The Triple Climatic Dividend of COVID-19

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1 Introduction

Several measures in terms of mobility restrictions are adopted worldwide to prevent the spread of COVID-19. The crisis has slowed down the economic activity around the world by impacting each sector. At the same time, the overwhelmed hospitals with patients and increased number of infections have demonstrated that the resources of the health systems to be fragile and insufficient, with several bottlenecks, particularly in the underdeveloped countries (Chattu & Yaya, 2020). Besides these negative impacts of the crisis on the economy, the pandemic has brought several unexpected positive consequences on digital transformation, environment, innovation capacity, and structure of the governance. An unexpected positive effect on "biodiversity," "global warming," and "nature" is reported, resulting in a significant reduction of CO_2 emissions during the lockdown of 2020.

COVID-19 pandemic and climate change exposed the fragility of the global society to cope with shocks like natural disasters and pandemics. Both of them have a disproportionate impact on different communities (IPCC, 2014; Douglas et al., 2020; Botzen et al., 2021), thus intensifying inequalities worldwide. The impact of climate change and the COVID-19 crisis is felt more in the vulnerable population. Poor countries are more vulnerable to the effects of climate change since they are highly dependent on natural resources and their limited capacity to cope with climate variability and extremes. In the same way, COVID-19 impacts were more severe in the poor population. Not everyone has access to water, the main factor that helped in the prevention of the spread of COVID-19. This results in an increase

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of fundamental concerns about the sustainability of the way we are living (Tiba & Belaid, 2020).

There is a dual and complex relationship between human health and climate change (McMichael et al., 2008; Butler, 2018). The rapid ecological changes and severe effects of climate change may have led to the emergence of the COVID-19 pandemic. There is an ongoing debate about the relationship between COVID-19 pandemic and climate change, which is still conclusive. Several studies highlight the relation between COVID and environmental factors like temperature, humidity, and climate latitude (Shi et al., 2020; Poole, 2020; Guo et al., 2020; Chen et al., 2020). It is well known that the weather has a significant impact on respiratory infections (Sajadi et al., 2020; Wang et al., 2010; Ruiz et al., 2010; Vandini et al., 2013). The transmission of the epidemic could result due to the instability of the temperature, humidity, visibility, and wind speed (Chen et al., 2020). With increasing temperatures and human pressure on ecosystems, pandemic episodes of coronavirus or other types of viruses are expected to intensify in the future. The transmissions are made mainly with ecological vectors—water and/or insects. Environmental policies should emphasize the nexus of a healthy environment and public health policies.

This crisis could be a listening experiment on how to combat climate change. COVID-19 has raised awareness about the importance of changing human behavior since human activities significantly impact the environment. The change of the lifestyle during COVID-19 could help to shift toward a sustainable way of living. There is a lot of doubt about how long the new COVID-19 behaviors will last. Soon, people are expected to return to normal behaviors as before the pandemic crisis, and therefore, more actions need to be taken to maintain sustainable human behavior.

This chapter aims to explain the triple climatic dividend of COVID-19 by bringing three main contributions to the existing evidence. First, we discuss the reduction of global emissions as a result of the COVID-19 crisis. World emissions were reduced by 5.8% in 2020, but there exists the risk of the rebound of the emissions if the recovery is not sustainable (Belaïd et al., 2018, 2020). Second, we examine the impact of stimulus packages on climate change. Putting the green investment component in the recovery plans could lead to building back better and in a sustainable way. Third, we have found an important change in the behavior of people and the increase of awareness during the COVID-19 crisis. This change in the behavior of people has resulted in the improvement of the air quality and reduction of emissions. May this behavior change will be long-lasting, resulting in a sustainable future.

The chapter is structured as follows: Section 2 describes the major socio-economic impacts of the COVID-19 pandemic, Sect. 3 provides the analyses about the direct effect of COVID-19 on greenhouse gas (GHG) emissions, Sect. 4 discusses the green recovery plans and their impacts on climate change, Sect. 5 shows the change in the behavior of people during COVID-19 pandemic.

2 The Main Socio-Economic Impacts of the COVID-19 Pandemic in 2020 and 2021

The COVID-19 pandemic has affected most of the world's economies. Total containment policies during the first wave in 2020 have significantly impacted economic activity. Most of the world's economies are in recession, with significant repercussions in terms of job losses and loss of income for citizens. The recession in the world economy can be considered the "deepest" since the Great Depression of the 1930s.

After the first lockdown of spring 2020, several countries have reopened their borders. This reopening in May–June 2020 has led to the second wave of infections. Many measures and restrictions are taken to cope with the second and third waves of COVID-19 infections. This stop-go rhythm means that recovery is uneven and will take time to be back to "normality" again. According to the estimates of the IMF, the global economy experienced a contraction of −3.3% in 2020 and is projected to grow at 6% in 2021, moderating to 4.4% in 2022 (IMF, 2021).

COVID-19 has had a significant impact on international value chains. Several value chains exhibited discontinuities as some critical components for producing goods and services around the world are produced in China. Several countries were unable to produce basic goods and services. The crisis has shown that most countries depend on China for basic equipment and medicines. It is essential for the future to set up a "domestic sector" of health services in order to be able to react to any new wave of coronavirus. France, like several countries in the world, has adopted an "industrial policy" for basic drugs and medical equipment for the post COVID-19 period.

Many countries rely heavily on tourism, and the huge disruption caused by the pandemic is likely to increase other problems to capital flows, weak health systems, and limited fiscal space to allow the provision of support. In addition, some of these economies were already suffering from slow economic growth, which is likely to have major consequences in the near future. International arrivals dropped by 74% (UNWTO, 2020), due to an unprecedented fall in demand and travel restrictions worldwide. Global tourism has experienced the worst year on record in 2020, and the recovery remains still uncertain.

COVID-19 has devastating impacts on the labor market. Many businesses have reduced their activities temporarily in order to cut costs, and employees have been made redundant, asked to work from home or to work reduced hours. In the first quarter of 2020, around 5.4% of working hours were lost, compared to the fourth quarter of 2019. The estimate of overall working time lost in the second quarter of 2020 (compared to the fourth quarter of 2019) is 17.3%, or 495 million full-time equivalent jobs (ILO, 2020a, b). In 2020, 8.8% of global working hours were lost compared to the fourth quarter of 2019, equivalent to 255 million full-time jobs (ILO, 2020a, b).

COVID-19 has impacted the live conditions and well-being of many people worldwide. According to the World Bank estimates, COVID-19 has pushed between

119 and 124 additional people into extreme poverty, with around 60% living in South Asia. In 2021, the estimated poverty is set to rise to between 143 and 163 million (World Bank, 2021).

Vaccination of the population is accelerating, but the return to normalcy is not expected to happen soon, and a situation described as "new normal" seems to be happening. However, even with an effective vaccine, the concerns will continue to remain for a minimum of 1 or 2 years. Thus, cohabiting with the virus is the strategy adopted by many countries that will have to manage more or less a long transition period.

3 Direct Effect of COVID-19 on Greenhouse Gas Emissions

In the last few decades, the CO_2 levels were higher than at any time in the past 800,000 years (Lüthi et al. 2008). The last decade is considered the warmest decade on record during the past 150 years (Mann et al., 2016; Vitasse et al., 2018). According to NASA (2021), 2020 was the warmest year on record and saw a high decrease in global emissions due to the COVID-19 crisis.

Social distancing measures aimed at slowing the spread of COVID-19 have had a significant impact on the environment. The slowdown in economic activities has caused a drastic drop in greenhouse gas emissions, considered the most significant drop since World War II. Annual CO_2 emissions fell by an average of 4% during the Second World War (1939–1945), 3% during the 1991–1992 recession, 1% during the 1980–1981 energy crisis, and 1% during the 2009 Global Financial Crisis (Boden et al., 2017). Compared to the previous crisis, the decline of CO_2 emissions in 2020 is significant compared to major historical wars and epidemics (Pongratz et al., 2011; Boden et al., 2017).

The impact of the COVID-19 in the CO_2 emissions started to be felt at the end of February. In April, global emissions saw the most significant drop in many countries. Le Quéré et al. (2020) claim, in early May 2020, that daily global carbon emissions had declined by -17% from average levels in 2019. Global energy-related CO_2 emissions fell by 5.8% in 2020 (IEA, 2021).

However, the effect of COVID-19 on global emission reduction in 2020 could be short-lived. While the effects of the restrictive measures on the emissions were dramatic, the risk of the rebound of the emissions in 2021 is significant. IEA (2021) predicts that global emissions could increase by almost 5% in 2021.

3.1 Different Emission Reduction Across Countries

Bera et al. (2020) has examined the impact of COVID-19 lockdown on urban air pollution and amelioration of environmental health in Kolkata. They found that air was improved significantly during COVID-19, and they suggest implementing

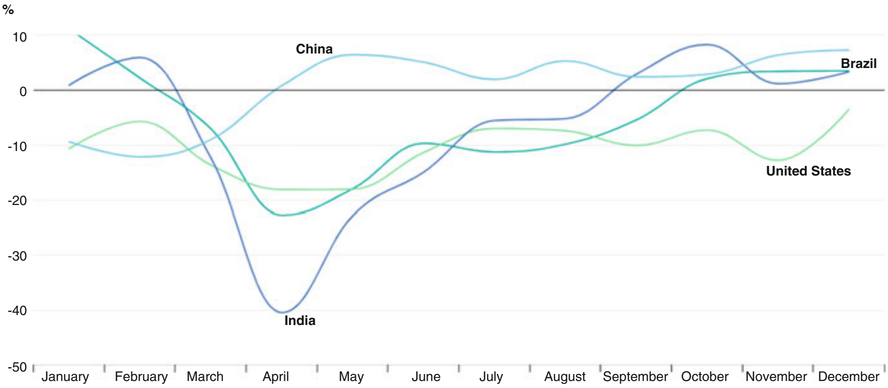

Fig. 1 Monthly evolution of CO_2 emissions in selected major economies, 2020 relative to 2019. (Source: IEA, 2021)

sustainable practices in the post-COVID-19 world. Li et al. (2020) have examined the impact of COVID on air quality in the Yangtze river delta region in China. They found a significant improvement in the air quality in this region. Similarly, Kerimray et al. (2020) found a significant reduction of CO, NO_2, and PM2.5 levels (by 49%, 35%, and 21%) during the lockdown period across Almaty, Kazakhstan compared with the previous year. According to IEA (2021), India has experienced the most significant drop in emissions during the lockdown of 2020.

However, after the first wave, measures started to be relaxed, and economic activity increased. This has resulted in an increase in emissions toward the middle of the year. The emissions continued to rebound also during the second half of 2020. In December 2020, global emissions were 2% higher than they were in the same month a year earlier (IEA, 2021) (Fig. 1).

3.2 *Transport Saw the Most Significant Drop in Emissions, While the Decarbonization of the Power Sector Has Accelerated*

Global emissions from sectors are reduced differently. Some sectors, like transportation and power production that have been hardly hit by the pandemic restrictions and measures, have contributed to a big drop in emissions.

Shan et al. (2021) have estimated the emission reduction according to the sectors. In their sample, they include 79 countries. According to their results, power and heating production and transport contribute most to emission reduction in 2020. The emission reduction in the power production sector is caused due to the decrease in demand for electricity from other sectors. The emissions of the transport sectors are reduced due to the big restrictions in the means of transportation, such as bus, railway, and flights.

According to IEA (2021), the transport sectors saw the most significant drop in emissions due to the COVID-19 crisis. Emissions from oil use in transport accounted for over 50% of the global drop in emissions in 2020. The restriction imposed on this sector resulted in about 14% drop in the emissions from this sector compared to 2019. Among the transport sectors that were hardly hit by COVID-19 is the aviation sector. Emissions from the aviation sector drop by about 45% in 2020, which was the level of the emissions seen in 1999. On the other hand, road transport was severely impacted, where the sales of cars declined about 15%, while the sale of electric cars was grown by more than 40% in 2020.

CO_2 emissions declined by 3.3% (or 450 Mt) in 2020 in the power sector. The power sector decarbonization has accelerated during this period. The COVID-19 epidemic encouraged increased investment in renewable energy in the first quarter of this year. The surge in renewable energy investment marks the industry's best first-quarter performance in a decade. Renewable energies maintained substantial investments in the entire 2020. The share of renewables in global electricity generation increased from 27% in 2019 to 29% in 2020, which is considered as the most considerable annual increase on record.

4 The Green Recovery Plans and Their Impacts on Climate Change

Countries around the world have launched economic stimulus programs to mitigate the effects of the COVID-19 pandemic. In total, governments have already announced nearly $12 trillion in fiscal stimulus in response to the COVID-19 health and economic crisis, more than three times the amount spent in response to the Great Recession of 2008–2009 (Dagnet & Jaeger, 2020). Details of spending remain largely unclear, and package estimates vary by institution.

The novelty lies in the magnitude of the environmental and climatic components. While the bulk of this funding will prioritize healthcare and direct support to the unemployed, around 30% of stimulus packages are spent on sectors that impact the environment and climate change. Most countries have adopted recovery plans, prioritizing policy choices that respect the natural environment and that would help achieve the sustainable development goals (SDGs). Stimulus packages have become a second chance to accelerate structural change toward low carbon economies, resilient to future shocks, and inclusive.

Several studies are discussing the impact of the recovery policies on the environment. Hepburn et al. (2020) have discussed the impact of the fiscal stimulus on climate change in G20 countries. They have proposed five main policies to be implemented in order to achieve the economic growth and climate goals: clean physical infrastructure, building efficiency retrofits, investment in education and training, natural capital investment, and clean R&D. Kroner et al. (2021) have discussed the recovery packages of different countries, and they highlight the importance of the actions for a green economic recovery putting policy climate actions in the center of the plan, in order to build back better and in a sustainable way. Forster et al. (2020) in their paper found that green stimuli is an important action, which led to the reductions in fossil fuel and could help to avoid additional global warming of 0.3 °C by 2050.

However, the recovery policies and plans are different around the world. While some countries have included a large investment in the green transition, in some other countries, environmental initiatives have been weakened. EU recovery plan has included a large number of green investments, even though the EU Green Deal could cause environmental damages elsewhere (Fuchs et al., 2020). The EU's green stimulus package can close the emissions gap between current policies and the ambitious 55% reduction target by 2030. The US has introduced their recovery plan of 1.9 trillion dollars, which is not clear for the investments in the green transition. However, the new government has pledged to put green policies at the heart of the actions, and this is demonstrated by the rejoining of the US in the Paris Agreement. South Korea, China, and India are planning green investments but are also supporting coal as part of their economic stimulus plans. However, strong commitments from South Korea toward carbon neutrality by 2050, from China for carbon neutrality by 2060 show that COVID-19 has accelerated the announcements of the ecological transition plans.

Governments have the option of putting in place "green" stimulus packages to accelerate structural change toward the low carbon transition. Designing stimulus packages with decarbonization goals in mind will help ensure a solid recovery and build a more sustainable growth path. National stimulus plans should be designed to enable countries to reap the benefits of the green transition, such as job creation, economic growth, and cleaner and resilient air (Heilmann et al., 2020).

The green stimulus can halve the accumulated global warming over the next 20 years. Significant disparities exist between countries and regions in terms of their ability to cope with both the pandemic and decarbonization. However, implementing suitable stimulus packages is essential for the low-carbon economy in the post-COVID-19 world.

5 Are Consumers Becoming Shifters?

Behavioral change is a crucial component in addressing both climate change and COVID-19 (Fischer et al., 2012; Engler et al., 2019, 2021). The period of COVID-19 not only reduced emissions but also changed consumer behavior and made citizens think more about ecological and sustainable issues. Coping with the spread of the COVID-19 requires significant challenges to address the social behavior values. In the same way, combating climate change requires addressing human behaviors.

The pandemic has affected almost every aspect of our lives. While some developments have been unexpected and unintentional, such as social distancing, wearing masks, banning public transport, travel restrictions, etc., other developments have accelerated the adoption of behaviors, such as the use of digital technologies, electronic commerce, e-work, and so on.

Several changes in consumer habits and behaviors were observed during the lockdown in the spring of 2020: a particular interest in health, a minimalist approach to consumption, an interest in purchasing and local production, an increase in the use of technology, and the increase in online shopping. These changes have resulted in emission reduction (Ben Youssef et al., 2020). Structural trends for eco-responsible purchasing behavior have been observed. Faced with supply chain disruptions, consumption has turned to local producers. Citizens are adjusting to spending more time at home and are expected to consume less outdoors while supporting their local producers. In addition, consumers are increasingly aware of the importance of consuming sustainable products.

The COVID-19 crisis also has affected incomes, forcing many to focus their spending on essential items. The closure of restaurants and food services has resulted in increased home cooking and more of a focus on healthy food and the potential consequences for the environment of purchasing activity. Many people are working remotely, and conferences have been held online using various platforms. Online activity has increased hugely during the COVID-19 crisis, with more online ordering, virtual tourism, online meetings, telemedicine, and distance learning; all trends that may continue after the COVID-19 crisis are over, which could result in more sustainable and eco-friendly consumption.

The awareness of the importance of the green and blue spaces is increased during this time (Rousseau & Deschacht, 2020), because when people feel a connection with nature and green spaces, they are more likely to spend time in them (Lin et al., 2014) and protect it (Schultz, 2002). Public green spaces are becoming appreciated to be visited. Moreover, urban green spaces have played a critical role in maintaining the physical and mental well-being of people (Samuelsson et al., 2020). Severo et al. (2020) found that COVID-19 is an essential factor impacting the behavioral change of people toward sustainability and responsibility.

The COVID-19 crisis has made clear the importance of the behavior to address climate change. More actions should be taken into the health and well-being of the global community in order to result in a long-lasting behavioral change (Betsch et al., 2020). In this matter, we should be concerned if these changes in people's behavior will be short-lived or long-lasting. The behavior of people may revert to the pre-pandemic patterns. As countries are recovering from the crisis, the behavior of people could be impacted by many factors. In this way, it is very important to take more actions to keep these changes in the long term. However, many of the long-term changes in consumer behavior are still forming, giving businesses the opportunity to help shape the next normal.

Environmentally friendly behaviors should be promoted in a post-pandemic world. These behaviors should be promoted at the local, national, and global levels and share values in the entire environmental ecosystem. Environmentally friendly activities should always be the main objective of the governments, in order to have a greener and greater way of living.

6 Concluding Remarks

This chapter aims to explain the triple climatic dividend of COVID-19: the reduction of global emissions as a result of the COVID-19, the impact of stimulus packages in climate change and the behavioral change of people, and the increase of awareness during COVID-19 crisis.

Lockdown during the first wave of COVID-19 had a positive impact on the environment, leading to a decrease in pollution and an improvement in air quality. This happened due to the shutdown of industries, aviation, and the downturn in the transportation sector in general. A reduction in commuting due to e-work policies has also played its part in reducing carbon emissions. This reduction was neither planned nor intentional, but in the end, it made it clear what could happen if no pro-climate action is taken. The reduction in emissions for the year 2020 is compatible with the achievement of the objective of the Paris Agreement.

Most countries have introduced their stimulus packages by prioritizing green policy choices that help promote environmental goals and accelerate structural change toward a low-carbon transition. Despite a wide variety of approaches, the stimulus packages indicate apparent changes in policy directions for the next decade. The investments made within the framework of these recovery plans show the principle of the double dividend: creating "green jobs" and respecting international commitments for the climate. This heralds a new post COVID-19 economic paradigm, which is substantial in terms of CO_2 emissions.

The response to this health crisis will determine how we deal with a climate crisis over the coming decades. Due to this pandemic, certain habits which are incidentally beneficial for the environment may persist even after its occurrence, such as the use of digital technologies, reduced travel, and reduced food waste. Maintaining this behavioral change could help in the transition toward a more sustainable world in the long term.

The recovery from the COVID-19 crisis should be green and sustainable. Investments should be redirected toward decarbonizing the economy and improving productivity for general well-being, as well as improving energy security, greater environmental and public health. Companies need to rethink their business models and should not revert to their usual "Business As Usual" practices. Covid-19 alone cannot change the profoundly unsustainable social and economic processes and practices that we have relied on for decades. Therefore, governments must act now and implement measures to achieve stronger environmental outcomes that can ensure economic prosperity, build resilience, and decarbonize the economy.

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