

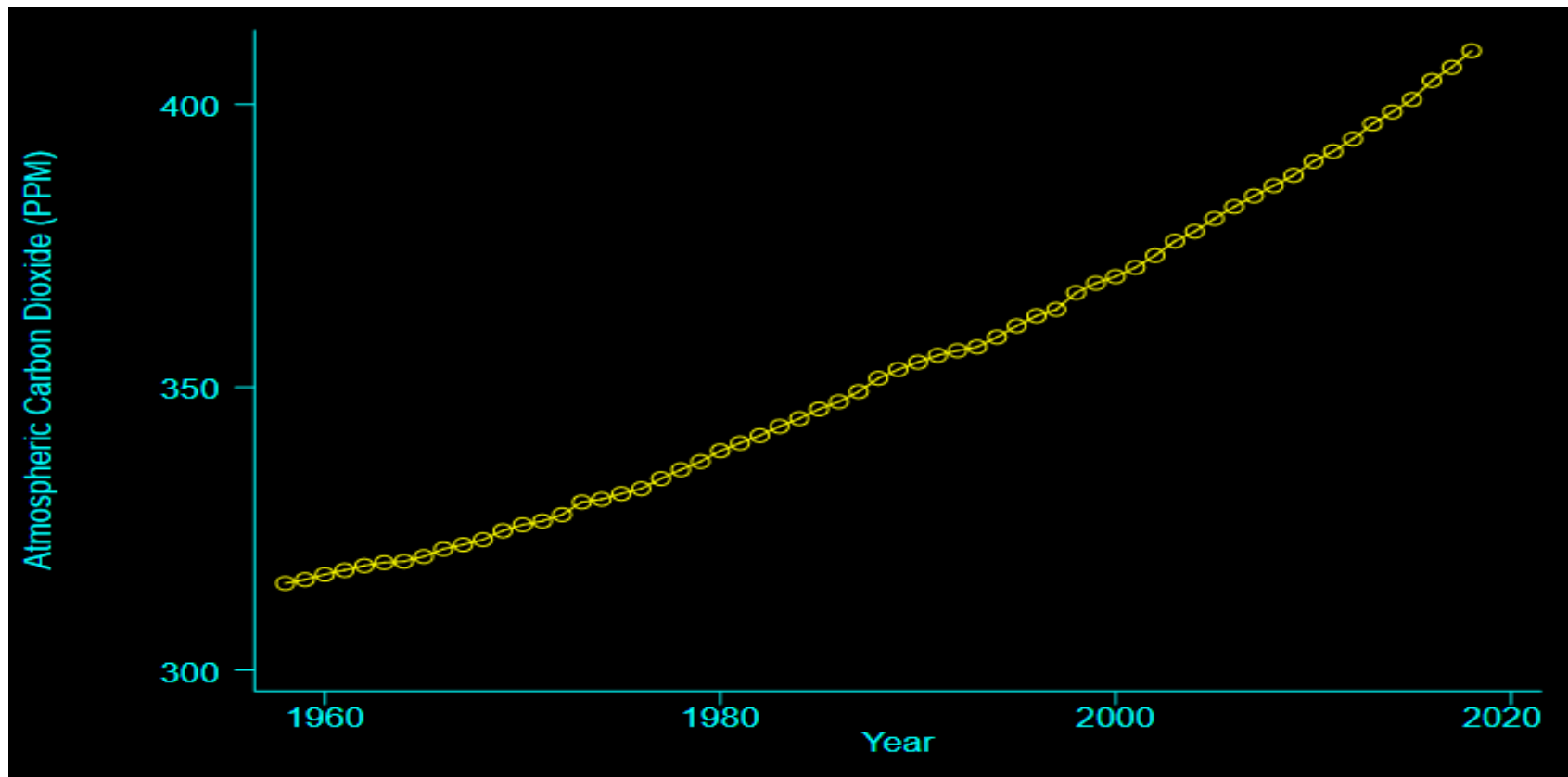
The Microeconomics of Adapting to Climate Change: Lessons for India

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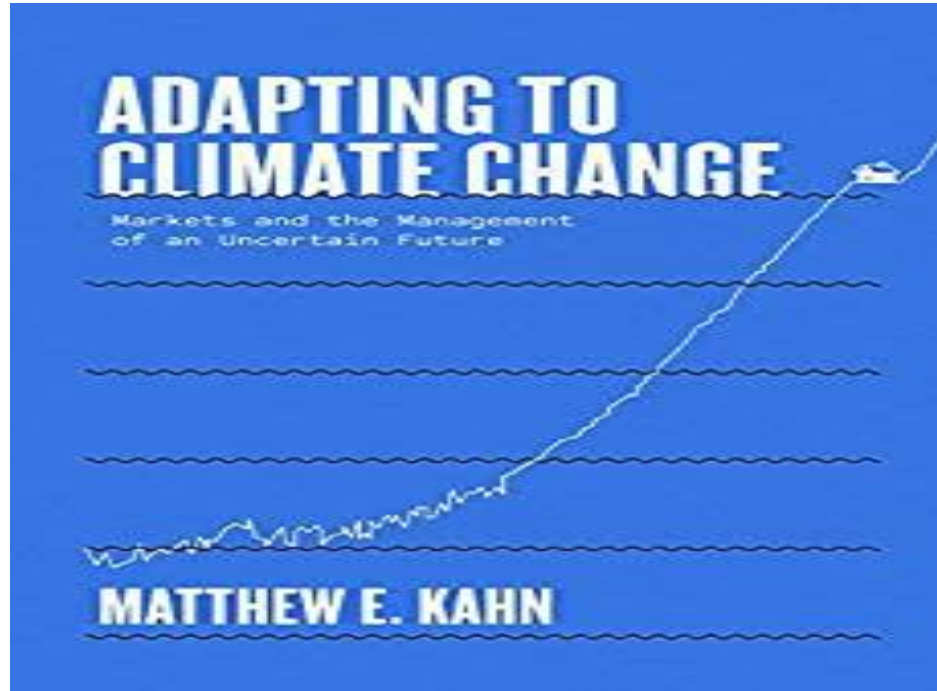
Global Greenhouse Gas Concentration Dynamics



A Prediction: The World's Overall GHG Level Will Continue to Rise

- Yes, we are decarbonizing the electric power grid
- Yes, electric vehicle progress is taking place
- But, the demand for energy in the developing world is huge and coal and natural gas offer reliable service.
 - Wolfram C, Shelef O, Gertler P. How will energy demand develop in the developing world?. *Journal of Economic Perspectives*. 2012 Feb;26(1):119-38.
 - Davis LW, Gertler PJ. Contribution of air conditioning adoption to future energy use under global warming. *Proceedings of the National Academy of Sciences*. 2015 May 12;112(19):5962-7.
 - Dargay J, Gately D, Sommer M. Vehicle ownership and income growth, worldwide: 1960-2030. *ENERGY JOURNAL*. 2007 1;28(4):143.

My 2021 Yale University Press Book is U.S Focused



The Lucas Critique Revisited

- We are not “passive victims” as Mother Nature throws harder punches!!
- In 1976, Robert Lucas stated that as the Government changes the “rules of the game”, that forward looking households and firms change their optimal decision rules and thus one cannot extrapolate using regression reduced form estimates of historical consumption and investment functions
 - Barreca A, Clay K, Deschenes O, Greenstone M, Shapiro JS. Adapting to climate change: The remarkable decline in the US temperature-mortality relationship over the twentieth century. *Journal of Political Economy*. 2016 Feb 1;124(1):105-59.
 - Burgess, Robin, Olivier Deschenes, Dave Donaldson, and Michael Greenstone. "Weather, climate change and death in India." *University of Chicago* (2017).

An Overview of my Book

- We seek to be healthy, comfortable and to raise happy children.
- Climate change threatens all of these Household goals
- How do we use human capital and markets to better protect us?
- How do we structure government's rules of the game at the federal and local level to be a complement not a substitute for individual efforts to cope with emerging risks?
- Empirical hypotheses versus wishful (magical?) thinking.
- Julian Simon versus Paul Ehrlich again “The Bet” !!

The Book's Chapters 1-3

- A Microeconomic Perspective on the Climate Change Prediction problem
 - Risk assessment of a “moving target”
 - Rational expectations, behavioral economics, and robust decision making when confronted with “known unknowns”
- Daily Quality of Life
 - Migration, self protection, disruption
- Protecting the Poor from extreme shocks
 - Reducing poverty as a resilience strategy, Where do the poor live in cities? Their housing quality, consumption buffer stocks

Chapters 4-6

- Upgrading Public Infrastructure
 - The system of cities and competition to be resilient
- Will Climate Change Threaten Economic Productivity?
 - Superstar firms in the U.S versus smaller firms with lower quality managers, transition dynamics
- Protecting Urban Real Estate
 - <https://theconversation.com/a-new-ratings-industry-is-emerging-to-help-homebuyers-assess-climate-risks-171898>

Chapters 7-10

- Big Data Facilitates Adaptation
 - The amazing role of cell phones and Amazon's incentives
- Reimagining the Real Estate Sector
 - Zoning and land use in the United States, identify "higher ground" and up zone there
- Reimagining Laws and Regulations to Facilitate Adaptation
 - Road pricing, allow natural resource prices to reflect scarcity dynamics (water and drought)

Chapters 11 and 12

- Globalization
 - International migration can be more “orderly” using ideas from mechanism design to match those who want to leave distressed areas with destination areas that will welcome them.
 - Trade in agricultural goods to smooth local production shocks (Townsend risk sharing!)
 - International capital markets

Lessons for India?

India's Urbanization Accelerates Adaptation Progress

- Output volatility down, urbanites richer , urbanization → education investment
- India's Urbanization and the System of Cities
 - Which cities have a natural advantage and a leadership advantage in coping with extreme weather?
 - Which cities have a flexible land use regulations to allow for more new construction to take place on “higher ground”?
 - Which slum areas face the greatest risks due to climate shocks? , Are local residents aware of these risks?
 - The aggregate demand for solutions induces endogenous innovation (Acemoglu and Linn QJE 2004)

Protect the poor through transfers to people or places?

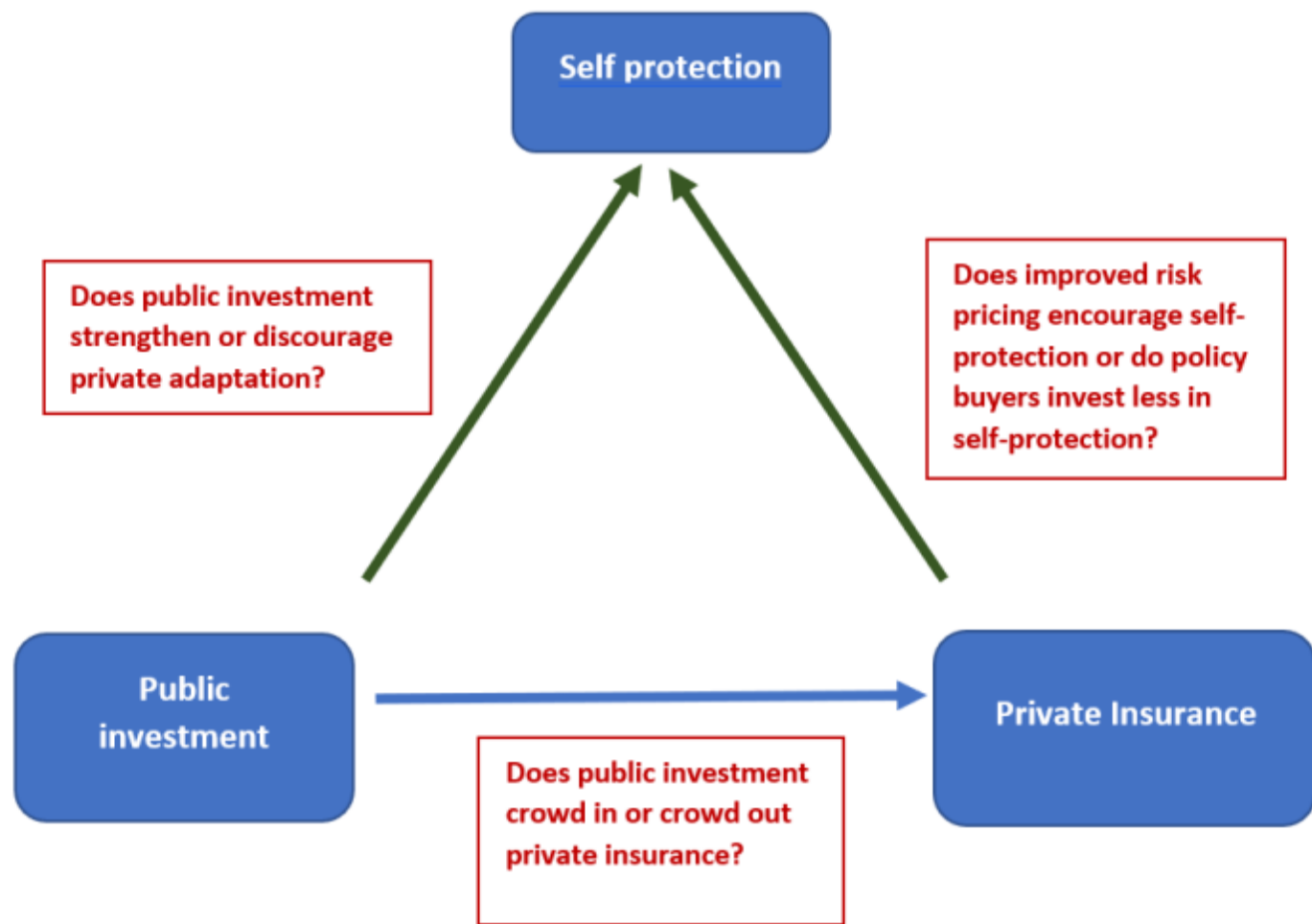
- Hurricane Katrina Again: Vouchers to Leave New Orleans or rebuild the City? (irreversible investment under uncertainty)
- When East and West Germany unified, there was a policy debate on the merits of West German subsidies to East Germany; did these place based subsidies, slow down the transition?
 - Uhlig, Harald. "The slow decline of East Germany." *Journal of Comparative Economics* 36, no. 4 (2008): 517-541.
 - Bryan, Gharad, Shyamal Chowdhury, and Ahmed Mushfiq Mobarak. "Underinvestment in a profitable technology: The case of seasonal migration in Bangladesh." *Econometrica* 82, no. 5 (2014): 1671-1748.

Does Government Investment in Climate Resilience Crowd Out Private Investments in Safety?

- How much capacity do firms and urbanites have to protect themselves from emerging climate risks?
 - In developing countries, what is the proper role for government in enhancing resilience?
 - Ehrlich, Isaac, and Gary S. Becker. "Market insurance, self-insurance, and self-protection." *Journal of political Economy* 80, no. 4 (1972): 623-648.
 - Kousky, Carolyn, Erzo FP Luttmer, and Richard J. Zeckhauser. "Private investment and government protection." *Journal of Risk and uncertainty* 33, no. 1 (2006): 73-100.

My New “City Level” Adaptation Research

- In joint work with Sahil Gandhi, Rajat Kochhar, Somik Lall, and Vaidehi Tandel, we revisit the impacts of climate shocks;
 - Kocornik-Mina, Adriana, Thomas KJ McDermott, Guy Michaels, and Ferdinand Rauch. "Flooded cities." *American Economic Journal: Applied Economics* 12, no. 2 (2020): 35-66.
- Using recent data, we examine lights at night dynamics at the nation/city/year/month level;
 - Do cities in richer nations suffer less and recover faster from extreme weather events?
 - Kahn, Matthew E. "The death toll from natural disasters: the role of income, geography, and institutions." *Review of economics and statistics* 87, no. 2 (2005): 271-284.
 - Is there more or less population growth in cities whose geography and exogenous features place them at less risk from disasters?
 - When governments invest in dams, does this have the unintended consequence of encouraging more people to move to these areas?



Within Cities: Do Climate Shocks Cause Poor Areas to Suffer More and Recover More Slowly?

- For 75 major floods, we explore how different neighborhoods within these cities were affected and their respective flood recovery dynamics;
 - We identify poor and non-poor areas within the city to explore the implications for inequality
 - We are preparing to do new survey research to learn about how do different people cope and whether they are learning over time to become more productive “adapters”?
 - The adaptation hypothesis posits that even slum dwellers are not “passive victims” and are suffering less over time from the same “punch” by Mother Nature.

Conclusion

- Starting with my 2010 book *Climatopolis* and my 2021 book *Adapting to Climate Change*, I have posited an ironic and optimistic adaptation thesis.
- Since climate change is such a **SERIOUS** challenge, self interested households, firms and governments will use their various strategies to build up our collective resilience.
- The COVID crisis has only reaffirmed my optimism here in a Julian Simon ingenuity sense
- Building on Paul Romer's themes, good adaptation ideas are global public goods.
- Successful adaptation means that the Social Cost of Carbon declines over time!

Testing My Core Adaptation Hypothesis Using Data from India

- Somanathan, Eswaran, Rohini Somanathan, Anant Sudarshan, and Meenu Tewari. "The impact of temperature on productivity and labor supply: Evidence from Indian manufacturing." *Journal of Political Economy* 129, no. 6 (2021):
- Burgess, Robin, Olivier Deschenes, Dave Donaldson, and Michael Greenstone. "The unequal effects of weather and climate change: Evidence from mortality in india." *Cambridge, United States: Massachusetts Institute of Technology, Department of Economics. Manuscript* (2014). 1797-1827.