

Multiple climate ambiguities and optimal carbon emission abatement decisions

GA, UNITED STATES, October 14, 2025 /EINPresswire.com/ -- The study develops a [climate-economy model](#) focusing on three sources of ambiguity: climate sensitivity, climate-related economic damage, and abatement cost-effectiveness. Aversion to climate sensitivity and damage ambiguity increases abatement, while aversion to abatement cost ambiguity reduces it. If the extent of climate change or its damage is believed to be overstated, optimal abatement can drop sharply or even disappear. Perceived relationships among uncertainties can amplify or offset their effects.

A new climate-economy model reported in Risk Sciences examines how ambiguity about key climate and economic factors shapes carbon abatement decisions. The study (doi: <https://doi.org/10.1016/j.risk.2025.100024>) focuses on three sources of ambiguity—climate sensitivity to emissions, climate-induced economic damage, and the cost-effectiveness of abatement—and shows that they push policy in different directions.

“Aversion to climate sensitivity and economic damage ambiguity increases abatement, while aversion to abatement cost ambiguity reduces it,” shares first author Peixin Liu from University of Illinois Urbana-Champaign. “When the decision maker believes the extent of climate change or its economic damage is overstated, optimal abatement can drop sharply or even disappear. Moreover, perceived relationships among uncertainties can amplify or offset their effects.”

The authors first started with analysis of a stylized abatement-versus-non-abatement decision and then introduced a continuous decision model with smooth ambiguity preferences (Klibanoff–Marinacci–Mukerji). A key contribution is a certainty-equivalent productivity metric that summarizes outcomes across different ambiguity attitudes and information environments.

“Numerical illustrations highlight the mechanisms. Without ambiguity, the optimal policy reduces emissions by 51.49% relative to business-as-usual, with an abatement cost of 0.80% of output and climate damage of 1.46%,” explains Liu.

With ambiguity aversion to climate sensitivity ($\theta = 10$), abatement rose to 56.93%; with ambiguity aversion to economic damage, abatement rose to 54.11%. In contrast, ambiguity aversion about abatement cost was reduced abatement to 48.79% ($\theta = 10$). When two ambiguity sources reinforced each other (e.g., climate sensitivity and damage), combined effects are stronger; when they opposed (e.g., damage vs. abatement cost), effects were offset.

“Our results help explain conflicting attitudes toward carbon policy and highlight the need for frameworks that reflect diverse uncertainty perceptions,” adds Liu. “The findings suggest that differing beliefs about uncertainty—and how uncertainties are related—can rationally lead to stronger, weaker, or even no abatement, with important implications for policy design.”

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