

“Measuring and Managing Climate Risk” B8028

Class meetings: MONDAYS - Half Term, Fall B Term, 3 hours

Shiva Rajgopal, sr3269@gsb.columbia.edu¹

Course Description and Objectives

The traditional financial reporting model is deficient in two fundamental respects: (i) we set the cost of natural capital used by the business to zero; and (ii) we either under-emphasize or ignore accounting for externalities, both positive and negative, imposed by the business on other stakeholders.

The objective of this class is explore one major aspect of natural capital and its attendant risks—related to climate. The focus is mostly on how companies, both in the U.S. and elsewhere, measure, disclose, govern and hence manage (or sometimes mis-manage) climate risk exposures.

The Paris Agreement of 2015 was meant to mobilize a global response to the threat of climate change, amid growing concerns by scientific experts, as documented in a series of IPCC reports. Since the Paris agreement was signed, hundreds of firms have made net zero emissions promises. Regulators and the investment community has been pushing firms to evaluate their climate risk exposure and the impact thereof on the firm’s business model and value drivers.

Having said that, integrating environmental risks into company and investment analysis is not easy. The data and disclosures underlying measurement of these risks are all over the place. The tools and metrics used in practice, such as carbon footprints to forward looking climate scenario analysis, range from snake oil to highly sophisticated scientific approaches aimed at understanding climate exposure of a firm or an asset management fund’s business.

On the positive end of the spectrum, technological innovation has and will continue to give rise to many investment opportunities. Sustainable finance has exploded to cover low carbon funds, green bonds, sustainability linked debt and other securities designed to capture these opportunities. Many of these investment vehicles need careful scrutiny as financial and legal engineering and associated greenwashing is not uncommon.

¹ I am grateful to Geoff Heal, Bruce Usher and Gernot Wagner for valuable comments on an earlier draft of this syllabus.

We hope to cover these issues and ask a few hard questions related to (i) how do firms and some state owned entities measure and manage climate risks; (ii) how should we consume trillion dollar forecasts of the costs and opportunities associated with climate change; (iii) should we trust a net zero pledge; (iv) how should we assess physical and transition risks for firm exposed to climate change; (v) how should we consume ESG reports and ESG data providers; (vi) will businesses manage to transform themselves enough to adapt to decarbonization challenge; (vii) do low carbon funds help or hurt; (viii) how should we think about climate related KPIs (key performance indicators) in financing and executive compensation contracts; and (ix) how might regulators and financial supervisors measure the impact of finance sector on climate and how might they address such impact.

We will also take some time each week to address any topics that are in the financial press that bear on the subjects and the approach.

Graded Learning

The best way you will internalize the information in the course is by actually digesting the disclosed climate plans of a business and identify and think about the models of climate risk used, measurement and the governance of climate risk.

You can pick ANY company of your choosing on an individual basis. However, feel free to talk with each other or with others to help you maximize your learning.

At the end of the class, the deliverable is a **final project for your chosen company**. The final project asks you to assume the role of an investor and

- Document the climate risks associated with the company,
- Assess the quality of the climate risk data disclosed by the company,
- Are the climate disclosures adequate for an investor or a user to assess the robustness of the company's business plans in response to climate change?
- Is the governance structure of the company (CEO compensation, board structure and response to proxy proposals) adequate to deal with the company's climate impact?
- Does the company invest in positive pro climate lobbying or in defensive lobbying to stall regulation on climate change?
- Has the company taken steps to reduce greenhouse gas emissions (GHG) and whether you believe such steps are credible or impactful?
- Document the ratings assigned to climate risk management by outside raters, and
- Ultimately decide whether or not you find the climate transition plans of the company satisfactory and whether, all else constant, you could invest in the firm, assuming you are investor focused on avoiding stocks or bonds with significant climate risk.

The grades will be based on your engagement in the class, the assignments, weekly quizzes and the final deliverable but we have **no exams**.

What you will get out of this

There is no textbook for what we teach in class. The approach we advocate is quite unique and if I may say so myself, quite ahead of most of the fundamentals' work practiced on the Street. Every student **who puts in effort** should have a fun and stimulating journey.

High quality investment decisions in the real world are grounded in a lot of detail about the sustainability and risks associated with the business model. Following that objective, this is a detail-heavy class that gets deep into financial and non-financial data to assess the climate risk of a business.

Required Text and Readings

1. Weekly handouts/posts on Canvas substitute for a course packet
2. There is no required text. I am in the early stage of planning to write one, hopefully by the end of 2023. Here are a few references you can look at in the meanwhile to get inspired or informed:

The Ministry of the Future: this is cli-fi (climate fiction) novel that anticipates a near future with rampant climate change. The book is a work of fiction but it proposes economic theories, technical solutions, and political changes to address the challenge of climate change. The book is not directly related to the coursework but it might help motivate why the study of climate change is important.

IPCC 2021 report (see <https://www.ipcc.ch/report/ar6/wg1/>): this is a mega document. Consume parts W1 and W3 in smaller bites in whatever order interests you.

Project Drawdown (see <https://drawdown.org/>) rank orders climate solutions most likely to have the greatest impact on addressing climate change.

3. There will also be additional references provided for those students who want to get more background and a deeper understanding of some of the technical aspects of any topic, but this is **not required**.

Grading

You have four sets of deliverables with different grading components as follows:

1. In class 1, I would like you to submit your assessment of whether or not you believe the climate risks and opportunities forecasted by the U.S. Budget Office and McKinsey respectively. This assignment is mandatory and counts for 5% of your final grade.
2. There will be approximately six other written assignments during the semester. All these assignments relate to the understanding how climate risk is measured, managed, governed and rated by an actual company or an institution. These assignments will be done by you using the Type B assignment scheme (see below) and cover 50% of the grade.
3. Five short quizzes, beginning the second class, account for 20% of the grade.
4. The remaining 25% of your grade will be based on your attendance at class in general, and my perception of your preparation and understanding of the class.

Seeking Alpha

Students with outstanding project reports could consider sending their case for shorting or longing a stock to the website "Seeking Alpha" <http://seekingalpha.com/>. I encourage you to shoot for such a publication at the end of the class. Well written and well analyzed articles get thousands of page views in Seeking Alpha and might represent a credible way to get noticed in the analysis world.

Audits

I do not encourage auditing/observing the class. The only way you learn the material is by actually working through the assignments and quizzes.

TA

The TA for the class is Anthony Le, a PhD student in accounting. His email address is ALe25@gsb.columbia.edu.

You can communicate with Anthony via email to discuss the course and assignments. **You should also copy me on all correspondence.**

Office Hours: By appointment.

I will give you as much personal attention as feasible to maximize the benefit from your work. Feel free to find me during the half semester to talk about your project and the difficulties encountered as you work through the questions week after week. As people come in with different expertise, we can (partially) tailor the output to your strengths and expertise. I appreciate constructive feedback during the course to help optimize your learning, but I have to consider the class as a whole, so individual needs are best dealt with by me or Anthony one-on-one.

Relation to the Core:

This course incorporates elements of every core class.

This course adheres to the Columbia Core Culture. Students are expected to be:

Present:

- On time and present for every session
- Attendance tracked

Prepared:

- Complete pre-work needed, expect cold calls
- Bring nameplates and clickers

Participating:

- Constructive participation expected and part of grade

- No electronic devices unless explicitly called for by the instructor (look under “tablets/computers” below)

Code of Conduct: aka our Contract

The value of the course will depend on how much effort you are willing to put in, and on attendance and participation in the lectures and assignments.

You are expected to treat the class as you would your job, i.e., as a business professional, demonstrating mutual respect for each other, and performing as if it is an important business assignment. This means you need to be prepared, be on time, and be attentive during the class.

Grading scheme:

Type	Designation	Discussion of Concepts	Preparation of Submission	Grade
B	Group/Individual	Permitted with anyone	Individually (No sharing of any portion of the submission.)	Individual

B 8028: Preliminary Course Outline			
Date	Class #	Subject matter	Specific Topics
OCT 24	1	<p>Introduction to the problem and the opportunity</p> <p>IDENTIFY THE COMPANY YOU WANT TO WORK ON</p>	<ul style="list-style-type: none"> • Observations of climate change • Climate change before humans • Causes of climate change • Projected future warming • Projected impact of climate change • GDP costs and size of business opportunity • Possible policy responses • What are states and cities doing about climate change • The U.K.'s Natural Capital Committee • <u>Case #1: critique the U.S. government and McKinsey report on costs and benefits of climate change</u>
OCT 31	2	Institutional framework for climate risk measurement	<ul style="list-style-type: none"> • Sustainability and climate risk • The U.N. SDGs at companies and funds • SASB framework and its applications • GHG protocol • Grappling with double counting of emissions • TCFD framework and the SEC's proposed rules • Physical risks, transition risks, stranded asset concerns • <u>Case # 2A on assessing physical risks: real estate- Equity Residential REIT (students whose last names run from A-M works on case 2A)</u> • Indirect risks related to supply chains • Policy risks, legal risks and reputational risks • Application to banks, insurance companies and corporates • <u>Case # 2B on evaluating transition risk: Electric utilities- Duke Energy (students whose last names run from N-Z works on case 2B)</u>
NOV 14 (NO CLASS ON NOV 7 AS PER CBS)	3	Governance of climate risk in companies and funds	<ul style="list-style-type: none"> • International climate policies • Understanding cumulative versus annual emissions • Climate risk and financial supervision

			<ul style="list-style-type: none"> • Central bank consideration of climate risks in bank capital stress tests- Bank of England • Private sector frameworks including Science based Targets Initiative (SBTI), Climate Action 100+, Net Zero Assets Owners Alliance (NZAOA) and its affiliated frameworks, (Net Zero Asset Managers Initiative, Net Zero Banking Alliance, Glasgow Financial Alliance for Net Zero) • <u>Case # 3: Net zero case: Chevron vs BP</u>
NOV 21	4	Green Finance: measurement and accountability challenges	<ul style="list-style-type: none"> • The explosion of climate finance • EU green taxonomy • Climate KPIs in contracts (compensation and loans/debt) • Debt for nature swaps • Climate and ESG integration in investing and the quality of ESG data providers • The noodle soup of ESG raters, ratings and data providers • Critiquing Engine no.1's Total Value Framework • Linking CEO pay to climate (Exxon example) • Auditors' concerns on climate (BP 2021 example) • <u>Case #4 on rating Tesla's ESG practices with an emphasis on "E" (long case)</u>
NOV 28	5	Climate risk measurement, data sources and management	<ul style="list-style-type: none"> • Identifying micro sources of climate risk including operational risk, credit risk, liquidity risk, underwriting risk, market risk and sovereign risk • Identifying macro sources of climate risk including systemic risk and financial stability concerns • Critiquing Climate value at risk (CVAR) • Company and asset level carbon data-how good is it? • Portfolio level climate risk analysis and actions • <u>Case #5 on AP2, the Swedish pension fund's climate risk strategy</u>

			<u>related to divestment and engagement</u>
DEC 5	6	Climate models and scenario analysis	<ul style="list-style-type: none"> • What is scenario analysis, the underlying parameters, assumptions, analytical choices and scenario outputs? • IPCC scenarios • Application to banking, insurance and a look at a couple of vendors' methodologies • Pushback against scenario analyses in proxy resolutions (Exxon 2021) • <u>Case #6 on BHP's scenario analysis</u> • Wrap up
DEC 12			Final project due (no extensions please)

Assignment #	Topic (every student works on every assignment here unless stated otherwise)	Due Date
1	<i>Critique the U.S. government and McKinsey report on costs and benefits of climate change</i>	First day, Oct 24
2A	<i>Case on assessing physical risks: Real estate (last names A-M) - Equity Residential REIT</i>	Oct 31
2B	<i>Case on evaluating transition risk: Electric utilities (last names N-Z) – Duke Energy</i>	Oct 31
3	<i>Net zero case: Chevron vs BP</i>	Nov 14
4	<i>Case on rating Tesla's ESG practices with an emphasis on "E" (long case)</i>	Nov 21
5	<i>Case on AP2, the Swedish pension fund's climate risk strategy related to divestment and engagement</i>	Nov 28
6	<i>Case on BHP's scenario analysis</i>	Dec 5
7	<i>Final project due a week after the last class</i>	Dec 12