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Sharing solutions for better regional policies

IMPACTS OF COVID-19 ON MOBILITY

CISMOB - Cooperative information platform for low carbon and sustainable mobility

ABSTRACT

This report seeks to present an overall view on the COVID-19 pandemic impacts on mobility in the regions within the CISMOB Partnership. Governments were forced to undertook intervention measures that affected both mobility patterns and social behaviour. Different open mobility data sources were used to assess the mobility-related issues due to the many and different preventive actions set by regional authorities to avoid the spread of the virus among the citizens. Results highlight the strong effects the pandemic caused either in a short or long-term period in the mobility sector. Besides the reduction in the trips for working places, and air quality, data suggest that from 2022, we are back or surpassing 2019 levels of vehicles in the streets, with consequent impacts on emissions.

Introduction

The COVID-19 pandemic yielded from March 2020 strong effects not only in terms of public health but also on people's lifestyles and travel behaviour. Additionally, more than ever, real-time and contextually relevant data has been important to make decisions in our daily life. Governments had to implement several immediate preventive actions to avoid the virus spreading within the population, such as school and workplace closures, remote working, lockdowns, public transport closures, restrictions on movement (including international travel), cancellation of events, public information campaigns, and personal care including wearing face coverings, washing and sanitising hands frequently (de Palma, Vosough, and Liao 2022). While these governments' actions were fundamental in minimising social contact and in reducing the number of COVID-19 cases, they affected the global economy and triggered a consequent transformation of the future of mobility, impacting all transport modes, particularly in urban areas.
Publicly available data on mobility (e.g., collected by Google (Google LLC 2023) or Apple (APPLE 2022) apps) can be used to analyse the evolution patterns of mobility and can then support the design of effective policy measures to improve mobility conditions in general. In particular, we use these data and reports to derive insights into how restrictive policies have been impacting mobility patterns in CISMOB partnership regions. However, due to the lack of more specific data available for some regions, we used aggregate data at the national level.

Impacts on Mobility Patterns

Governments have recommended or implemented several measures to control the spread of COVID-19. As a result of these measures, travel behaviour has been dramatically affected, although people continue to need to travel for different purposes, from groceries to work (Abdullah et al. 2020). Additionally, there is evidence that voluntary physical distancing has played an essential role during COVID-19, besides mandatory lockdowns. As a result, the collected data can be analysed holistically, regardless of the time of lockdowns in different countries (Goolsbee and Syverson 2021). Several studies analyse travel behaviour changes resulting from the COVID-19 pandemic. An overview of the mobility impacts can be found through data provided by different platforms, such as Google Mobility or Apple reports that provide free aggregated and anonymised information on the movement of users of their online platform. The following figures are related to each country within the CISMOB partnership and highlight clear differences in the visitor numbers to the considered categories of location and purpose of the trip (workplaces, grocery stores; parks and outdoor spaces; public transport hubs - which includes subway, bus and train stations; residential areas, retail and recreation areas) and compare a typical value with the change relative to baseline days before the pandemic outbreak.

Concerning the countries within the CISMOB partnership, the demands for parks and outdoor spaces increased significantly, while the demands for recreation, work and shopping dropped. During lockdown periods, it can be observed that in the case of Portugal, there is a dramatic decrease. However, the changes in mobility are not uniform across the world and depend on spatial factors. The short-term impacts of COVID-19 on urban mobility were the trips' decrease for all transport purposes and modes, the reduction in the frequency of transit use, and the increase in the modal share for cycling and walking.

There is no doubt of evidence of changes in many different activities due to COVID-19 that turn out to be conducted online, and this has also contributed to changes in mobility. The frequency of remote online activities significantly increased due to COVID-19 and revealed that telework, teleconferencing, e-learning, e-shopping, and telehealth have impacts and conduct changes in urban mobility (Mouratidis and Papagiannakis 2021).

As can be seen in the figures below, these changes continue through different phases of the pandemic and nowadays, it seems that remote online activities have replaced a significant part of trips compared to pre-COVID-19 times.

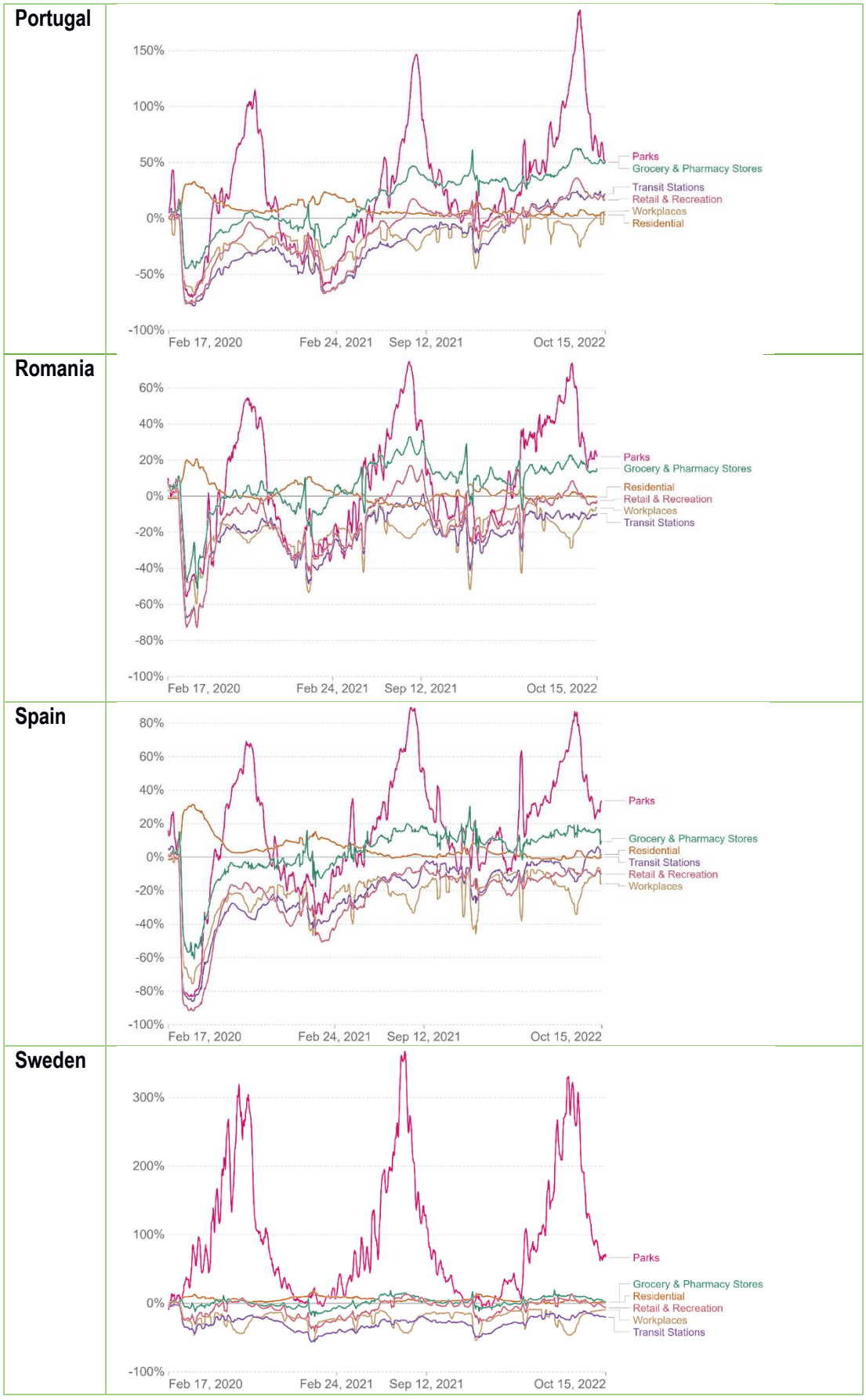

Fig 1: Changes in the number of visitors: Portugal, Spain, Romania and Sweden (Our World in Data n.d.).

In particular, for Portugal, Spain, and Romania, it can be observed how the decrease in economic activity and implementation of restrictions have caused a significant decrease in the number of visits to various sectors in the first year of the pandemic. Work, retail, and transit-related travelling had a more medium-long-term effect (COVID-19 Community Mobility Reports n.d.). The positive peaks related to the parks curve correspond to the season in which there are holidays and higher levels of tourism. In these three countries, the measures set by governments were particularly stricter, when compared to the Sweden case, and all of them present similar patterns, although with different impacts magnitude. Due to the first shutdown of several activities and lockdowns or recommendations for working from home show a sharp change in mobility patterns, with reductions up to around 80% in all activities, alongside increased residence mobility ranging between 20-40% in these countries.

Comparing the four regions, it is noticeable the difference along the considered period for Stockholm, since there were no lockdown measures implemented, people continued to go to parks and a very small percentage of change in the other categories was observed. This picture contrast with that observed for the remaining regions, in which the strict measures imposed by immediate lockdowns forced people to stay at home and work remotely to avoid the spread of the virus within the community. In particular, in the first semester of the beginning of the pandemic: workplace and transit stations had a dramatic reduction of activity especially in Spain (reaching +85% reduction).

In Stockholm, although there were slight changes, the curves corresponding to Parks and Residential assume, in general, values above the baseline during the considered study period.

Nevertheless, and considering different magnitude levels of the use of public transport, it can be seen from the figure above that all countries experienced a decline in demand that for Sweden and Romania suggest to still below pre-pandemic levels. While this situation is different in Portugal, since last months revealed a gradual increase. Overall, data suggest that teleworking may remain even after the crisis, with movements regarding workplaces seeming to be below pre-pandemic levels.

Pronounced changes and a decline in daily trips from, respectively, car, public transport and walking during lockdown and restrictions on movement set by governments. Data from Apple show the changing volume, in percentage, of people who drive, walk, or use public transport in their communities (aggregated data for various cities and countries – not all categories are available for all regions). The baseline value in this case corresponds to the volume of requests in the Apple platform observed on January 13th, 2020. The following figures show the evolution regarding data on private car use or walking mode for the available information within the CISMOB partnership.

Regarding data on private car use or walking mode, all regions suffered changes during the core period of the pandemic – 2020 and 2021. An evident increase in the use of private vehicles compared to pre-pandemic levels can be spotted especially in Portugal. However, the last couple of months in 2021 suggest the possibility of maintaining the observed shift towards soft mobility and car use in the long term, which impacts the public transport landscape.

Significant efforts must be put into practice to raise trust in public transport to enhance urban resilience and sustainability.

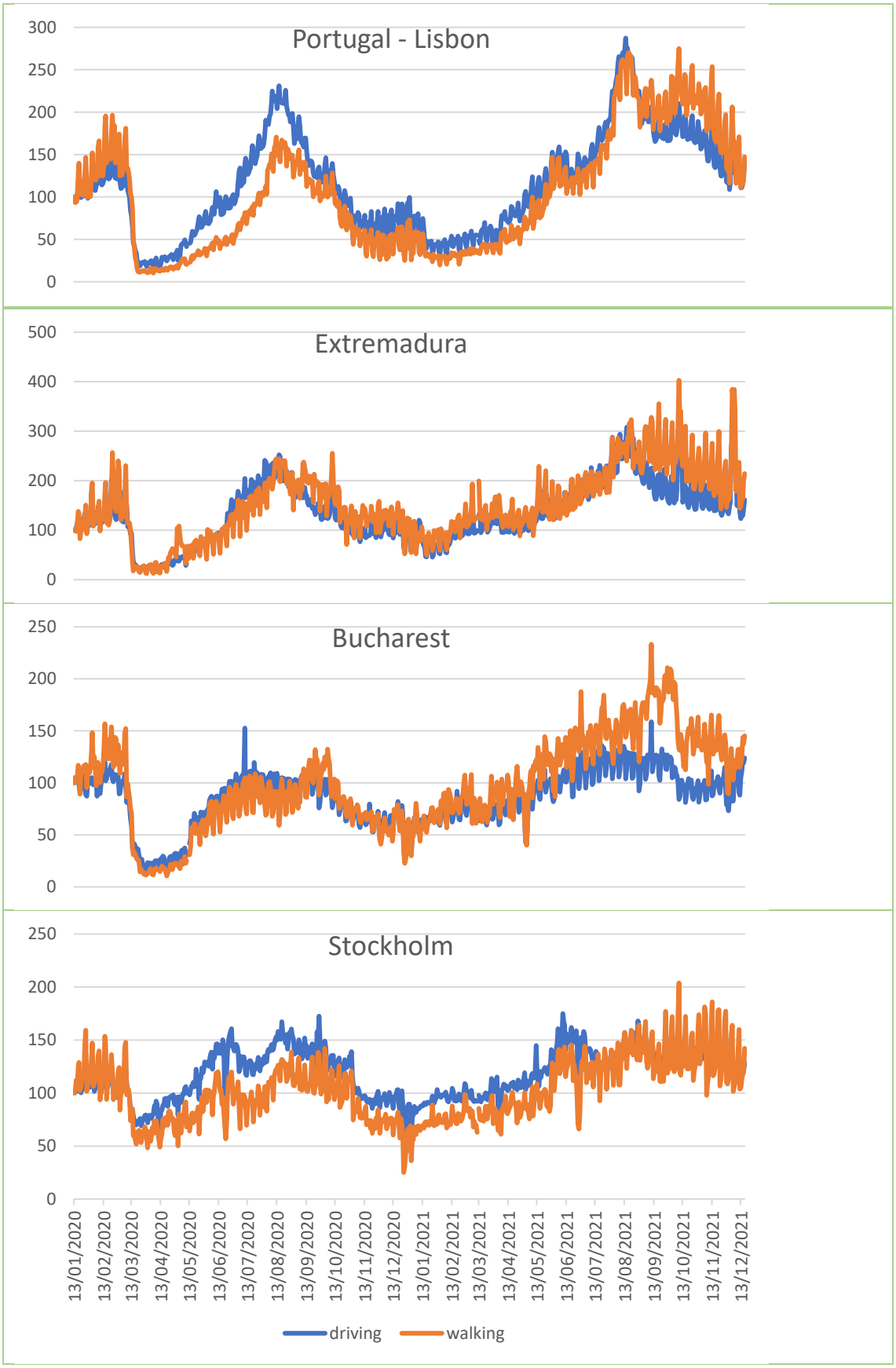

Fig 2: Changes in the volume of requests in the Apple platform: Portugal, Extremadura, Bucharest and Stockholm (APPLE 2022).

Impacts on Emissions

The transport sector has been responsible for nearly a quarter of Europe's greenhouse gas (GHG) emissions. Between 2013 and 2019, the EU's domestic transport emissions have been increasing following the economic growth trends. But due to the disruptive decrease in transport activities during the first period of the COVID-19 pandemic, the emissions decreased by almost 15% between 2019 and 2020 (EEA 2022), as the lockdown measures restricted global mobility and hampered economic activity in the year's first half. It could be expected that this could be the beginning of a shift downward in emissions; however, recent data dashed those hopes. However, according to preliminary estimates, emissions increased by almost 8% in 2021, following a rebound effect of the economy, also surpassing previous epidemic peaks as global economic activity recovered (Bhanumati, de Haan, and Tebrake 2022).

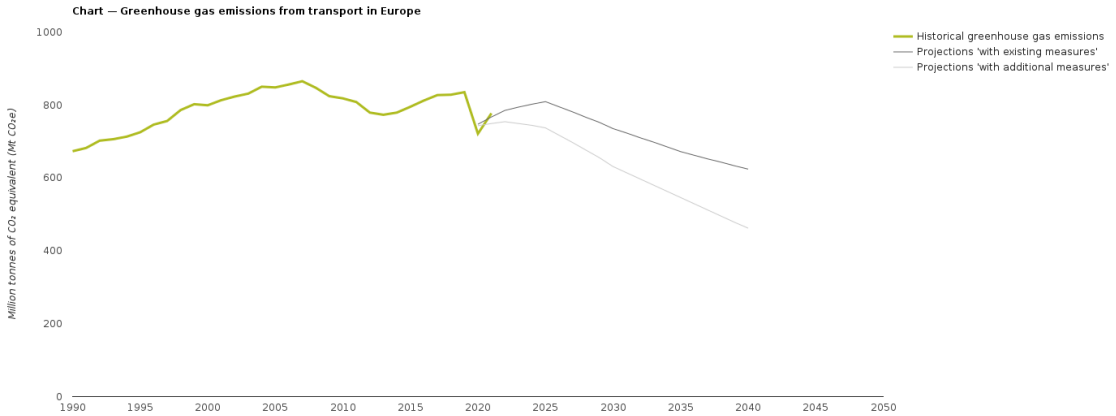

Fig 3: Global GHG emissions between 2019 and 2021 (Climate Change Indicators Dashboard n.d.).

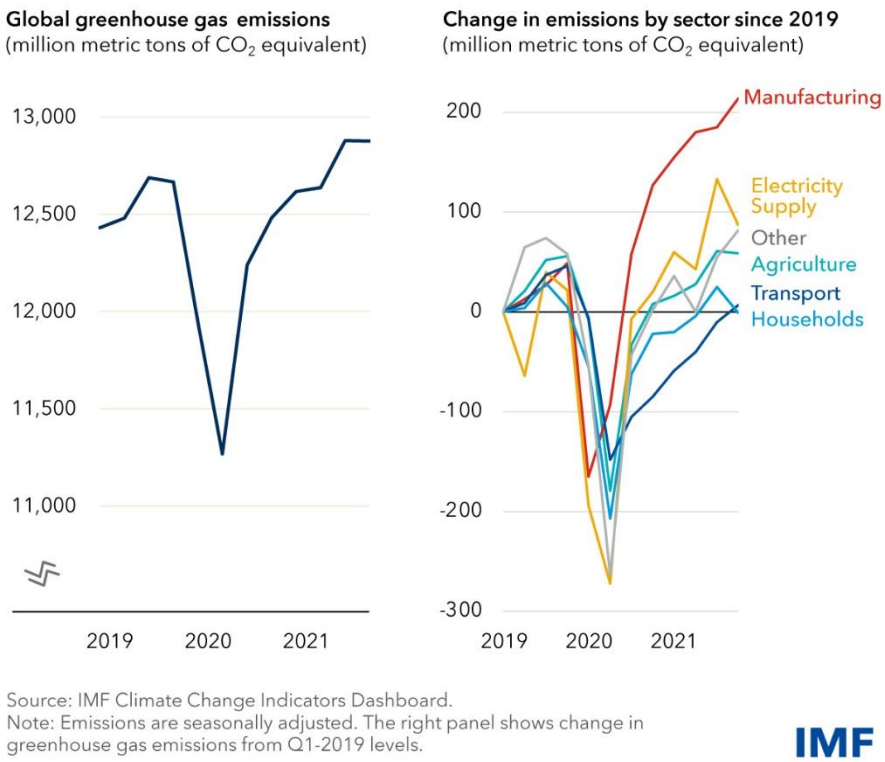

Fig 4: Global GHG emissions between 2019 and 2021 (Climate Change Indicators Dashboard n.d.).

Besides being an important source of GHGs (as carbon dioxide – CO_2), road transport is a major contributor to air pollution (nitrogen oxides – NOx). These yield impacts on health and the environment and cause economic costs to society. COVID-19 has impacted the transport sector due to several factors, such as mobility restrictions and increased remote work. By the end of March 2020, road transport activity dropped by approximately 50% worldwide (Energy Agency 2022), and emissions have decreased due to the COVID-19 pandemic. It has been estimated that global daily CO_2 emissions decreased by approximately 17% in April 2020 compared to the 2019 levels (Le Quéré et al. 2020). In the first semester of 2020, the CO2 emissions represented a reduction of almost 10% compared to 2019 values (Liu et al. 2020). In European countries, soft modes of mobility such as walking and cycling increased, and it was found that the number of trips related to commuting has decreased due to lockdowns and working from home (Boons et al. 2020). Due to the fear of contagious of the virus, public transport use has also suffered a sharp decrease, especially in cities (Gutiérrez, Miravet, and Domènech 2021). The reduction in mobility levels could reduce GHG emissions after the pandemic if mobility rates do not reach the pre-pandemic levels. However, data suggest that for many regions, nowadays, urban traffic may surpass pre-pandemic levels.

An analysis conducted in an attempt to estimate and quantify the impact of the COVID-19 restrictions on primary emissions of criteria pollutants and greenhouse gases for 2020 in various European countries (including Portugal, Spain and Sweden) revealed heterogeneous results due to different COVID-19 restriction measures implemented across countries (Guevara et al. 2022). In particular, studies show that air pollutants and greenhouse gases levels for a total of nine anthropogenic activity sectors, including road transport, the energy industry, the manufacturing industry, residential and commercial combustion, aviation, shipping, off-road transport, use of solvents, and fugitive emissions from transport and distribution of fossil fuels, yield the following findings:

- The largest decreases in European emissions in 2020 due to the COVID-19 lockdown measures were found for **NOx (approximately −10.5 %) and CO_2 (−7.8 %) emissions, representing savings of approximately 11 and 8 %, respectively**. The most pronounced drop was found during April (−33 % and −26 %) when the mobility restrictions were at their maximum.
- By the end of the **summer, the effect of COVID-19 measures on emissions diminished as lockdown restrictions relaxed**, and emissions remained at values of around −5 % and −4 % below baseline levels for NOx and CO_2.
- The emission reductions observed during the second epidemic wave (October-December) were between 3 and 4 times lower than those that occurred during the spring lockdowns, up to −11 % for NOx and −7 % for CO_2 fossil fuel, since mobility restrictions were generally softer.
- **At the country level, Spain presented one of the largest relative emission declines** ranging between −15.1 % and −13.5 % for NOx and −11.4 % and −10.4 % for CO_2 fossil fuel emissions.
- At the sectoral level, the largest emission declines were found for aviation (between −51 % and −56 %) and road transport (between −15.5 % and −18.8 %). A drop of similar intensity was observed for both sectors at the beginning of the pandemic. However, while aviation emissions remained almost unchanged, road transport started to gradually recover during late April, and the beginning of May, and emissions reached values of around −5 % below baseline values by the end of September. A decrease of approximately 50 % lower than in April was observed during the second epidemic wave.
- **The largest contribution to the EU27+UK decrease in emissions comes from the road transport sector for the majority of pollutants** – up to 70.5 % for NOx emissions.
- **Regarding spatial analysis, the largest emission reductions occurred in urban areas and main interurban roads**. Rural roads have, on the contrary, had lower reported differences in emissions. The decline in NOx urban emissions was, on average 11.3 %.

As we move forward to the new normality, concerns regarding climate change are still at their highest level since global yearly CO_2 emissions from transport are estimated to be over 18 Gt in 2050 if no stricter policies will be put into practice (to achieve the European goals, the emissions should not exceed 2 Gt) (Gota et al. 2018). Moreover, an increase of more than 40% is estimated in passenger transport by 2050 in Europe (European Commission 2018). In particular, in 2021 global CO_2 emissions from the transport sector rebounded, growing by 8% compared to 2020 levels, as pandemic restrictions were lifted and passenger

and goods movements began to pick up following their unprecedented decline in 2020 (Transport – Analysis - IEA 2022). Emissions will follow the trend when mobility increases after the core period of the pandemic due to the high levels of use of passenger cars. Changes will only be possible if the modal mobility share is nearly the same as during the COVID-19 restricted period. However, recent survey results to understand if post-pandemic mobility behaviour would change showed that 6% of participants whose households owned a vehicle would use public transport, while 19% were public transport users before the pandemic (Das et al. 2021). Respectively, 36% would use a car post-pandemic, while 29% used a car before the pandemic. Remote work could be an effective way to decrease emissions in mobility also in the future since it would not be necessary to commute to workplaces. Mobility after the pandemic has the potential for modal change. However, it might take some time to increase public transport to the level it was before the pandemic. Hence, In essence, the transition to more sustainable mobility behaviour could be possible after the pandemic in addition to increasing remote work due to accelerated digitalisation (Boons et al. 2020). Nevertheless, stricter policies, changes in modal shares, or support from renewable mobility energy sources are still needed to achieve the targets. Remote work and shifting to soft modes of transport could be a more common practice after the pandemic, which could be one of the solutions to reduce emissions.

Take home remarks

It is of utmost importance to focus on policies and measures to promoting low-carbon fuels or electric cars, as well as encouraging a modal shift to public transport to make a substantial impact on curbing emissions. New information and communication technologies-based systems can be relevant tools to provide a basis for analysing mobility patterns and support the decision-making process at citizen (greener and safer journey planning) and policy (to support the design of more environmentally friendly and safer mobility strategies, also improving mobility conditions) levels. Given that there has been a sharp decline in the use of public transport and a consequent shift to other modes of transport, authorities should take these inputs into account when assessing investments in the transport sector. Moreover, the pandemic and the "new normal" turn out to be an opportunity to make changes in the way people move to reach a new level of more sustainable mobility. New policies in the mobility sector should be implemented and can contribute to a faster reduction of GHG emissions through decarbonisation of the sector and travel behavioural promotion to more sustainable mobility options, and also a reduction of the external costs of transport. In addition to this, this effort contributes to a better quality of life in cities and urban areas through better sustainable planning.

References

Abdullah, Muhammad, Charitha Dias, Deepti Muley, and Md Shahin. 2020. “Exploring the Impacts of COVID-19 on Travel Behavior and Mode Preferences.” *Transportation Research Interdisciplinary Perspectives* 8: 100255.

APPLE. 2022. “APPLE-Mobility Trends Reports.” https://covid19.apple.com/mobility.

Bhanumati, P., Mark de Haan, and James Tebrake. 2022. “Greenhouse Emissions Rise to Record, Erasing Drop During Pandemic.”

Boons, F., A. Browne, M. Burgess, and U. Ehgartner. 2020. “ Covid-19, Changing Social Practices and the Transition to Sustainable Production and Consumption.” *Manchester: Sustainable Consumption Institute*.

“Climate Change Indicators Dashboard.”

“COVID-19 Community Mobility Reports.”

Das, Sanhita et al. 2021. “Impact of COVID-19: A Radical Modal Shift from Public to Private Transport Mode.” *Transport Policy* 109: 1. /pmc/articles/PMC9759716/ (April 17, 2023).

EEA. 2022. “Greenhouse Gas Emissions from Transport in Europe.” https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-transport (April 17, 2023).

Energy Agency, International. 2022. “Global Energy Review 2020.” https://iea.blob.core.windows.net/assets/7e802f6a-0b30-4714-abb1-46f21a7a9530/Global_Energy_Review_2020.pdf (April 17, 2023).

European Commission. 2018. “Transport in the European Union - Current Trends and Issues.” (April). https://ec.europa.eu/transport/sites/transport/files/2018-transport-in-the-eu-current-trends-and-issues.pdf.

Google LLC. 2023. *Google COVID-19 Community Mobility Reports*. https://www.google.com/covid19/mobility/.

Goolsbee, Austan, and Chad Syverson. 2021. “Fear, Lockdown, and Diversion: Comparing Drivers of Pandemic Economic Decline 2020.” *Journal of Public Economics* 193: 104311.

Gota, Sudhir et al. 2018. “Decarbonising Transport to Achieve Paris Agreement Targets.” 12: 363–86. https://doi.org/10.1007/s12053-018-9671-3 (April 17, 2023).

Guevara, Marc et al. 2022. “European Primary Emissions of Criteria Pollutants and Greenhouse Gases in 2020 Modulated by the COVID-19 Pandemic Disruptions.” *Earth System Science Data* 14(6): 2521–52.

Gutiérrez, Aaron, Daniel Miravet, and Antoni Domènech. 2021. “COVID-19 and Urban Public Transport Services: Emerging Challenges and Research Agenda.” *Cities and Health* 5(sup1): S177–80. https://www.tandfonline.com/action/journalInformation?journalCode=rcah20 (April 17, 2023).

Liu, Zhu et al. 2020. “Near-Real-Time Monitoring of Global CO2 Emissions Reveals the Effects of the COVID-19 Pandemic.” *Nature Communications 2020 11:1* 11(1): 1–12. https://www.nature.com/articles/s41467-020-18922-7 (April 17, 2023).

Mouratidis, Kostas, and Apostolos Papagiannakis. 2021. “COVID-19, Internet, and Mobility: The Rise of Telework, Telehealth, e-Learning, and e-Shopping.” *Sustainable Cities and Society* 74: 103182.

“Our World in Data.”

de Palma, André, Shaghayegh Vosough, and Feixiong Liao. 2022. “An Overview of Effects of COVID-19 on Mobility and Lifestyle: 18 Months since the Outbreak.” *Transportation Research Part A: Policy and Practice* 159: 372–97.

Le Quéré, Corinne et al. 2020. “Temporary Reduction in Daily Global CO2 Emissions during the COVID-19 Forced Confinement.” *Nature Climate Change 2020 10:7* 10(7): 647–53. https://www.nature.com/articles/s41558-020-0797-x (April 17, 2023).

“Transport – Analysis - IEA.” 2022. https://www.iea.org/reports/transport (September 30, 2022).