Threshold Effects on Climate Change Policy

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Selected Poster prepared for presentation at the Agricultural & Applied Economics Association’s

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Introduction:
Climate scientists have expressed concerns about possible sudden changes due to crossing a temperature threshold. For example, above a certain temperature level, we may face melting of the ice sheets of Greenland and west Antarctica—events that would have large economic consequences due to rising sea levels (Yohe and Schlesinger 1998).

Although we suspect there may be a threshold temperature for this melting, there is high uncertainty about it. We study the economic consequences and policy implications of this uncertainty.

Research question:
How is optimal pricing of carbon emissions affected by uncertainty about the temperature threshold for major sea-level rise?

Model:
We assume that there is a temperature threshold, above which there is a 10% loss in GDP due to sea level rise. In one scenario we assume this threshold occurs at 2°C. The other, has a probability distribution for the threshold, with mean 2°C.

We use the DICE model (Dynamic Integrated model of Climate and the Economy) developed by Nordhaus (2009) to test the effect of certain and uncertain thresholds.

Results and conclusions:
Results show the following:
- If there is a substantial increase in damage above a threshold temperature, the optimal carbon price is higher than for a scenario without such a threshold.
- After about 50 years, the carbon price given a certain threshold becomes much greater than under an uncertain threshold.
- The optimal strategy under a certain threshold keeps the temperature just below the threshold, whereas the optimal strategy for an uncertain threshold does not prevent the temperature rising substantially.

References: