

Disrupting COVID-19 by Improving Environmental Performance

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Research Article

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Disrupting COVID-19 by Improving Environmental Performance

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Abstract

This paper provides evidence that increasing environmental quality can mitigate the spread of COVID-19 by producing natural antibodies. Using recent data from the 2020 Environmental Performance Index for more than 70 countries, our findings validate the effectiveness of lockdown policies in preventing outbreaks. The results are robust across econometric techniques as well as across the environmental proxy variables adopted. We also suggest implementing specific reforms to strengthen ecological performance.

Keywords: COVID-19, EPI, AQI, PM_{2.5}

1. Introduction

The recent SARS-CoV-2 (COVID-19) outbreak has profoundly disrupted our ingrained habits. IMF (2020) defined this event as a natural calamity natural from an economic point of view, since COVID-19 has so far pushed 71 million people to the extreme poverty threshold. If a second wave appears, that number could reach 100 million. The pandemic triggered the deepest global recession since the Second World War, with a contraction in

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global gross domestic product of about 5.2 percent in 2020, and with long-run effects on the level of investments and the erosion of human capital stock ([WorldBank, 2020](#)).

We believe that mitigating this pandemic calls for a multidisciplinary approach; in this vein, this research builds on several recent environmental studies to investigate whether country-level environmental health plays a role in slowing the virus's spread. Specifically, this paper analyzed the relationship between the country's environmental performance and COVID-19 diffusion. Some studies highlighted that SARS-CoV-2 propagates through air pollution (e.g., [Cui et al., 2003](#); [Conticini et al., 2020](#); [Contini and Costabile, 2020](#); [Yongjian et al., 2020](#); [Martelletti and Martelletti, 2020](#)). For instance, [Yongjian et al. \(2020\)](#) documented a direct relationship between daily confirmed COVID-19 cases, the concentration of air pollution, and meteorological variables in China. Likewise, it is well known that air pollutants affect the upper respiratory tract, reducing the immune defense, so they can be considered a Trojan horse for the virus ([Cao et al., 2020](#)). In this regard, [Conticini et al. \(2020\)](#) argued that the Northern regions of Italy are a focal point of the infection as a result of confounding effects, either directly or indirectly related to being one of the most polluted regions of Europe.

In this vein, the present study is the first to track global COVID-19 spread using the 2020 Environmental Performance Index (EPI), a comprehensive indicator evaluating environmental performance according to sustainability targets. Using 32 performance indicators across 11 issue categories, the EPI ranks 180 countries on environmental health and ecosystem vitality ([Weldling et al., 2020](#)). Therefore, the EPI index allows us to assess how close countries

are to achieving ecological policy targets. Moreover, it constitutes forward guidance to apply the best practices for meeting the UN Sustainable Development Goals.

All in all, the present study’s most significant contribution derives from adopting different and more extensive country-level ecological performance indicators, going beyond air pollution data to gauge the potential impact of ecological performance on the COVID-19 pandemic. In the remainder of the paper, Section 2 presents the data and variables, Section 3 reports and discusses the results, and Section 4 concludes the paper.

2. Data and Variables

This section presents and comments on the variables in the empirical model. Virus data has been extracted from the Our World in Data (OWID) COVID-19 dataset and covers the period from December 31, 2019 to June 10, 2020. The OWID research teams collect statistics from the European Center for Disease Prevention and Control and post daily updates online.¹

Tables 1 and 2 report the definitions of the variables and their summary statistics, respectively.

[Tables 1 & 2 about here]

COVID-19 is the variable capturing the relevance of the disease in a country; it is defined as the total positive cases per million inhabitants divided by the total number of tests carried out in the country during the sample period. As a consequence, this outbreak measure is not sensitive to the

¹See [Roser et al. \(2020\)](#) for more details.

heterogenous government policies implemented around the world to prevent infections. The 2020 EPI index supplies composite metrics on the whole environmental quality of a given country. We assume that the EPI index is not affected by reverse causality issues, since most of the datasets on which this indicator and its sub-inductors were constructed were collected in 2018 or earlier, before the pandemic started ([Weldling et al., 2020](#)). Similarly, the EPI team states that the variables are not conditioned by the emissions gathered from the Amazon rainforest fires in 2019. The average EPI score is 55 percent, but the sample includes both top and laggard countries in terms of ecological performance.

Furthermore, to stress test the goodness of our findings, the specification also focuses on a set of standard environmental performance indicators, such as the pollutant air emissions provided from the EPI dataset. We also adopt three alternative measures of environmental quality, namely air quality (*AIR*), *PMD*, and *GHP*. *AIR* is a weighted composite index structured as follows: PM_{2.5} Exposure (55%), Household Solid Fuels (40%), and Ozone Exposure (5%). *GHP* is another weighted air pollutant indicator, defined as the greenhouse gas (GHG) emissions per capita for the year 2017. This index considers the four main gas pollutants directly related to anthropogenic activities, i.e., CO₂, CH₄, F-gases, and N₂O, which are responsible for climate change and in turn impair both the environment and human health. Conversely, *PMD* is a relative measure of air pollution, capturing the effect of the exposure to fine air particulate matter smaller than 2.5 micrometers (PM_{2.5}). Specifically, *PMD* measures the number of age-standardized, disability-adjusted life years lost per 100,000 persons (DALY rate) owing to

exposure to $PM_{2.5}$ in the previous years (Kyu et al., 2018).

Among the other explicative variables, *Latitude* is the distance from the equator, calculated as the absolute value of latitude in degrees divided by 90; it captures two distinctive features of the region that should affect the propagation of the contagion. First, it defines the climate condition of the area, which captures the seasonal patterns in COVID-19 incidence. In this regard, Hopman et al. (2020) pointed out that as pneumonia infection is climate-sensitive as a result of cultural differences (outdoors social living), either UV radiation or high temperature reduces the virus's survival time on surfaces. Indeed, Sajadi et al. (2020) found that significant community outbreaks distributed along restricted latitude, temperature, and humidity lines, supporting the seasonal behavior of human respiratory viruses. Further, Rhodes et al. (2020) documented that countries that lie below 35 degrees North have relatively low mortality rates and low infectious. According to the author, this is also related to the residents' Vitamin D levels during winter, as Vitamin D is a natural defense from infections. Second, the farther a country is from the equator, the more likely it is to have prominent property rights and high-quality institutions relevant to pollution levels. Therefore, countries with less corruption have lower emission levels, both in terms of CO₂ (Hall and Jones, 1999; Cole, 2007; Biswas et al., 2012; Arminen and Menegaki, 2019) and SO₂ (Cole, 2007; Leitão, 2010; Biswas et al., 2012), and better overall environmental performance (Lisciandra and Migliardo, 2017). To a large extent, corruption also affects the quality of national health systems.

Imposing lockdowns has relieved the COVID-19 infection outbreaks, flattening the contagion curve and saving a lot of human lives. As a consequence,

a Government Response stringency index (*Stringency*) has been adopted to assess the impacts of government actions to change the curve of the contagions. In detail, the index is a composite measure grounded on nine response sub-indicators embracing school closures, workplace closures, and travel bans, rescaled to a value from 0 to 100, where higher values stand for stricter responses (Hale et al., 2020).

The specification also includes other control variables that most likely relate to the pandemic, namely the GDP per capita in log terms, the population density, and the share of the population that is 70 years and older. This set of control variables is strictly related to facility for spreading the virus, such as the propensity of international travel, active social life, and the demographic factors of the elderly population. At the same time, other factors play an important role in the COVID-19 data. Some countries adopted different policies to address the outbreaks, for example, and developing countries without surveillance systems may face a shadow pandemic. Finally, the specification includes a set of regional dummy variables to control for the heterogeneous geographical spread of COVID-19. Because the explicative variables refer to a period (2018 or earlier) before the outbreaks started—the exogenous shocks occurred at the beginning of 2020—this time shift protects the robustness against endogeneity.

3. Empirical Results

This section reports and comments on the empirical results of the two robust regressions, both applied to infer the relationship between the pandemic and environmental quality indicators. The empirical strategy is based

on two robust estimators for cross-sectional data, i.e., quantile regression and the ordinary least square, with robust variance estimates (for more detail, see [Berk, 1990](#); [Hamilton, 1992](#); [Koenker and Hallock, 2001](#)).

[Tables 3 & 4 about here]

The results are robust across both the estimators and environmental quality measures, although GHP shows less significance than the other indicators. As expected, our findings confirm the novel literature on the effects of pollution as a catalyst of the propagation of the novel coronavirus; better environmental performance is associated with lower contagion rates. Likewise, air pollution is one way the virus spreads, magnifying the pandemic. Lastly, the coefficient associated with the distance from the equator validates the assumption that COVID-19 is an infection contingent on climate and seasons.

Overall, the present paper provides evidence that may be of interest in identifying “red zones” of virus hotbeds. Moreover, our findings confirm the effectiveness of the lockdown policies in mitigating the contagion. With respect to the other control variables, the associated coefficients are statistically significant, and their signs are in line with the findings highlighted in the literature. Interestingly, the coefficients associated with the continental dummy variable show that the worst-hit pandemic regions lie in European or South America countries; *ceteris paribus*, Oceanic countries are less prone to COVID-19.

4. Conclusion

This analysis extends the debates on the relationship between pollution and the COVID-19 pandemic. From a robust regression, some intriguing regularities appear. First, environmental quality is associated with a natural antibody for the virus diffusion. As a consequence, curbing emissions can combat the propagation of SARS-CoV-2. All in all, the empirical evidence seems to reshuffle the contraposition between economic growth and environmental performance, underlining that ecological policy cannot be postponed: every action towards sustainability implies more protected health and, in turn, preserves the economic welfare of the country. Therefore, promoting environmental policy is a long-term strategic action since efforts towards sustainability not only represent a weapon to fight climate change but also indirectly induce health and economic stability.

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Supplementary Files

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- [tablescovid.pdf](#)