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Solar Geoengineering, Uncertainty, and the Price of Carbon[☆]

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Abstract

We consider the socially optimal use of solar geoengineering to manage climate change and its implications for carbon emissions abatement policy. We show that solar geoengineering is a substitute for emissions abatement; optimal policy includes less abatement, by up to eight percentage points, and has a lower carbon price, by up to fifteen percent, than recommended by models that ignore solar geoengineering. However, it is an imperfect substitute, since it reduces temperature without reducing atmospheric or ocean carbon concentrations. Carbon concentrations are higher but temperature is lower when allowing for solar geoengineering. Ignoring geoengineering in climate models can lead to welfare losses of up to 4 percent of GDP. Uncertainty over climate sensitivity leads to more abatement and solar geoengineering, while uncertainty over solar geoengineering damages leads to less geoengineering.

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I. Introduction

Greenhouse gases (GHGs) like carbon dioxide contribute to climate change and thus create negative externalities. The standard Pigouvian solution to the market failure caused by negative externalities is to price the externality at marginal external damages. Solar geoengineering (SGE) is an alternative way to reduce the damages from GHGs: instead of reducing the quantity of GHGs, SGE can, at least in part, reduce the damages that they inflict by directly reducing incoming solar radiation. SGE does not, however, reduce atmospheric or ocean carbon concentrations. Furthermore, there is tremendous uncertainty over the risks of SGE. If SGE is part of the optimal policy portfolio, then its inclusion will affect the optimal amount of emissions reductions (abatement) and the optimal Pigouvian

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