migration, and demographics. According to the findings, existing climatic circumstances continue to have a significant influence on modern society, and future climate changes will almost surely have an even greater impact. Current climates have an economic and social impact that is equivalent to the additional estimated impact of future human climate change [6].

Tol considers the impact of climate change over a century, which is equivalent to economic growth over a few years, and the uncertainty around the social cost of carbon is high and biased. He believes that the influence of climate change on welfare is complicated since the population is endogenous, and policy evaluations should distinguish across and within nations impatience, risk aversion, and inequity aversion [7]. Kurane focuses on the direct impact of infectious diseases on humans as well as the impact of climate change on human health in general. As a result, he claims that even the most stringent mitigation measures will not prevent global warming for decades. As a result, the most practical action we can take is to implement adaptation measures to the effects of global warming [8].

Destoumieux-Garzo et al. identify seven long-term research questions about COVID-19 and emerging infectious diseases (EIDs) based on effective integration of environmental, ecological, evolutionary, and social sciences to better predict and mitigate EIDs. They include developing nature-based solutions to interconnected global planetary challenges. In support of this study, they recommend that novel interdisciplinary facilities be integrated into local social ecosystems [9]. Archibong et al. begin their investigation of the relationships between climate change, epidemics, and group-based inequality by analyzing the scientific literature on the impacts of global warming on infectious disease outbreaks. They also evaluate the consequences of climate-induced diseases on inequality using data from the African meningitis belt. The findings suggest that epidemics might worsen outcomes for populations already in economically disadvantaged situations, hence increasing socioeconomic disparity between groups [10].

1.3 Objective

This research paper mainly focuses on the interdependence relationship between the environment, pandemics, and economic activities. First, this paper introduces how climate change has accelerated the spread of covid. Then, this paper analyzes the pandemic effect on both environment and the economy separately. Concerning the economic activities, this article chooses international trade as one of the most obvious activities that have been severely affected during the pandemic; and this paper chooses air quality as an important index for the evaluation of the environment. Lastly, this article evaluated the long-term effects on economics and the environment.

2. How does climate change accelerate the spread of Covid-19

2.1 Climate change

Ever since industrialization, climatic changes are always under people's attention, especially in recent years. Within the current circumstances of our world suffering from dramatic climate changes and its ecocentric and anthropogenic crises such as deforestation, air and water pollution, rising sea levels, and industrialization. Meanwhile, the consequences generated by climate change will predispose us to the factors that make humans more vulnerable to the viruses.

The factors include changes in bat population and distribution, changes in vegetation and cross-species interaction, alterations in host immunity, and so on. Given this case, and with sufficient evidence, there is a correlation between natural and climatic change and human health. We can easily conclude that natural disasters such as floods, forest fires, and volcanic eruptions have directly or indirectly influenced human health, mortality, the possibility of exposure to viruses, and vulnerability. More specifically, in southern Yunnan, which is presumably the origin of COVID-19, the changing climate has played a significant role in transferring and constructing the native habitats from shrublands to savannah. The corresponding effect is that the species quantity, density, and distribution of bats have changed and resulted in the expansion of bats species.

2.2 Spread of Covid-19

Although it's still debatable the origin of the pandemic coronavirus, one likely assumption of where the SARS-CoV-2 virus came from is from animal reservoirs. And the reports of SARS-CoV-2 related viruses in Asian *Rhinolophus* bats including the closest virus from *R. affinis*, and pangolins may indicate the origin of the pandemic. The reason why bats survive from coronavirus is that bats themselves evolved a unique immune defense system over 64 million years which allow them to defend against numerous deadly and infectious virus. The evolutionary changes also give bats the ability to be oriented to many viral infections including gene mutation which refines their immune system and passes the adaptive genes to the next generation. Heat shock proteins, which protect bats from high temperatures and oxidative stress by chaperoning viral proteins and allowing them to produce virus mutations, are also abundant in bats. However, humans don't have relevant antibodies, so the coronavirus could cause illness and death among humans.

The symptoms of COVID-19 aren't noticeable and the impact on the human body may not be notable, but climate change increases the degree of desertification in many areas, which make the population more concentrated in a smaller area, especially around the hospital, leading to a higher vulnerability of infection. And due to the characteristics of SARS-CoV-2, this virus has a relatively long incubation period, making it more difficult to track the source of the virus. And this is simply how coronavirus spread in such a short time.

2.3 Relationship between Climate Change and Covid-19

If the bats are the intermediate carriers of the virus but how did the SARS-CoV-2 virus have been infected by a human? As we all know, the most ideal natural habitat for bats includes several characteristics: less interaction with other communities, an isolated local niche environment, and more importantly, less human invasion. But climatic changes consist of the flood, and drought which altered the earth's surface structure and bats' habitat are the crucial factors that could bring the coronavirus close to the human society. And the continuous climate-changing activities may result in different living habits and migration patterns. Predictably, this will increase the contact with humans, especially under the activities of selling the wild bats and consuming them for food festivals or traditional ceremonies.

Others are anthropogenic factors, under continuous invasion and exploitation of natural resources, the habitat of bats has been harmed to varying degrees, which increases the human's probability of coronavirus exposure. With the expanding animal husbandry and agriculture, human has enlarged the farms and lands to satisfy the market demand, which shorten the distance from the habitats of bats, then the daily activities of farm animals and crops have a more frequent intersection and interaction with bats carrying SARS-CoV-2. All these factors caused by climatic changes and anthropogenic factors are the hidden bombs and when they are added up, there is a high possibility that a pandemic outbreak will occur.

3. Impacts on Economic activities

Governments and municipal officials have used a variety of strategies to combat the pandemic, including improving medical facilities, imposing quarantine, isolating infected cases, and shutting

down factories and businesses to reduce the risk of infection. Human resources, public health resources, and implementation costs are all involved in tracking infected contacts. It also covers medical charges like medical supplies, antibiotics, and personal protective equipment, as well as supplies like medicines, and pharmaceuticals. Pandemics may also put budgetary pressure on governments by lowering tax collections and raising spending, particularly in low- and middle-income countries (LMICs), where fiscal constraints are tighter and tax systems are still in need of modernization. Due to a labor shortage induced by the disease, increased morbidity and mortality, and fear-driven and worried behavior, economic shocks are common during pandemics. Transportation interruptions, trade and travel restrictions, company shutdowns, and a closed border are all contributing to the pandemic's worldwide recession.

3.1 International trade

With the sudden interruption of transportation and travel, international trade has been significantly affected. The infectious virus alters the demand and supply sides in the trade between countries when both of them are all concerned about the potential infection risks of trading. In this section, we analyze the potential influences that pandemic brings to the importing and exporting countries and summarize the global trade tendency in general.

3.1.1 Effects on exporting countries

Lockdown implementation and social distancing measures during the Covid restriction period have forced people to adapt to online and remote working. Workers who are infected by Covid have lower productivity, and death shrinks the volume of workers in the workplace. Women are more likely to leave work to take care of the children due to school closure. The unemployment rate has skyrocketed which casts a crucial effect on the supply change and product market. All these adding up alter the supply chain to the left and the price elasticity becomes steeper since people don't have as much income as before. So, countries that depend heavily on exports have lost a great portion of production which further decrease the total supply to importing countries.

Nevertheless, the supply change in exporting countries has promoted the use of telecommunication systems which is a useful tool during remote working and social distancing. This system increases the net productivity and efficiency compared with before when there was no tech support for telecommunicating. Once the efficiency and productivity are increasing, the exporting countries will increase the total production so that the global supply chain will tend to be stable and more sufficient. However, countries that are not able to use telecommunication tools or don't have such technology are not likely to recover their scale of production.

3.1.2 Effects on importing countries

Due to the supply shock and decrease in exporting products, importing countries' aggregate demand decreases. One reason is that people are losing their jobs and with limited income, their demand for some product that has greater elasticity decreases. Another reason is that people with enough earnings for consumption are aware of the infection risk so they avoid going to supermarkets or public shopping stores. People are more likely to save money for future use in case of any emergency due to the feeling of uncertainty increases.

3.1.3 Volume of global trade

Figure 1 shows that declines in global industrial production and goods trade in the first half of 2020 were equivalent to those recorded at the bottom of the Global Financial Crisis (GFC). They did, however, develop and disappear with more speed, allowing for a V-shaped recovery in 2020. However, we notice that the trough in the early 2020 trade collapse did not affect all items equally, and the rising tide did not raise all elements of the global trading system equally. So we can conclude that Trade consequences on individual commodities, services, and trade partners paint a very different picture, with considerably more acute pressures on certain.

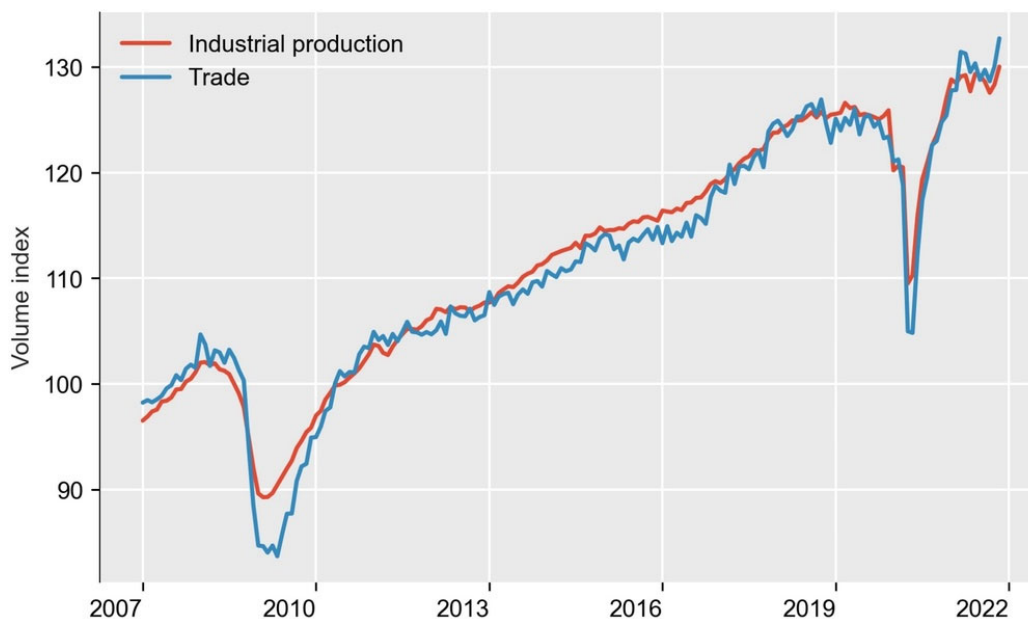


Figure 1. Volume of world trade and industrial production (from OECD calculations based on CPB World Trade Monitor)

Briefly, during the pandemic, the value of service exports in OECD nations fell by -16.7 percent in 2020, more than twice as much as the value of goods exports, which fell by -8.2 percent. More specifically, when we zoom in in figure 2 to see the difference between the service products and the good products around the trough area, there is a gap between them meaning that the trade of services has declined more than the produced goods. We conclude that as the variation in trade affected the market structure among different product categories, the market in trade has changed in the long run.

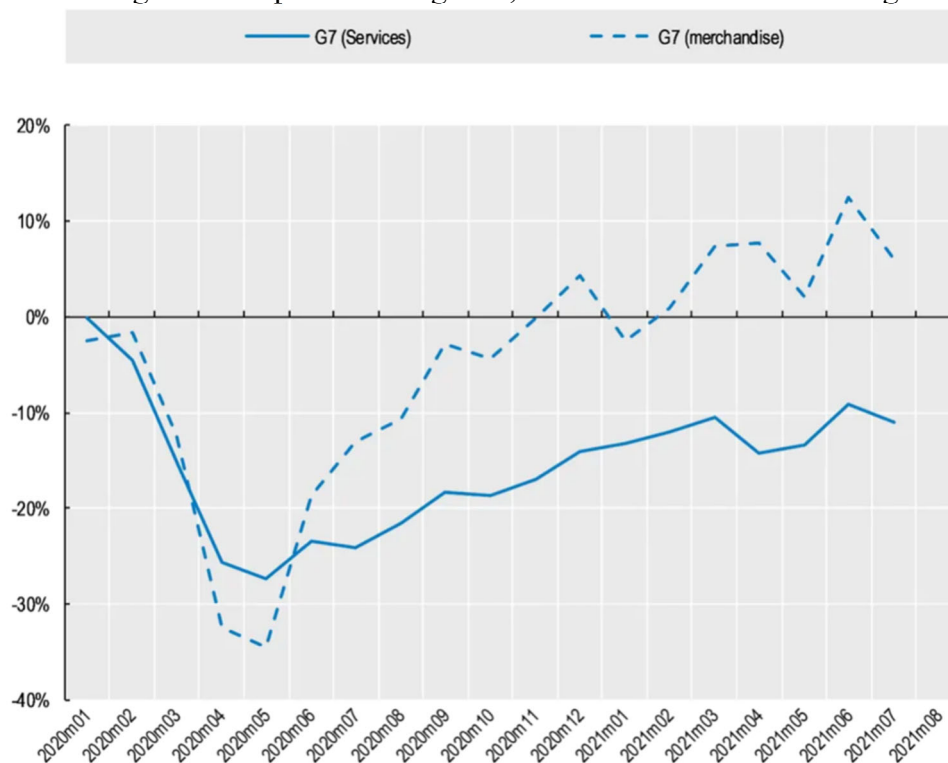


Figure 2. Service trade and goods trade: Exports of services and goods compared in the same month in 2019. G7 economies, in current USD.

3.2 Climatic impacts

One of the substantial influences on climate is the reduction of carbon emissions. The dramatic responses to the outbreak of pandemics including business shutdowns, remote learning and working, and transportation restrictions have caused a decrease in consumption of crude oil and other sources that could potentially emit carbon dioxide and other greenhouse gases, which improves the air quality. Figure 3 shows the immediate change in air quality three months after covid pandemic NO₂ is a gas produced mostly by the combustion of fossil fuels and is thus a useful indicator of human activity outside the home. Air pollution is caused by a variety of sources, including transportation, industry, natural events such as storms or fires, and the combustion of solid fuels, not all of which are influenced by the viral outbreak. Another reason is related to public attitudes toward climate change and climatic policies. As the disease is now established in the human population, people shift their focus from solving environmental issues to reducing infections and curing patients. Thus, the government uses more expenditure and tax revenue on refining the medical system, tracking infected cases, and giving financial aid which all have an opportunity cost. The progress of easing climate change has been slowed down due to the lack of human capital and financial support.

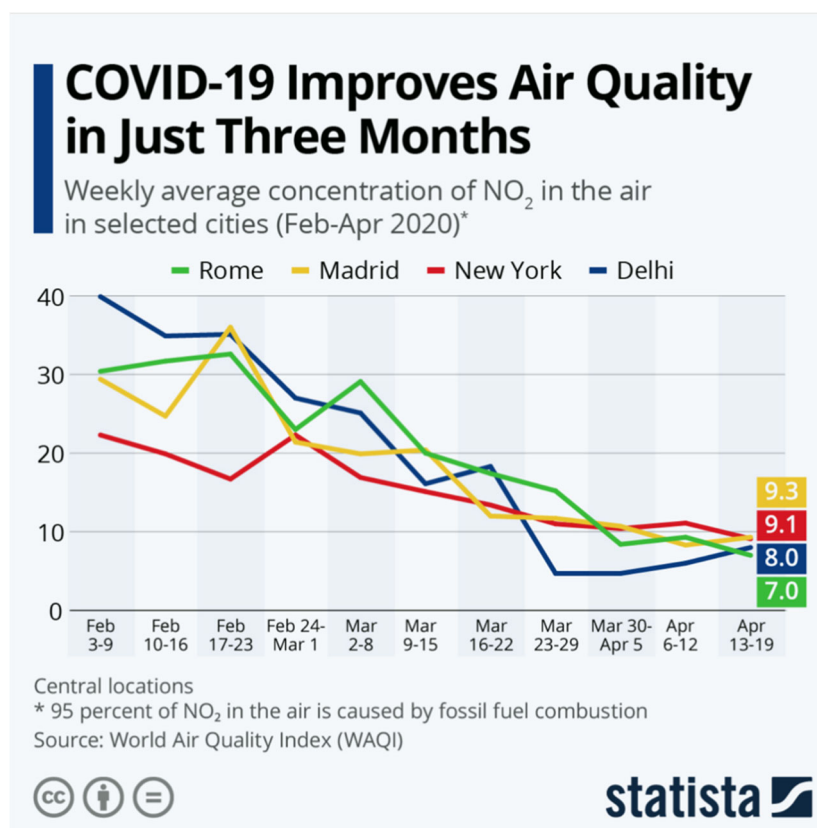


Figure 3. While cities are under lockdown owing to the coronavirus outbreak, NO₂ levels in the air have dropped dramatically. The weekly average concentrations of the gas fell between February and April in Madrid, Rome, New Delhi, and New York, according to data from the World Air Quality Index website.

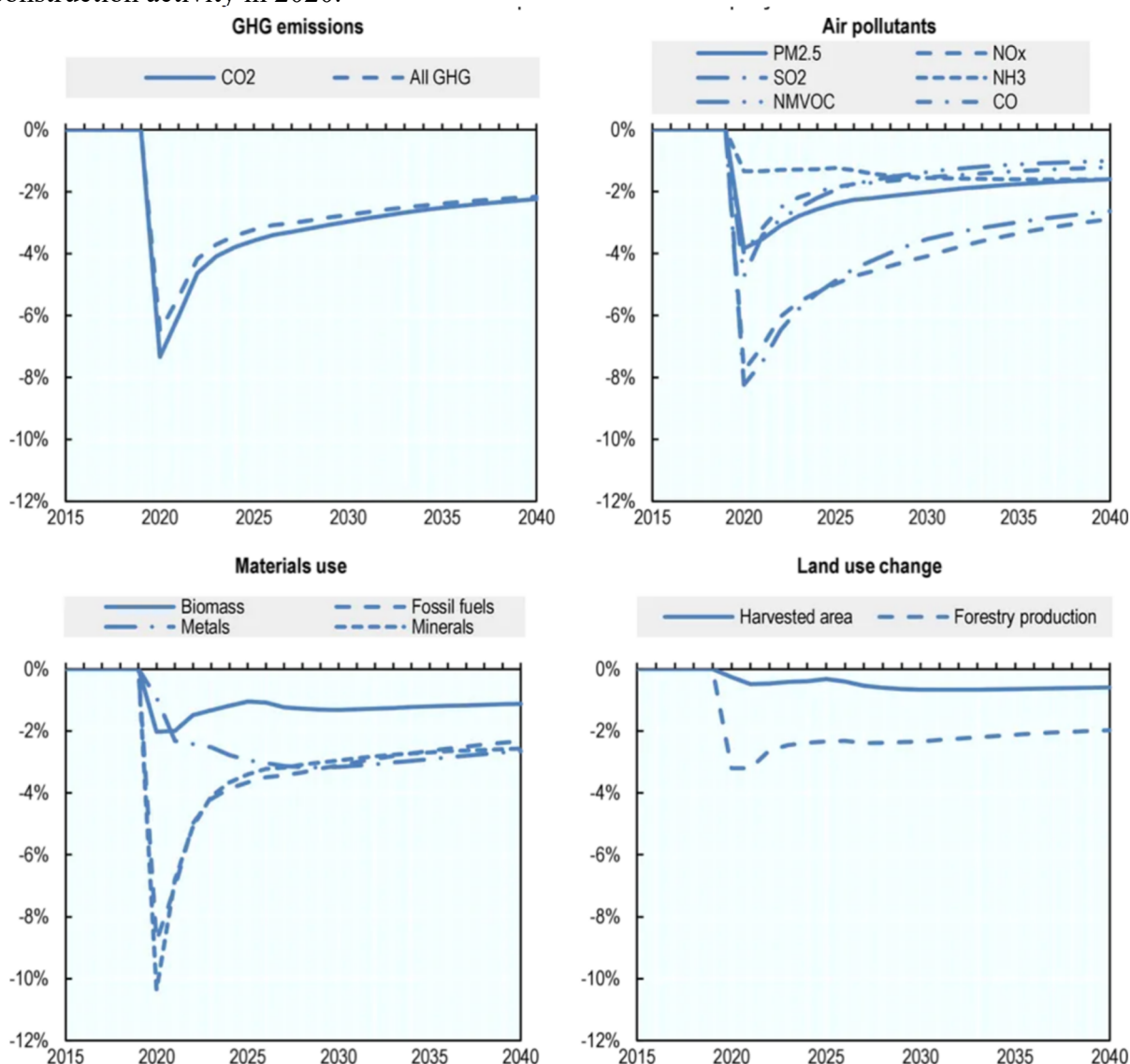
4. Long-term Evaluation

4.1 Climatic change is more obvious than the economic effect

Environmental pressures, which are primarily tied to energy consumption, fell by 7-8 percent in 2020, while gradually recovering to around 2.5 percent under the pre-COVID baseline prediction. This includes carbon dioxide (CO₂) emissions, nitrogen oxide (NO_x), and sulfur dioxide (SO₂), and the usage of fossil fuel resources shown in the figure 4.

On the other hand, air pollution emission levels, material consumption, and land use change connected to agriculture are less influenced, both in the short term and long term: The least impacted air pollutant is ammonia (NH₃); biotic resources are less affected by materials usage; and land-use change, particularly in terms of harvested area, is little. In the near run, the area devoted to farmland (harvested area) is roughly stable, and the relatively quick rebound in food demand guarantees that land-use change remains close to baseline values. This, along with low forestry effects, shows that reduced economic activities may have little impact on environmental services and biodiversity.

Other environmental issues have their own set of economic incentives and patterns of influence. PM_{2.5} emissions, which include black carbon and organic carbon, come from a range of sources, including transportation (which is particularly affected) and residential activities (which are less affected). Metals consumption is linked to industrial activities, which are less damaged in the short term but have started to perform worse than other sectors over time - the immediate reduction is small but increases over time. The nonmetallic mineral impacts are linked to a significant decline in construction activity in 2020.



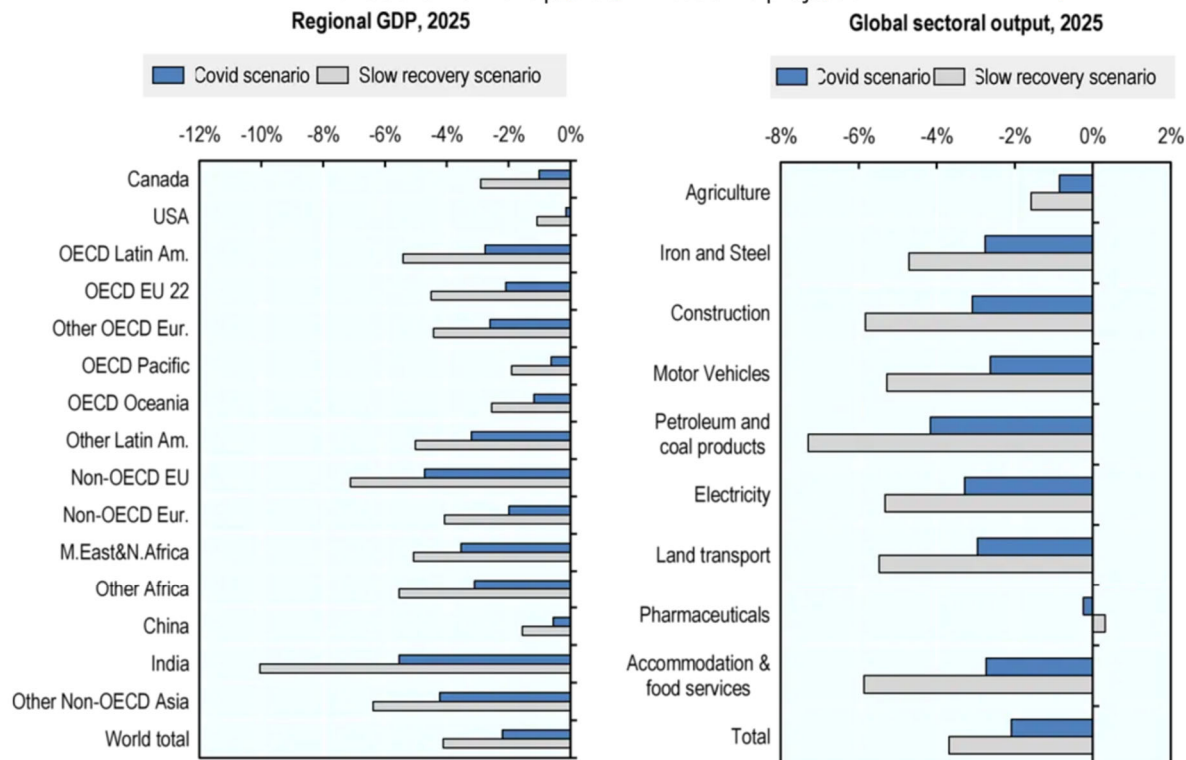
Source: ENV-Linkages model.

Figure 4. Changes in four index: GHG emissions, Air pollutant, Material use, Land use change.

4.2 Recovery in economics and environment

The rate at which various economies will recover from the epidemic, as well as the moderate effects, are very unpredictable. The economic repercussions will endure much longer in all countries

if GDP recovers more slowly (see Dellink et al. (2021[12] for information on the scenario assumptions), and differences will be notably severe in 2025 for nations that are expected to recover more quickly (Figure 5, left panel). Slow recovery suggests that India's GDP loss remains high in absolute terms since the global economy's greater toll is particularly devastating to big exporters like India and China. All industries, while not equally, are affected by a slower recovery.



Note: For an explanation of the regional aggregation see [Annex A](#).

Source: ENV-Linkages model.

Figure 5. Recovery in different sectors under two scenarios: covid scenarios and slow recovery scenarios.

5. Conclusion

Whereas the impacts of climate-induced pandemics on climatic changes are concerning, particularly their involvement in worsening economic results in international trade, there are crucial policy measures that may be sought in terms of adaptation. The policy could focus more on solving environmental effects since climate change is more obvious than economic changes. Such policy can be implemented through more government revenues in support of decreasing greenhouse gases emission and shutting down ineffective and unsustainable plants and factories. Other policies could focus on balancing the trade between exporting and importing countries by controlling the prices or making agreements among local retailers, international commerce cooperation, and other trading bodies.

Further research needs to be done to make the appropriate and applicable solution and evaluate the effectiveness of the solution and made policy. The policy should be centered on the rule of lowering the risks of epidemics while eliminating inequalities in international trade and decreasing greenhouse gases emission at the same time. More research should also consider more on how to provide possible suggestions for future unknown epidemics.

References

- [1] Archibong B, Annan F, Ekhaton-Mobayode U E. The Epidemic Effect: Global Governance Institutions Mitigate the Effects of Epidemics[J]. Social Science Electronic Publishing.
- [2] Carleton T A, Hsiang S M. Social and economic impacts of climate[J]. Science, 2016, 353(6304):1112-1112.
- [3] Cook J A, Newberger N, Smalling S . The Spread of Social Distancing[J]. SSRN Electronic Journal, 2020.
- [4] Dang H, Nguyen C V. Gender inequality during the COVID-19 pandemic: Income, expenditure, savings, and job loss[J]. World Development, 2021, 140.
- [5] Fazio R H, Ruisch B C, Moore C A, et al. Social distancing decreases an individual's likelihood of contracting COVID-19[J]. Proceedings of the National Academy of Sciences of the United States of America, 118(8): e2023131118.
- [6] Fenichel E P. Economic considerations for social distancing and behavioral based policies during an epidemic[J]. Journal of Health Economics, 2013, 32(2):440-451.
- [7] Kurane, Ichiro. Effect of global warming on infectious diseases[J]. Global Environmental Research, 2009, 14:279-283.
- [8] Rillig M C, Lehmann A, Bank M, et al. Scientists need to better communicate the links between pandemics and global environmental change[J]. Nature Ecology & Evolution, 2021.
- [9] Roson R. The economic impacts of climate change.
- [10] Adda, Jérme. Economic Activity and the Spread of Viral Diseases: Evidence from High Frequency Data[J]. CEPR Discussion Papers, 2015, 131(2).
- [11] Dellink, R. et al. (2021), “The long-term implications of the Covid-19 pandemic and recovery measures on environmental pressures: A quantitative exploration”, OECD Environment Working Papers, No. 176, OECD Publishing, Paris, <https://dx.doi.org/10.1787/123dfd4f-en>