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Pandemics and the Environmental Rebound Effect: Reflections from COVID-19

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Abstract
The irruption of the COVID-19 pandemic has raised concerns on sustainability issues. The pandemic has accelerated the implementation of technologies such as ICT and shifts in mobility behaviour. Such changes have the potential to reduce environmental burdens, but also to trigger large environmental rebound effects. This perspective article reflects on some emerging concerns on the socio-economic effects of a pandemic on the environment from a rebound effect perspective. Although the pandemic offers potential to improve the environmental conditions, it brings also a high risk to produce Jevons' Paradox, i.e., increase environmental burdens rather than decrease them, as initially expected. Governments should be aware of these risks and assess the possibility to implement additional measures, like environmental taxation or limiting the use of resources, to help achieving sustainability targets.

Keywords COVID-19 · Pandemic · Rebound effect · Sustainability

1 Introduction

Rebound effect studies have been generally focused on energy use (Sorrell 2007; Greening et al. 2000), although some studies for other natural resources have recently emerged (Freire-González and Font Vivanco 2017). Rebound effect occurs when the use of resources is not reduced as expected after a resource efficiency policy or a specific behavior. Empirical rebound studies aim at capturing the secondary effects of policies and behaviors in order to obtain more adjusted assessments of policies and actions. It is well known in the rebound literature that, counterintuitively, resource efficiency may not reduce the use of these resources, but the contrary. This extreme case is known as backfire, Khazzoom-Brookes postulate, or Jevons' Paradox. Rebound effects are not usually observed by policy-makers, as it requires different perspectives and approaches coming from social, behavioural and environmental sciences. Environmental and social sciences show us that human–environment systems are deeply interconnected. This way of thinking has,

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however, still not fully permeated in mainstream policy decision circles, which are largely rooted in old intellectual paradigms and other short-term interests.

2 Potential Environmental Rebound Effects Post COVID-19

The pandemic has caused many abrupt changes in production and consumption, transport patterns, working conditions, social interaction and many other aspects. Most of these changes have been triggered by the policies implemented to contain the pandemic. Overall, they have translated into improvements in most environmental indicators, such as carbon emissions, air quality, and biodiversity loss (Saadat et al. 2020). While some authors claim that such changes will not have a lasting impact when the epidemic disappears (McCloskey and Heymann 2020), others argue that aspects related to urban planning, micro-mobility, sharing economy, public transportation, tele-working, tourism, etc. may change for good (Honey-Roses et al. 2020). An important question is thus, whether COVID-19 will reduce environmental impacts in the future, when economic activity returns to 'normality' (in terms of pre-COVID conditions).[1] Rebound literature shows the importance of considering behavioral and systemic responses to answer this question.

Beyond other considerations, the pandemic has accelerated some already observed trends, like the pace of implementation and use of digital technologies. One of the most remarkable changes are those related to the impulse of information and communications technologies (ICT), due to imposed social distancing rules. There already was a tendency towards an increased use of ICT, but its use has been dramatically accelerated due to the pandemic.[2] This acceleration can be observed in many areas, such as teleworking, e-commerce, remote social relationships, virtual sightseeing, surveillance technologies, and other online areas and events (cultural, academic, leisure, educational, etc.). For instance, in many countries, non-essential workers have been legally obliged to be confined during the pandemic to stop the contagion of the virus, thus promoting telework. Despite the potential advantages of teleworking in increasing labor productivity in many industries (Harker Martin and MacDonnell 2012), rigidities in corporate culture and other legal and cultural restraints were hindering and adjourning its consolidation. The use of ICT is thought to be environmentally beneficial, largely due to decreased transport, but this premise has been challenged by rebound effect studies. Gossart (2014) shows that existing evidence suggests that ICT are subject to important rebound effects, mainly because it is a general-purpose technology, and so, prone to backfire (Sorrell 2007). Takahashi et al. (2004) calculated the rebound effect of ICT services in a case study on videoconferences and found that rebound can reduce up to 20% of carbon savings. Joyce et al. (2019) recently found for Sweden strong environmental rebound effects associated with ICT use, in most cases far above 100% (more resources use than before). This backfire effect is strongest for energy use and total material footprint, both close to 200%.

Another change may take place in land use and the housing sector. As initial evidence suggests, attributes such as floor space and outdoor space will have elevated importance (Mikolai et al. 2020). The potential re-distribution of time and expenditures towards resource-intensive sectors, such as construction, water, and energy services, will likely

[1] During the Covid-19 crisis, most environmental indicators have been improved due to confinements and contraction of economic activity.

[2] https://www.nytimes.com/interactive/2020/04/07/technology/coronavirus-internet-use.html.

cause material, water, and energy rebounds. However, the expansion of teleworking can, at the same time, reallocate space and incomes in office rental market. City centers will not need to concentrate workspaces, changing mobility patterns and urban structures in the long term (Elldér 2017). Public transport may also be negatively impacted in the short and mid-term, leading to increased private transport (Honey-Roses et al. 2020), another resource-intensive activity.

Other structural changes may also take place, such as changes in sufficiency measures and broader productivity, leading to macro-economic rebound effects (Lemoine 2020). The pandemic may increase the social acceptance of sufficiency measures such as working less time, spending more time with family and friends, or connecting with nature. These measures have long been proposed to reduce consumption and associated environmental impacts (Hayden and Shandra 2009). They have, however, been associated with macro-economic price rebound effects as the decreased demand for some products can lower their price and induce additional demand (Sorrell et al. 2020). Moreover, the post-pandemic society may likely be a more productive one in labor and capital terms. For example, teleworking (Harker Martin and MacDonnell 2012) and increased spending in research and development have been associated with productivity growth, which boosts economic growth and resources use.

3 Final Remarks

The COVID-19 pandemic will likely cause a range of changes in society, but their permanence and impacts on the environment is unclear, especially if we contemplate the secondary effects of behaviors, measures, and policies. A key question is whether they will acquire a certain level of permanence, even modifying the mindset of the people. Given the high uncertainty around this aspect, its real dimension could only be assessed *ex-post*. However, due to confinements, the pandemic has greatly accelerated the expansion and use of general-purpose technologies, like ICT. As this has been a long-observed trend, before the irruption of the virus, they have probably come to stay to a large degree.

The pandemic offers a great potential to improving (and consolidating) environmental conditions. But beyond what conventional environmental indicators show, additional measures would be needed to counteract hidden rebound effects and, therefore, take full advantage of potential improvements. Recent literature shows that different economic instruments like environmental taxation, resource pricing or setting limits to resource use, can be effective for this purpose. This is particularly necessary in this case, given the high risk of backfire due to the high expansion of general-purpose technologies observed.

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