The high climate costs of animal-based foods

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Abstract

Despite mounting evidence that reductions in agricultural emissions must be part of the global climate agenda, the economic benefits of such reductions have not yet been quantified in a manner appropriate for rigorous cost-benefit analyses. Here we couple the global agricultural and industrial economies in a leading macroeconomic-climate model to quantify the climate costs of animal-based foods along several dimensions. Under representative temperature targets, a transition to veganism alleviates necessary reductions of industrial emissions by 25 percent. Under a business-as-usual pathway, standard diets high in animal protein contribute nearly \$100 per person, per year in climate damages; about two-thirds of the damages from the average passenger vehicle in the United States. At the product level, the true cost of a serving of beef is 62% more than producers now face. Disaggregating to the regional level, we highlight where food policy could provide the highest social return.

Full Text

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Figures

Figure 1

Dietary Emissions Have Large, Near-Term Temperature Effects. Temperature effects of veganism relative to standard diets. Total temperature effects of animal agriculture on global warming (left) and effects of yearly emissions for standard emission intense household activities (right). For total global effects we assume that annual per capita animal consumption is fixed over time; BAU is a “no climate policy” scenario in DICE, “Vegan” implies these projected emissions from animal agriculture are immediately and permanently eliminated. Slight cyclicity in temperature projections comes from cyclicity in solar irradiance forcings in the RCPs. Temperature response functions (right) are computed by exogenously adding the annual GHG emissions from the three most emission intense, common, household activities in

the U.S. Diets and their emissions intensities are computed within the model; carbon-dioxide emissions for average driving and average per capita household energy use are taken from the EPA.

Figure 2

Industrial and Livestock GHG Emissions Tradeoffs Underlying Limited Warming Scenarios. Plotted are combinations of industrial emissions and agricultural emissions for different temperature targets over the next century. To simplify analysis and presentation, the scenarios considered are one-dimensional reduction choices; the axes correspond to immediate and persistent reductions of the respective emissions by x% relative to their unconstrained path. For example, the upper-left most point on the “2 Deg.” curve implies that to stay under 2-degrees without any reduction in animal agriculture (y=100%) industrial emissions must be reduced to about x=19% of their unconstrained trajectory in all future years.

Figure 3

Spatial Variation in Intensive and Extensive Margins of Animal Product Consumption. (Top) Social benefits of transitioning to a vegan diet around the world. Results are analogous to the \$92 found in Table 1, row 1, column 2. Latin America, Oceania, and parts of western Asia have the highest dietary costs. (Bottom) Regional differences in cost per item (analogous to Table 1, row 1, columns 4-9) account for some of this difference, but additionally highlight where production methods are most emissions intense. “Lat Am” is Latin America; “Mid East” is Middle East. Note: The designations employed and the

presentation of the material on this map do not imply the expression of any opinion whatsoever on the part of Research Square concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. This map has been provided by the authors.

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