The faster the population grows, the higher the carbon tax needed to offset climate change

Essentially, all environmental problems are scale problems. It is difficult to imagine that the human impact on the global climate system would be a top priority in a world with a global population of 8 million. Even with substantially higher fossil fuel consumption per capita, this hypothetical economy would emit only a small fraction of current carbon emissions. However, the reality is that we are nearly 8 billion people on this planet, and it seems like climate change is one of the main global issues of the 21st century.

On the other hand, it is difficult to imagine that our technological achievements could have been realised in this hypothetical world of 8 million people. This is not only because true geniuses are few and far between. But also because a larger economy allows more people to be allocated to research, resulting in more ideas, technologies, and scientific discoveries.

When it comes to climate change, a key question is which of these (potentially) offsetting scale effects is likely to dominate. The global population is expected to increase by around 40 per cent over the remaining part of this century. These more than 3 billion additional people will put severe pressure on the climate, given current production technologies and lifestyle choices. But this population growth also increases the research capacity of the global economy. If this research capacity is directed toward environmentally friendly technologies, population growth could be part of the solution rather than the root of the problem.

In a recent article, I analyse this issue using an economic climate change model. My study shows that the environmental burden of population growth can be reduced through climate policies. A tax on carbon emissions or research subsidies can direct research towards environmentally friendly technologies, thereby exploiting the additional research capacity caused by population growth to reduce carbon emissions.

Nevertheless, my study finds that even with strong climate policies in place, population growth is a net burden on the climate. In other words, the direct scale effect, where more people imply more production and consumption – and thereby more pollution emission – cannot be fully offset by larger research capacity. Thus reducing the global population growth rate helps mitigating climate change.

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Without going into technical details, the intuition behind this result can be explained the following way. Recent empirical evidence suggests that it becomes increasingly harder to come up with new technological solutions to a given problem. In other words, the productivity of research declines as the technological level increases. As a consequence, it becomes increasingly harder to reduce the emission intensity of production over time via research. Population growth increases the research input which partly counteracts the declining research productivity. But this population growth also contributes directly to production, consumption, and emissions. In the long run, the analysis shows that the direct effect of population growth on emissions dominates the effect of technological development.

Model simulations show that compliance with the temperature target of the Paris Agreement is achievable through a global tax on carbon emissions. This is because the carbon tax not only directs research toward environmentally friendly production technologies. It also changes how production takes place given the technologies available. The size of this tax depends critically on the assumed population growth scenario, where faster population growth implies that a higher carbon tax is needed. Hence political acceptance of a sufficiently high carbon tax may heavily depend on expected population growth patterns.

In contrast, the model simulations indicate that a global subsidy to research in environmentally friendly production technologies cannot ensure compliance with the Paris Agreement under expected population growth scenarios. In fact, to ensure a carbon concentration that almost complies with the agreement, the research subsidy must be combined with zero population growth through the remaining part of this century. Intuitively, the research subsidy is inferior to the tax seen from an environmental perspective, as it does not affect the emission intensity of production given available technologies. It only affects the technological development over time. In contrast, a carbon tax affects both margins.

Although the analysis shows that population growth is a net burden on the environment, the policy implications are not obvious. It is difficult to assess the welfare cost of population control policies, and thus, population control measures are difficult to evaluate via standard cost-benefit analysis. In addition, there are some ethical issues that are difficult to handle for economists. For instance, is it ethically acceptable to interfere with people's reproductive choices? Another controversial issue is what the ultimate policy goal is. Should we maximise welfare for the average global citizen (average utilitarian approach), or should we maximise the sum of welfare for all global citizens (total utilitarian approach).

Nonetheless, the results of the analysis suggest that population control measures should at least be considered as an environmental policy instrument. An important point is that given some temperature target, a reduction in the population growth rate means that a less heavy burden is placed on other policy instruments like a carbon tax. Thus, it may be necessary to reduce the population growth rate to secure a politically acceptable carbon price in a global or even sub-global context.

Notes:

- *This blog post is based on Population growth is a net burden on the climate, presented in the European Economic Association's Annual Congress, August 2020.*
- *The post expresses the views of its author(s), not the position of LSE Business Review or the London School of Economics.*
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