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The economics (or lack thereof) of aerosol geoengineering

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Anthropogenic greenhouse gas emissions are changing the Earth's climate and impose substantial risks for current and future generations. What are scientifically sound, economically viable, and ethically defendable strategies to manage these climate risks? Ratified international agreements call for a reduction of greenhouse gas emissions to avoid dangerous anthropogenic interference with the climate system. Recent proposals, however, call for the deployment of a different approach: to geoengineer climate by injecting aerosol precursors into the stratosphere.

Published economic studies typically suggest that substituting aerosol geoengineering for abatement of carbon dioxide emissions results in large net monetary benefits. However, these studies neglect the risks of aerosol geoengineering due to (i) the potential for future geoengineering failures and (ii) the negative impacts associated with the aerosol forcing. Here we use a simple integrated assessment model of climate change to analyze potential economic impacts of aerosol geoengineering strategies over a wide range of uncertain parameters such as climate sensitivity, the economic damages due to climate change, and the economic damages due to aerosol geoengineering forcing. The simplicity of the model provides the advantages of parsimony and transparency, but it also imposes severe caveats on the interpretation of the results. For example, the analysis is based on a globally aggregated model and is hence silent on the question of intragenerational distribution of costs and benefits. In addition, the analysis neglects the effects of endogenous learning about the climate system.

We show that the risks associated with a future geoengineering failure and negative impacts of aerosol forcings can cause geoenginering strategies to fail an economic cost-benefit test. One key to this finding is that a geoengineering failure would lead to dramatic and abrupt climatic changes. The monetary damages due to this failure can dominate the cost-benefit analysis because the monetary damages of climate change are expected to increase with the rate of change.

Substituting aerosol geoengineering for greenhouse gas emission abatement might fail not only an economic cost-benefit test but also an ethical test of distributional justice. Substituting aerosol geoengineering for greenhouse gas emissions abatements constitutes a conscious risk transfer to future generations. Intergenerational justice demands distributional justice, namely that present generations may not create benefits for themselves in exchange for burdens on future generations. We use the economic model to quantify this risk transfer to better inform the judgment of whether substituting aerosol geoengineering for carbon dioxide emission abatement fails this ethical test.