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Climate change expected to damage world economies over the next century

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According to a recent study, "Long-term macroeconomic effects of climate change: a cross-country analysis" (*National Bureau of Economic Research,* Working Paper 26167, August 2019), authors Matthew E. Kahn, Kamiar Mohaddes, Ryan N.C. Ng, M. Hashem Pesaran, Mehdi Raissi, and Jui-Chung Yang find that rising global temperatures are projected to damage economic growth over the next century. The impact would be universal and will affect all countries, whether they are rich, poor, hot, or cold.

The researchers looked at the long-term impact of climate change on economic activity and used data from 174 countries from 1960 to 2014 to estimate the link between above-normal temperatures and income levels. They then modeled the income effects under a continuation of "business-as-usual" emissions (in which climate change-causing greenhouse gas emissions are not drastically lowered), as well as a scenario in which the world holds to the Paris Agreement (a global pact to fight climate change that nearly 200 countries agreed to in December 2015).

The economists' research focused on the United States because of its varied climates and found that ignoring the goals of the Paris Agreement would affect nearly all industries. They looked at 10 sectors ranging from manufacturing and services to retail and wholesale trade across 48 states. They found that each sector in every state suffered economically from at least one aspect of climate change, whether by heat, flood, drought, or cold.

Under a business-as-usual emissions scenario, researchers predicted average global temperatures to rise over 4 °C by the end of the century. This increase would cause a substantial economic hit to the U.S. economy, which is projected to lose 10.5 percent of its gross domestic product (GDP) by 2100, and Canada could lose over 13.0 percent of its income by 2100.

However, if countries abide by the 2015 Paris Agreement, income losses of these two North American countries would be less than 2.0 percent of GDP. In addition, the global temperature increase would only be 0.01 °C a year, and the loss in real GDP would be substantially reduced to an estimated 1.07 percent by 2100.

The authors find that 7.0 percent of global GDP is likely to vanish by the end of the century, unless action is taken. India, Japan, and New Zealand would lose 10.0 percent of their income. Switzerland is likely to have an economy that is 12.0 percent smaller by 2100. Russia would lose 9.0 percent of its income, and the GDP of the United Kingdom would be down by 4.0 percent.

The researchers argue that the size of income loss is determined not only by the number on the thermometer but also by the deviation of temperature from its "historical norm" (the climate conditions to which countries are

accustomed) that determines the size of income loss. They acknowledge that economies will adapt to changing climates, but argue that their modeling work shows that adaptation alone will not be enough.

The scientific consensus suggests that adapting to climate change takes an average of 30 years, as everything from cultural practice to infrastructure slowly adjusts. However, even if this adjustment were to take 10 years or less, the United States would still lose almost 7.0 percent of its economy with over 4.0 percent of global GDP gone by the end of the century.

If the current trajectory of carbon emissions continues, nearly all countries, whether rich, poor, hot, or cold, will suffer economically by 2100. The authors' analysis suggests that meeting the target presented by the Paris Agreement to stay within the global rise in temperature to within 2 °C could substantially reduce global losses in GDP.