

# Climate Models

2022-02-23

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#### Required Reading (everyone):

- Climate Casino, Ch. 3–4.

#### Reading Notes:

Chapter 3 treats global warming as a scientific consequence of an economic problem. As you read, consider the following questions. Some have clear answers while others are beyond the knowledge of experts and I ask them to challenge you to think about hard problems. On p. 30, Nordhaus describes three components that drive CO<sub>2</sub> emissions: population, per-capita GDP, and the carbon intensity of the economy. A mathematical expression for this relationship is known as the **Kaya identity**, and we will study this in great depth on Mar. 21–28 and in the lab project on decarbonizing the energy supply.

- Why don't free markets manage greenhouse gas emissions well?
- Are CO<sub>2</sub> emissions going up or down? Why?
- What is carbon intensity? Is it going up or down in the US? Why?
- When Nordhaus writes about models for predicting future climate change, he distinguishes between **predictions** and **projections**. What is the difference and why is it important?
- Table 1 on p. 31 shows two projections of future CO<sub>2</sub> emissions. Why are they different? How can we tell which is a better prediction?
- What is an **integrated assessment model (IAM)**?
- What are the biggest sources of uncertainty in predicting future CO<sub>2</sub> emissions?
- How much can we trust models of future climate change? What should we consider when deciding how much to trust a model?

Chapter 4 looks at what we do and don't know about future climate change.

- Pages 37–42 are largely a review of material we studied in much greater depth in the first few weeks of the term. You can read through it quickly.
- What is the difference between **transient** and **equilibrium** response to CO<sub>2</sub> emissions? What would we expect to happen to the global temperature if everyone around the world completely stopped burning fossil fuels this afternoon?
- Figure 9 shows several different projections for how temperature might change over the rest of this century. What is the biggest reason the projections don't all agree with each other?
- Pay close attention to the bullet points on pp. 47–48.
- How does Nordhaus recommend that we think about the uncertainties in predictions about the climate?
- Given these uncertainties, can we trust climate models and can they be useful?