

RESEARCH

Connecting the Dots: From Climate Change to Economics and Investing

Joseph Chi
Head of Responsible Investment

Mathieu Pellerin, PhD
Researcher

Jacobo Rodriguez
Head of Research Operations and Vice President

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Climate change is all over the news. But do you know the latest scientific estimates and projections about climate change? How do the projected physical effects of climate change translate into economic costs? What are the costs and benefits of different actions to address climate change? And what are the implications of climate change for asset pricing and investing?

The answers to those questions can shape our behavior as consumers, voters, and investors. Therefore, it is important to get robust, well-informed answers. Doing so requires studying the vast academic literature on climate science, economics, and finance. This approach takes time, but we believe it is the most effective way to build a robust framework for analyzing the links between climate change, the real economy, and investing.

In our new study “The Economics of Climate Change,” we do exactly that. We survey the literature to assess the potential economic impacts of climate change and their implications for investing. We first review the basics of climate science and the historical evolution of greenhouse gas (GHG) emissions. Greenhouse gas concentrations in the atmosphere have increased by about 50% relative to pre-industrial levels.¹ Consistent with the increased accumulation of GHG in the atmosphere, the global mean surface temperature has risen by approximately 1.0°C (1.8°F) since 1850.² If emissions were to stay constant at their current level, it would take only about 40 years for new emissions to equal the amount of CO emitted in modern history.

The paper then goes on to show how we can use economics to assess the potential damages, direct and indirect, of climate change. These economic costs are long lasting, uncertain, and highly sensitive to the choice of discount rate used to calculate their present value. Overall, the expected economic costs across studies range from about \$35 per metric ton of carbon emissions to over \$125.³ At current emission levels (36.6

gigatons per year), the annual economic costs of CO emissions alone would be equivalent to 1.5%–5% of global economic output.⁴

To address climate change, we can take many actions. In our view, economic reasoning provides a powerful tool to analyze the costs and benefits of those actions, including public policies such as carbon taxation and private sector responses designed to produce less carbon-intensive goods and services. Similarly, fundamental investment principles provide a useful framework to analyze the relation between climate risks and asset prices and can help investors navigate the risks and opportunities related to climate change.

The approach we take to analyze climate change and its investment implications is the same rigorous, science-based approach we have taken to study other investment challenges for close to 40 years. We harness the power of robust academic research to help us understand the issues relevant to investors and, where appropriate, apply the findings from that research to our investment process.

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1. See, for instance, Solomon Hsiang and Robert E. Kopp, "An Economist's Guide to Climate Change Science," *Journal of Economic Perspectives* 32, no. 4 (2018): 3–32.
 2. Ibid.
 3. See William Nordhaus, "Climate Change: The Ultimate Challenge for Economics," *American Economic Review* 109, no. 6 (2019): 1991–2014; and Kent D. Daniel, Robert B. Litterman, and Gernot Wagner, "Declining CO Price Paths," *Proceedings of the National Academy of Sciences* 116, no. 42 (2019): 20886–20891.
 4. Dimensional's calculations using data from the World Bank, available at data.worldbank.org/indicator/NY.GDP.MKTP.CD.

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