## Climate Finance Online PhD-Level Class

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### **Plan For Today**

- Some observations on today's topic: Climate Finance
- Present a research paper: Hedging Climate Change News

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- Six other presentations, followed by moderated panel
- Questions in Q&A

### **Research in Climate Finance**

- "Climate change is the defining issue of our time and we are at a defining moment" [UN Secretary General]
- As social scientists, we should attempt to speak to the important issues facing society
- Traditionally: Environmental Economics
- More recently: Using the tools of financial economics to think about climate change. Why?
  - Growing realization by financial regulators and market participants that risks from climate change will dramatically affect financial markets.
  - Climate change is an aggregate risk to the economy, and financial economics develops tools to manage risk.

Why Climate Finance?

# MANAGING CLIMATE RISK IN THE U.S. FINANCIAL SYSTEM

Report of the Climate-Related Market Risk Subcommittee, Market Risk Advisory Committee of the U.S. Commodity Futures Trading Commission

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#### Why Climate Finance?

Climate change poses a major risk to the stability of the U.S. financial system and to its ability to sustain the American economy. Climate change is already impacting or is anticipated to impact nearly every facet of the economy, including infrastructure, agriculture, residential and commercial property, as well as human health and labor productivity. Over time, if significant action is not taken to check rising global average temperatures, climate change impacts could impair the productive capacity of the economy and undermine its ability to generate employment, income, and opportunity. Even under optimistic emissionsreduction scenarios, the United States, along with countries around the world, will have to continue to cope with some measure of climate change-related impacts.

This reality poses complex risks for the U.S. financial system. Risks include disorderly price adjustments in various asset classes, with possible spillovers into different parts of the financial system, as well as potential disruption of the proper functioning of financial markets. In addition, the process of combating climate change itself—which demands a large-scale transition to a net-zero emissions economy—will pose risks to the financial system if markets and market participants prove unable to adapt to rapid changes in policy, technology, and consumer preferences. Financial system stress, in turn, may further exacerbate disruptions in economic activity, for example, by limiting the availability of credit or reducing access to certain financial products, such as hedging instruments and insurance.

### Larry Fink (CEO BlackRock) 2020 Annual Letter

Climate change has become a defining factor in companies' long-term prospects. Last September, when millions of people took to the streets to demand action on climate change, many of them emphasized the significant and lasting impact that it will have on economic growth and prosperity – a risk that markets to date have been slower to reflect. **But awareness is** rapidly changing, and I believe we are on the edge of a fundamental reshaping of finance.

Will cities, for example, be able to afford their infrastructure needs as climate risk reshapes the market for municipal bonds? What will happen to the 30-year mortgage – a key building block of finance – if lenders can't estimate the impact of climate risk over such a long timeline, and if there is no viable market for flood or fire insurance in impacted areas? What happens to inflation, and in turn interest rates, if the cost of food climbs from drought and flooding? How can we model economic growth if emerging markets see their productivity decline due to extreme heat and other climate impacts?

### Why Climate Finance?

### Larry Fink (CEO BlackRock) 2020 Annual Letter

Investors are increasingly reckoning with these questions and recognizing that climate risk is investment risk. Indeed, climate change is almost invariably the top issue that clients around the world raise with BlackRock. From Europe to Australia, South America to China, Florida to Oregon, investors are asking how they should modify their portfolios. They are seeking to understand both the physical risks associated with climate change as well as the ways that climate policy will impact prices, costs, and demand across the entire economy.

These questions are driving a profound reassessment of risk and asset values. And because capital markets pull future risk forward, we will see changes in capital allocation more quickly than we see changes to the climate itself. **In the near future – and sooner than most anticipate – there will be a significant reallocation of capital.** 

### **Research in Climate Finance**

- As you can see, climate change is **the** hot topic in the regulatory and financial market community
- As a research field, climate finance is very new, and poised to become more important
  - $\rightarrow$  Many first-order questions are still unanswered
- Great opportunity for current graduate students who have to be forward looking
- Recent review for *Annual Review of Financial Economics* on "Climate Finance" by Giglio, Kelly and Stroebel

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### **Research in Climate Finance**

- **Theory Perspective:** How to include climate risk in macro-finance models?
- What are the sources of uncertainty in the model?
  - Economic activity
  - Path of Climate
  - Interactions between climate and economy
- Important implications for the pricing of climate risk
- Role of ambiguity (uncertainty about the true probability law)
- As computational power increases, integrate more realistic physical models of climate change (e.g., tipping points), and interactions into macro-finance models

### How to value investments in climate change abatement

- Many projects/regulations require cost-benefit analysis
- What are the appropriate discount rates?
- Long-run nature of investments mean discount rates inferred from usual finite-horizon investments are tricky
- Take a stand on both risk free rates and risk premia (preferences)
  - Not the way that many people think about discount rates vs. risks ("opportunity cost approach")
  - Discount rate for investments in climate change abatement depend on the risk-properties of climate disasters

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- Matteo Maggiori and Stefano Giglio presentation
- Important implications for the pricing of climate risk
- Role of ambiguity (uncertainty about the true probability law)

### The Pricing of Climate Risk

- Types of Climate Risk
  - Physical Climate Risk
  - Transition Risk (e.g., regulatory risk, technological risk, legal risk)
  - Can interact: Regulation (realization of regulatory climate risk) reduces probability of physical climate risk
- Assets can have positive/negative exposures to these risks
  - Climate change can have winners and losers; eg.g., Tesla vs. Exxon likely have different exposure to regulatory climate risk

### How to Measure Climate Risk Exposures Across Asset Classes?

- Equities
  - ESG Scores for regulatory risk?
  - Public Filings, earnings calls discussion, etc. (Sautner)
  - Location of production facilities for physical risk
  - Exposure through suppy chains? Customers?
- Real estate and mortgages
  - · Location for physical risk (Giglio, Wallace, Ouazad)
- Fixed income
  - Location for physical risk in municipal and sovereign debt (Goldsmith-Pinkham)
  - Industrial mix for sovereign risk exposure to regulatory mix (oil exporters)

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### How is climate risk priced?

- Using these exposure measures across many asset classes, can now test the extent to which climate risk is priced
  - Do exposed assets have  $\alpha$  relative to models?
  - Do exposed assets move differentially on news about the climate?
- Challenge: Very short time series
  - Financial markets likely only started pricing climate risk recently, so even worse problem than in standard asset pricing

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• Can we use financial markets to hedge this risk (Stroebel presentation)?

Non-exhaustive list of interesting research questions

- Increased disclosure requirements from regulators (or demands from markets). But: What to disclose?
- Effect of investor engagement on firm behavior
- Effect of climate risk on the insurance industry?
- Extent to which climate risk is a systemic financial risk? Who is the residual holder/cliamnt to the climate risk?
- Effects on migration? General equilibrium effects (across regions, across countries?)

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