The long-term environmental implications of COVID-19

Updated 31 May 2021

This brief analyses the long-term effects of the COVID-19 pandemic and associated government responses on the environment. It links the impact of sectoral and regional shocks to the economy until 2040 to a range of environmental pressures, including greenhouse gas emissions, emissions of air pollutants, the use of raw materials and land use change.
The short-term reductions in environmental pressures are significant; as the economy gradually recovers, emissions are projected to increase again, with growth rates going back to the pre-COVID baseline projection levels. But there is a long-term – potentially permanent – downward impact on the levels of environmental pressures of 1-3%, with stronger effects for pressures related to capital-intensive economic activities. This Brief was first published on 21 May 2021. This is a revised version that updates the right panel of Figure 4 to show results for 2025 instead of 2040 and that clarifies the reference to the associated Working Paper by Dellink et al.

Key findings

- The COVID-19 pandemic and response measures have significant short- and long-term effects on macroeconomic activity as well as on the structure of the economy. The structure of the economy plays a key role in how economic effects translate into effects on environmental pressures.
- The short-term reductions in environmental pressures are significant: energy-related emissions declined by 7%, agriculture-related environmental pressures by less (around 2%). The reduction in the use of non-metallic minerals, including construction materials, reached double digits.
- Long-term changes in environmental pressure will depend crucially on their economic drivers and the regional impacts. Some sectors – e.g. manufacturing and construction – are more affected than others – e.g. agriculture. Regional differences are also large, with strong long-term effects in e.g. India.
- There is a projected long-term – potentially permanent – downward impact on the levels of environmental pressures of 1-3%, depending on the indicator. A slow recovery can double these impacts.

This Brief looks at the effects of the COVID-19 pandemic and recovery on environmental pressures. Using the large-scale model ENV-Linkages that links economic activity and environmental pressures, the medium- and long-term impacts on greenhouse gas (GHG) emissions, air pollution, materials use and land use change are projected. The COVID-related shocks are based on an assessment, as of April 2021, of the shocks to GDP, unemployment, labour productivity, trade barriers, stimulus packages to firms and households, and final demand, based on data and forecasts by OECD (2020[1]; 2021[2]), IMF (2021[3]), IEA (2020[4]) and Arriola and Van Tongeren (forthcoming[5]). More details on the approach and results can be found in Dellink et al. (2021[6]).

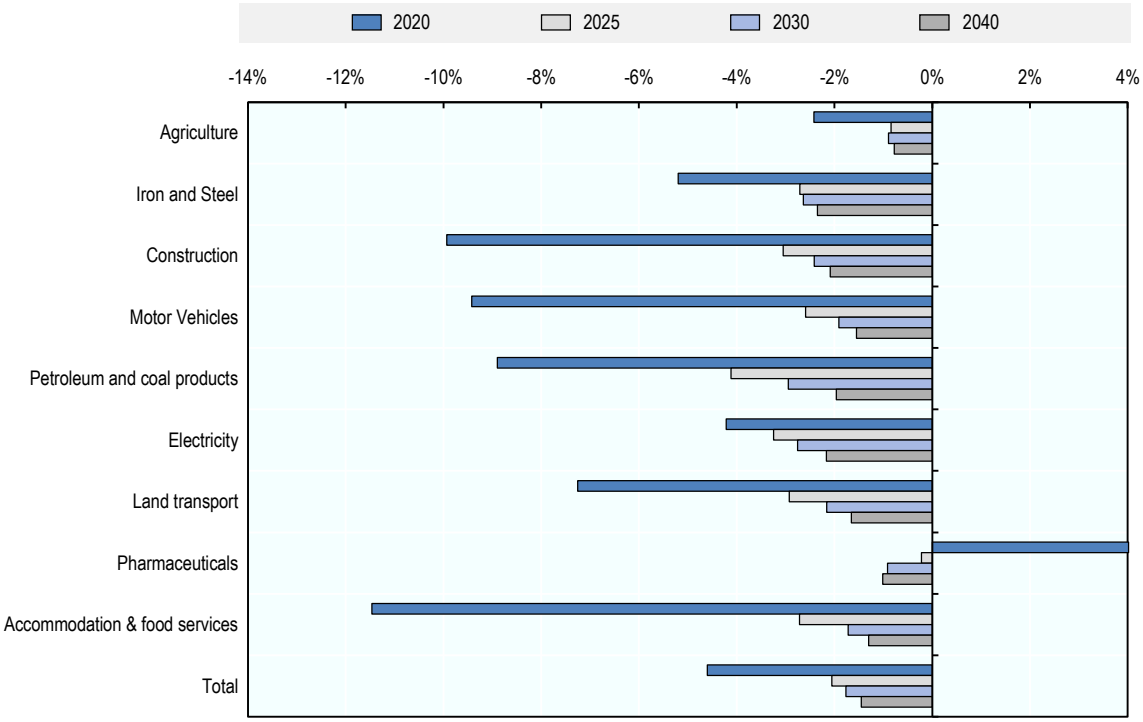
COVID-19 has long-lasting effects on the structure of the economy

The structure of the economy plays a key role in how economic effects translate into changes in environmental pressures. Services sectors, which are among the most severely hit by the pandemic (Figure 1), tend to produce less emissions and use fewer raw materials than most industrial sectors. This suggests that overall reductions in environmental pressure in the short run are smaller than the reductions in GDP. Fossil fuel demand, which links to GHG and air pollutant emissions, is heavily affected, not least through the effects of the lockdown measures on transport. Electricity demand also declines, especially in production, as firms close down temporarily, but less than fuel use. Construction activities are among the most severely affected in the short term, while the metals processing sectors are mostly through reduced demand for metals in e.g. construction and motor vehicles production. The only sector that increased output in 2020 was pharmaceuticals, as demand spiked. But in the medium term the overall slump in economic growth also drags down this sector, although it will probably continue to perform better than other manufacturing sectors.

In the longer run, services and agricultural sectors are projected to recover faster and more completely than manufacturing. This is linked to the capital intensity of these sectors (and the basic goods nature of food): in the short run the negative effects are largest in labour-intensive sectors (as labour productivity is directly affected), while in the long run the opposite is true (as capital growth is affected).

Figure 1. The pandemic and response measures change the structure of the global economy

Deviations from the pre-COVID baseline projection



Source: ENV-Linkages model.

The long-run environmental effects are larger than the macroeconomic effects

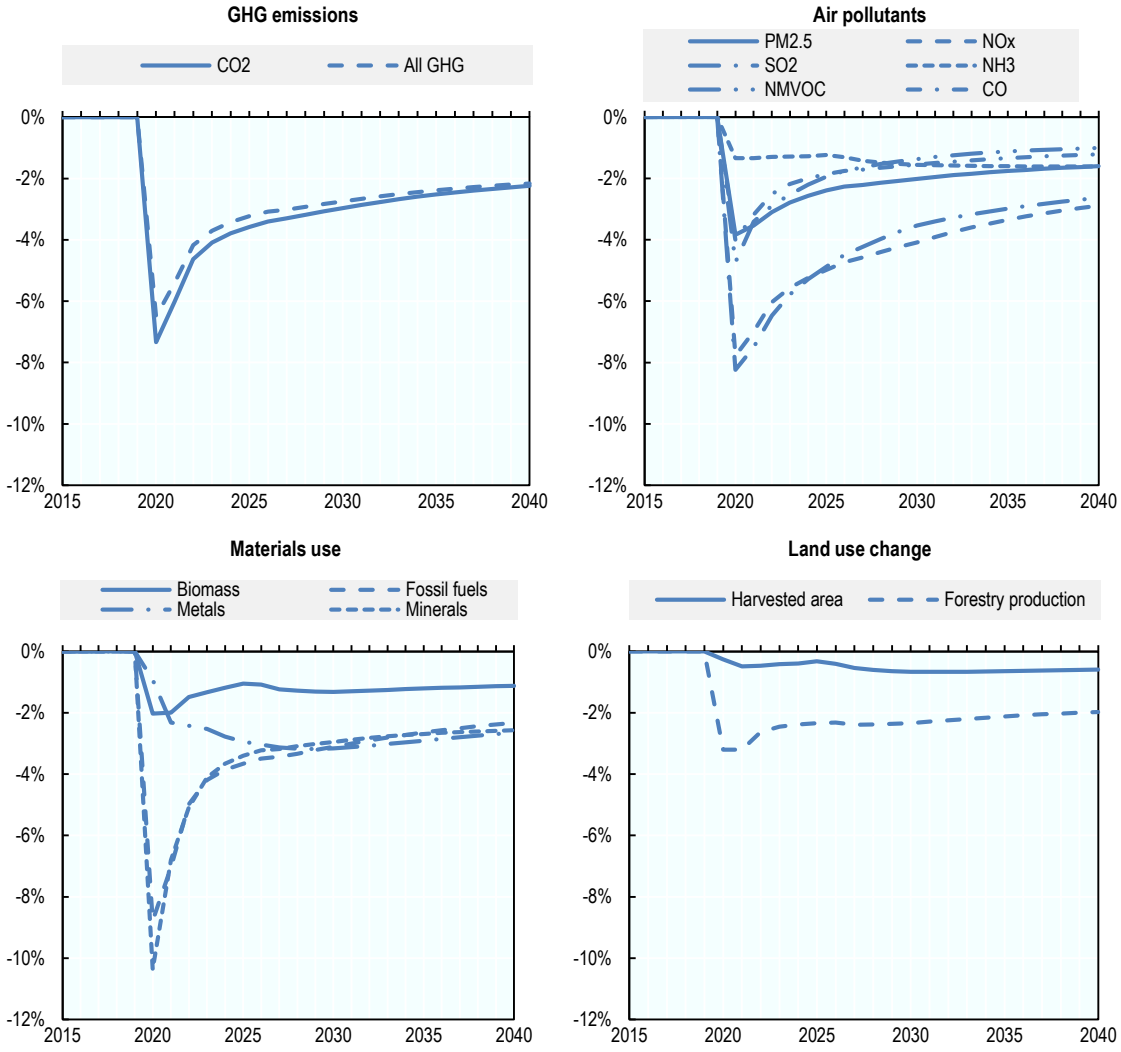
The environmental pressures that are mostly linked to energy use observed a sharp decline in 2020 of 7-8%, followed by a gradual recovery to 2-3% below the pre-COVID baseline projection. This includes emissions of GHGs (Figure 2; top-left panel), the air pollutants nitrogen oxide (NO_x) and sulfur dioxide (SO_2) (Figure 2; top-right panel) and fossil fuel materials use (Figure 2; bottom-left panel).

In contrast, air pollutant emissions, materials use and land use change related to agriculture are less affected, both in the short and long run: ammonia (NH_3) is the least affected air pollutant; for materials use the biotic resources are less affected, and for land use change especially the change in harvested area is very small (Figure 2; bottom-right panel). In the short run, the area devoted to cropland (harvested area) is more or less fixed, and the relatively rapid rebound of food demand ensures land use change remains very close to the baseline levels. This, and the small effects on forestry, suggest that biodiversity and ecosystem services may not benefit significantly from the reduced economic activity.

Other environmental pressures have a different set of economic drivers, and have a distinct pattern of impacts. Emissions of particulate matter (PM2.5), which includes black carbon and organic carbon, are linked to transport (heavily affected) and residential activities (less affected), among others. Metals use is linked to industrial activities, which are less heavily impacted in the short run but have gradually started performing worse than other sectors – the immediate decline is very small, but increasing over time. The effect for non-metallic minerals is linked to the sharp decline in construction activities in 2020.

Figure 2. Effects on global environmental pressures depend crucially on their economic drivers

Deviations from the pre-COVID baseline projection



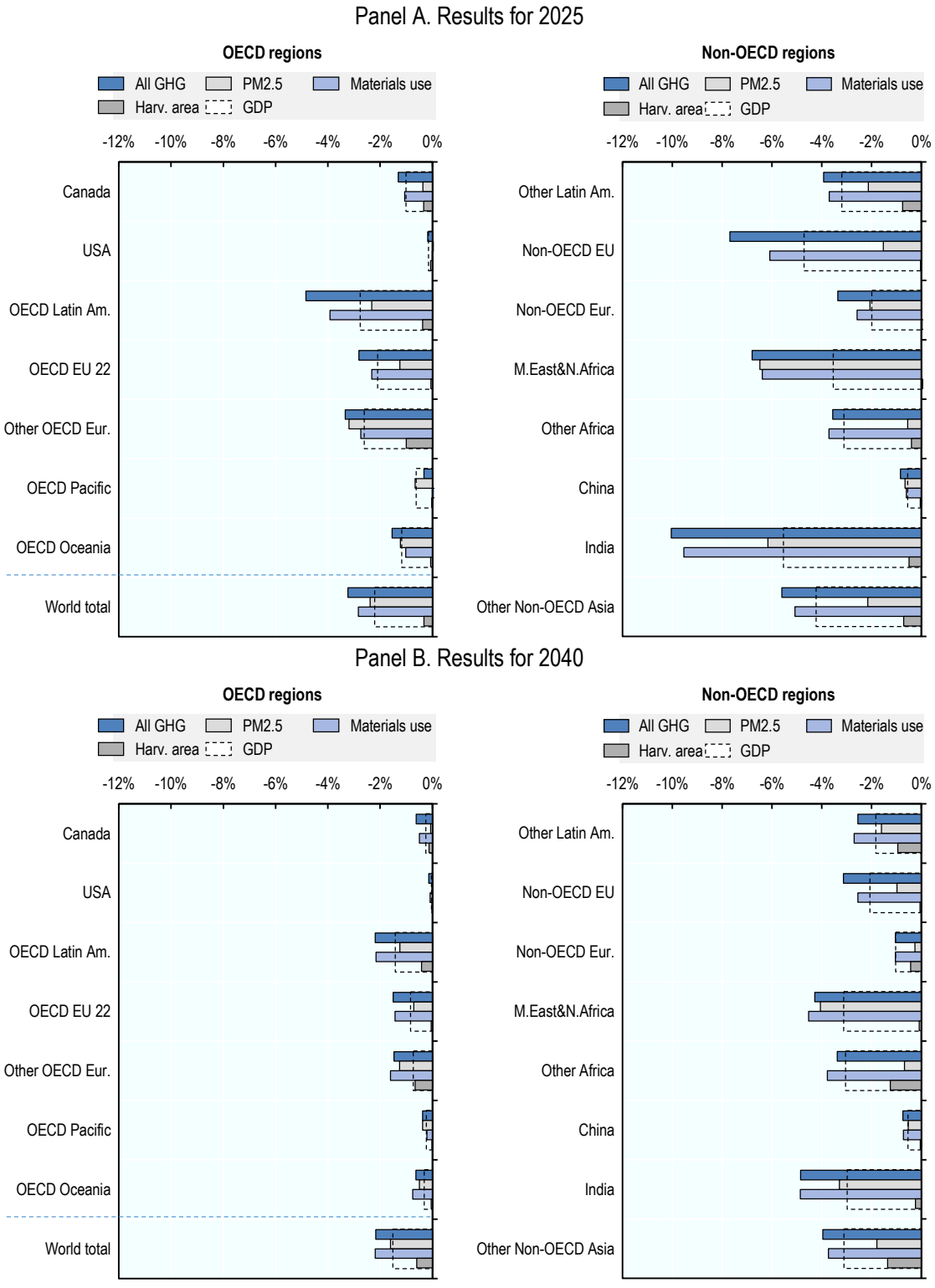
Source: ENV-Linkages model.

The regional differences in the effects on environmental pressures are significant

Regional changes in environmental pressures are driven by what happens to the regional macro economy and changes in the structure of that economy (Figure 3). For climate change, regional differences do not matter as GHG emissions uniformly mix in the atmosphere. But for air pollution, these differences have significant effects on local air quality. In the short run (2025, as shown in panel A), the pandemic and response measures lead to regional reductions in environmental pressures – or at least in GHG emissions and materials use – that are larger than reductions in economic activity in almost all countries. What is striking is the large reduction in GHG emissions and materials use in India, which is largely driven by the effects on the energy system in the country. By 2040 (panel B), both the economic losses and the reduced environmental pressures have partially faded away everywhere, but some significant environmental gains remain, especially in non-OECD countries. In the OECD, reductions in GHG emissions and materials use continue to outstrip GDP impacts, implying that these economies are specialising a bit more in relatively clean sectors as a result of the COVID-19 pandemic and response measures.

Figure 3. Effects on regional environmental pressures differ widely

Deviations from the pre-COVID baseline projection



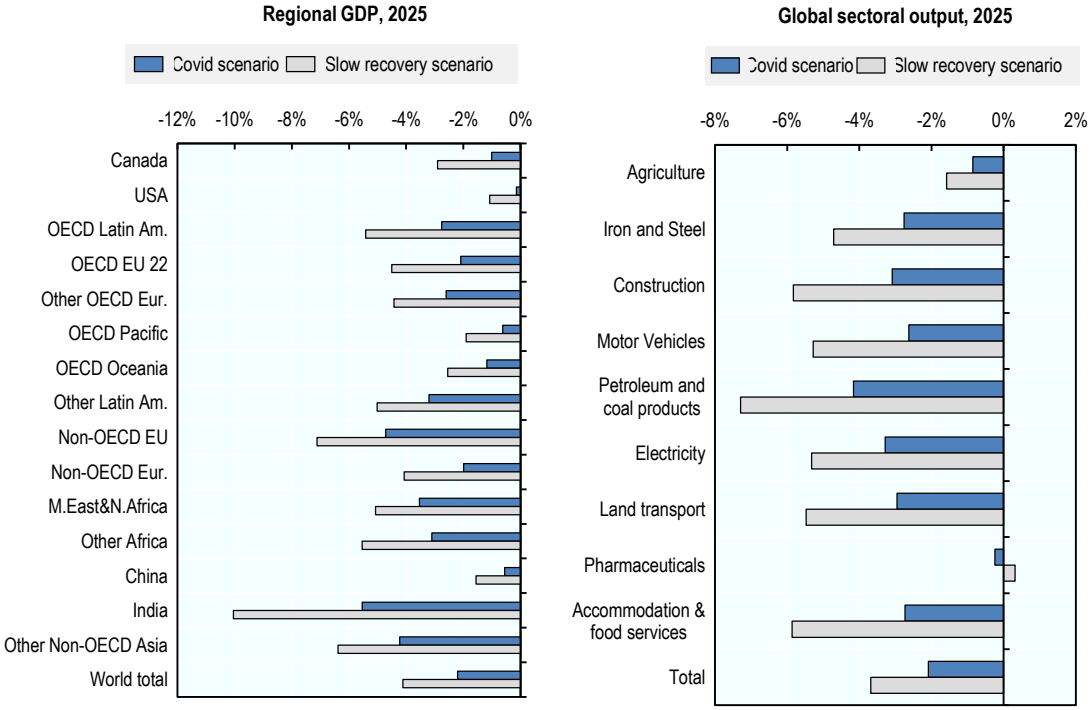
Note: For an explanation of the regional aggregation see Annex A.
Source: ENV-Linkages model.

A slower recovery increases long-term effects on the economy and environment

The speed with which the various economies will recover from the pandemic and the medium-term effects are highly uncertain. If the rebound of GDP is slower (see Dellink et al. (2021[6]) for details on the scenario assumptions), the economic impacts will last significantly longer in all countries and in 2025 differences are especially large for countries that are projected to recover faster (Figure 4, left panel). In absolute terms, slow recovery implies the GDP loss in India remains very large, as the heavier toll on the world economy is especially harmful to major exporters such as India and China. Slower recovery also affects all sectors, although not all equally.

Figure 4. Slow recovery affects some economies and sectors more than others

Deviations from the pre-COVID baseline projection

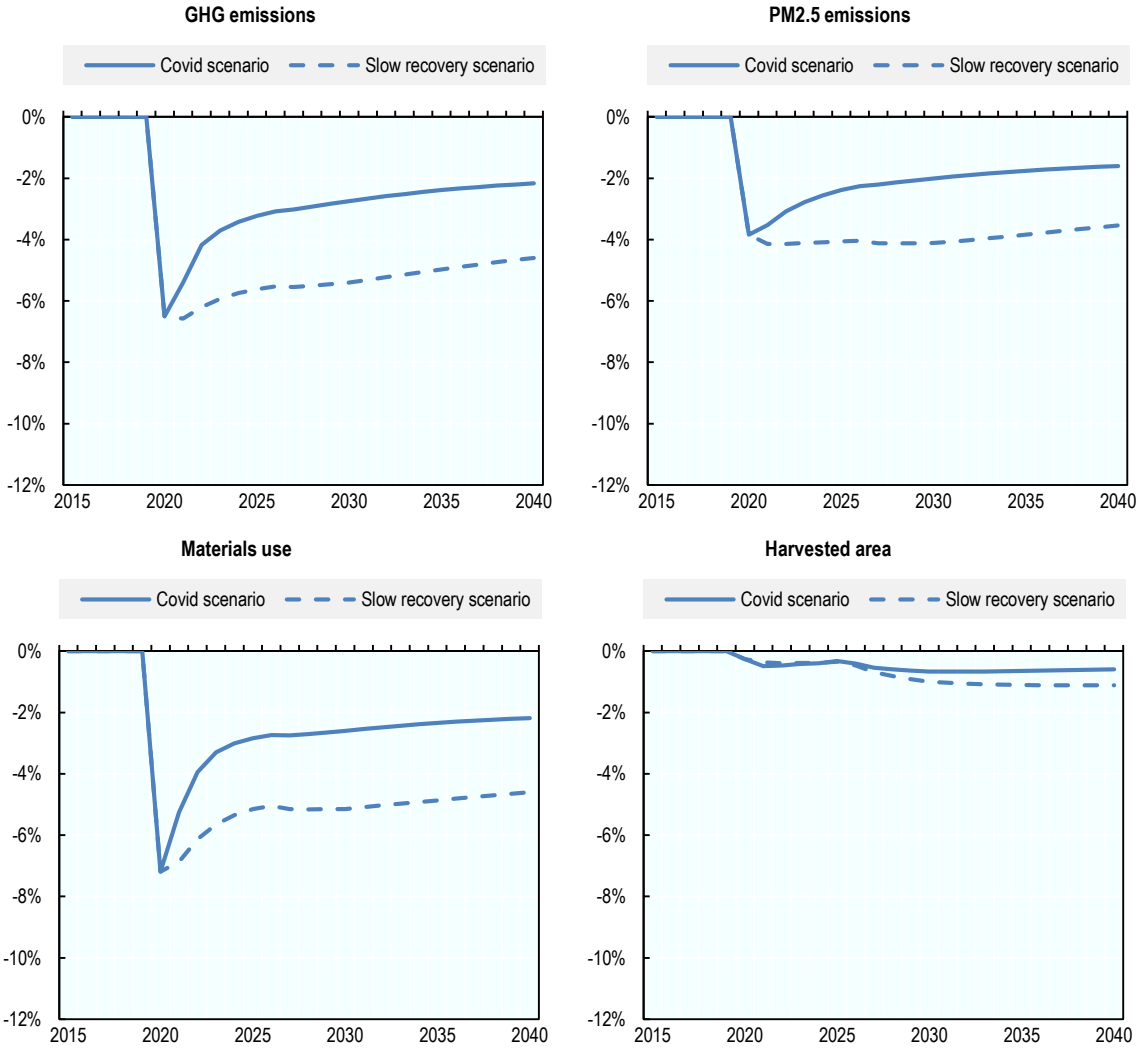


Note: For an explanation of the regional aggregation see Annex A.
Source: ENV-Linkages model.

The slower recovery also drives a larger wedge between sectors in terms of the consequences for production levels (Figure 4, right panel). Consequences for environmental pressures linked to more capital-intensive sectors, namely energy and manufacturing, persist longer than those pressures that are linked to agriculture (Figure 5). Nonetheless, the main effect of the slower recovery is a reduction in macroeconomic activity in the medium term, and an associated reduction in environmental pressures.

Figure 5. Slow recovery doubles long-term global environmental impacts

Deviations from the pre-COVID baseline projection



Source: ENV-Linkages model.

Final thoughts

The results presented in this Brief are surrounded by significant uncertainties. The impacts of the pandemic on sectoral economic activity are not clearly distilled yet. In addition, recovery packages are yet to be defined in many countries. Furthermore, while the start of vaccine campaigns implies that there is a lesser risk of a prolonged pandemic, the speed with which life "returns to normal" remains to be seen.

While many countries have announced that their recovery packages will be "green", the model does not include specific support to environmental goods and services. Indeed, the extent to which recovery packages steer government support to specific environmentally relevant sectors should be further investigated.

Finally, the Brief focuses on the implications of the COVID-19 shocks for environmental pressures. Assessing what these imply for environment quality, ranging from concentrations of GHGs and particulate

matter, to sea level rise, air pollution-related mortality, biodiversity and ecosystem services, is beyond the scope of the current paper.

References

Arriola, C., P. Kowalski and F. Van Tongeren (forthcoming), *Assessment of the Covid-19 pandemic: insights from the METRO model*. [5]

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. [6]

IEA (2020), *World Energy Outlook 2020*, OECD Publishing, Paris, https://dx.doi.org/10.1787/557a761b-en. [4]

IMF (2021), *World Economic Outlook, January 2021 update*, International Monetary Fund, Washington, D.C., https://www.imf.org/en/Publications/WEO/Issues/2021/01/26/2021-world-economic-outlook-update. [3]

OECD (2021), *OECD Economic Outlook, Interim Report March 2021*, OECD Publishing, Paris, https://dx.doi.org/10.1787/34bfd999-en. [2]

OECD (2020), *OECD Economic Outlook, Volume 2020 Issue 2*, OECD Publishing, Paris, https://dx.doi.org/10.1787/39a88ab1-en. [1]

Annex A. ENV-Linkages model regions

Macro regions		Model countries and regions	Most important comprising countries and territories
OECD	OECD America	Canada	Canada
		USA	United States of America
		Other OECD America	Chile, Colombia, Costa Rica, Mexico
	OECD Europe	OECD EU 22	Austria, Belgium, Czech Republic, Denmark, Estonia, Finland, France, Germany Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden
		Other OECD Europe	Iceland, Israel[1], Norway, Switzerland, Turkey, United Kingdom
	OECD Pacific	Australia and New-Zealand	Australia, New-Zealand
		OECD Pacific	Japan, Korea
Non-OECD	Other America	Other Latin America	Non-OECD Latin American and Caribbean countries
	Eurasia	Other EU	Bulgaria, Croatia, Cyprus[2], Malta, Romania
		Other Europe and Caspian	Non-OECD European and Caspian countries, incl. Russian Federation
	Middle East and Africa	Middle East and North Africa	Algeria, Bahrain, Egypt, Iraq, Islamic Rep. of Iran, Kuwait, Lebanon, Libya, Morocco, Oman, Qatar, Saudi Arabia, Tunisia, United Arab Emirates, Syrian Arab Rep., Western Sahara, Yemen
		Other Africa	Sub-Saharan Africa
	Other Asia	China	People's Rep. of China, Hong Kong (China)
		India	India
		Other non-OECD Asia	Other non-OECD Asian and Pacific countries

Notes:

[1] The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.

[2] Note by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

Contact

Rob DELLINK (✉ rob.dellink@oecd.org)