
MANDATORY CORPORATE CLIMATE DISCLOSURES: NOW, BUT HOW?

John Armour*
Luca Enriques**
Thom Wetzer***

Mitigating the worst consequences of climate change by transitioning to a net-zero economy requires investment on a large scale. Directly pricing emissions, the first-best solution to drive capital reallocation, is considered politically infeasible—so policymakers put their currency in facilitating the pricing of climate risk by investors. Yet investors, faced with scientific and policy uncertainty around climate risks compounded by a lack of information about companies' exposures, struggle to do just that. This Article shows that current disclosure policies do not require companies to disclose the information that investors need to price climate risk, and voluntary frameworks like the Task Force on Climate-related Financial Disclosures—important as they are—have failed to turn the tide. The result is mispricing and a misallocation of capital, which harms investors and hampers the net-zero transition. Against that context, this Article argues that traditional securities

* University of Oxford and European Corporate Governance Institute.

** University of Oxford, European Banking Institute, and European Corporate Governance Institute.

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regulation rationales and net-zero imperatives call for mandatory corporate climate disclosures. To create a yardstick against which governments' proposals can be evaluated, both to support their efforts and to call out policy greenwashing, this Article outlines several design principles that go beyond the emerging consensus and cover the regulatory architecture that supports such a disclosure regime.

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I. INTRODUCTION

There is overwhelming evidence that the climate is changing,¹ that this change is largely driven by human activity,² and that the changing climate will have enormous and potentially irreversible costs for people and planet.³ On

¹ Richard P. Allan et al., Intergovernmental Panel on Climate Change, *Summary for Policymakers*, in CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS, CONTRIBUTION OF WORKING GROUP I TO THE SIXTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, at SPM-1, SPM-5 (Valérie Masson-Delmotte et al. eds., 2021), https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report_smaller.pdf [<https://perma.cc/NQG3-4R97>] (“It is unequivocal that human influence has warmed the atmosphere, ocean and land. Widespread and rapid changes in the atmosphere, ocean, cryosphere and biosphere have occurred.”).

² *Id.*; see also, Veronika Eyring et al., Intergovernmental Panel on Climate Change, *Human Influence on the Climate System*, in CLIMATE CHANGE 2021: THE PHYSICAL SCIENCE BASIS, CONTRIBUTION OF WORKING GROUP I TO THE SIXTH ASSESSMENT REPORT OF THE INTERGOVERNMENTAL PANEL ON CLIMATE CHANGE, *supra* note 1, at 3–1 to 3–8; Nathan P. Gillett et al., *Constraining Human Contributions to Observed Warming Since the Pre-Industrial Period*, 11 NATURE CLIMATE CHANGE 207, 207–11 (2021).

³ See, e.g., Ove Hoegh-Guldberg et al., Intergovernmental Panel on Climate Change, *Impacts of 1.5°C Global Warming on Natural and Human Systems*, in GLOBAL WARMING OF 1.5°C, AN IPCC SPECIAL REPORT ON THE IMPACTS OF GLOBAL WARMING OF 1.5°C ABOVE PRE-INDUSTRIAL LEVELS AND RELATED GLOBAL GREENHOUSE GAS EMISSION PATHWAYS, IN THE CONTEXT OF STRENGTHENING THE GLOBAL RESPONSE TO THE THREAT OF CLIMATE CHANGE, SUSTAINABLE DEVELOPMENT, AND EFFORTS TO ERADICATE POVERTY 175, 177–181 (Valérie Masson-Delmotte et al. eds., 2018), https://www.ipcc.ch/site/assets/uploads/sites/2/2019/06/SR15_Chapter3_Low_Res.pdf [<https://perma.cc/VV57-XAEV>]; Ana M. Vicedo-Cabrera et al., *The Burden of Heat-Related Mortality Attributable to Recent Human-Induced Climate Change*, 11 NATURE CLIMATE CHANGE 492, 492–500 (2021) (finding that, on average, thirty-seven percent of warm-season heat-related deaths are caused by human-induced climate change); Wim Thiery et al., *Intergenerational Inequities in Exposure to Climate Extremes*, 374 SCI. 158, 158–59 (2021) (predicting that people born in 2020 will experience significantly more extreme warming events than those born in 1960); R. Daniel Bressler, *The Mortality Cost of Carbon*, NATURE COMM’NS, July 29, 2021, at 1, 4 ([“A]dding 4,434 metric tons of carbon dioxide in 2020—equivalent to the average lifetime emissions of 12.8 average world people or

December 12, 2015, 195 governments agreed to limit temperature increases to well below 2, preferably 1.5, degrees centigrade relative to pre-industrial levels in what is known as the Paris Agreement.⁴ Since the magnitude of global warming is roughly proportional to the amount of carbon in the atmosphere, the Paris Agreement in effect created a “carbon budget” that specifies how much carbon can still be emitted without exceeding the specified temperature limits.⁵

Unfortunately, progress on meeting the targets of the Paris Agreement has been uneven at best,⁶ which means that the window to mitigate the worst effects of climate change is closing fast. What is required now is an annual reduction in carbon emissions⁷ by about 1-2 GtCO₂ every year over the next decades.⁸ To give a sense of the scale of this challenge, consider that in 2020, with large parts of the world’s population confined to their homes for much of the year thanks to COVID-related lockdowns, emissions were down by 2.6 GtCO₂.⁹ A change in emissions equivalent to what was forced upon us by the worst pandemic in one hundred years now needs to occur every two years throughout the 2020s and beyond. Clearly, just “doing less” is not going to cut it.

3.5 Americans—causes one excess death globally in expectation between 2020 and 2100.”).

⁴ UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE, ADOPTION OF THE PARIS AGREEMENT (2015).

⁵ See, e.g., Joeri Rogelj et al., Perspective, *Estimating and Tracking the Remaining Carbon Budget for Stringent Climate Targets*, 571 NATURE 335, 335–42 (2019).

⁶ UNITED NATIONS ENV’T PROGRAMME, EMISSIONS GAP REPORT 2020 XIII (2020), <https://www.unep.org/emissions-gap-report-2020> (on file with the Columbia Business Law Review).

⁷ To be precise, we should refer to greenhouse gas emissions more broadly. See *id.* (referring to greenhouse gas emissions). However, it is common to refer to carbon emissions as a synecdoche. Unless wording or context suggest otherwise, references to carbon emitters/emissions and carbon neutrality throughout the paper should be read as comprising greenhouse gas emitters and emissions more generally.

⁸ See, e.g., Corinne Le Quéré et al., Brief Communication, *Fossil CO₂ Emissions in the Post-COVID-19 Era*, 11 NATURE CLIMATE CHANGE 197, 197 (2021).

⁹ *Id.*

Instead, meeting that target will require a fundamental rewiring of the way our economies and societies work. To make that possible, humankind and its main economic organizations, namely companies, must mitigate the degree of climate change by aiming for “net-zero” emissions, that is, to “achiev[e] a state in which [their] value chain results in no net accumulation of carbon dioxide in the atmosphere and in no net impact from other greenhouse gas emissions.”¹⁰ Reaching net-zero targets will, in turn, involve a reallocation of capital—e.g., from fossil fuel extraction, transformation, and distribution to alternative energy sources and electrification of almost all areas of the economy—on a scale that is unparalleled in modern history.¹¹ In market economies, capital allocation is driven by pricing mechanisms, which activate market forces that stimulate innovation. Pricing mechanisms, however, cannot work when market players are not required to pay for the consequences of their actions. In economic terms, that is, their actions engender negative externalities.¹² Because prices ignore such third-party effects (they are, by definition, *external* to the price-setting process), too much capital will flow into the activities that cause them.¹³

¹⁰ ALBERTO CARRILLO PINEDA, ANDRES CHANG & PEDRO FARIA, CDP, FOUNDATIONS FOR SCIENCE-BASED NET-ZERO TARGET SETTING IN THE CORPORATE SECTOR 18 (2020), <https://sciencebasedtargets.org/resources/files/foundations-for-net-zero-full-paper.pdf> [<https://perma.cc/PLG4-BH4G>]. See generally, Sam Fankhauser et al., *The Meaning of Net Zero and How to Get it Right*, NATURE CLIMATE CHANGE (2021).

¹¹ For example, transitioning the energy system would require investments of \$3.5 trillion a year on average until 2050, which is around twice current levels of investments. See INT’L ENERGY AGENCY & INT’L RENEWABLE ENERGY AGENCY, PERSPECTIVES FOR THE ENERGY TRANSITION: INVESTMENT NEEDS FOR A LOW-CARBON ENERGY SYSTEM 51 (2017), https://www.irena.org/-/media/Files/IRENA/Agency/Publication/2017/Mar/Perspectives_for_the_Energy_Transition_2017.pdf [<https://perma.cc/NZ9B-JMBP>].

¹² Thomas Helbling, *Externalities: Prices Do Not Capture All Costs*, INT’L MONETARY FUND (last updated Feb. 24, 2020), <https://www.imf.org/external/pubs/ft/fandd/basics/external.htm> (on file with the Columbia Business Law Review).

¹³ See *id.*

That is, high-emission projects will attract more capital than is socially optimal.¹⁴ A foundational question is therefore how the pricing mechanism can be made to work so that the social costs of carbon emissions are actually reflected in prices.

Economists widely agree that taxes on carbon emissions matched to their costs to society or carbon emissions trading schemes would be an effective way to enlist market forces in this capital reallocation.¹⁵ With such policy tools in place, the costs of carbon emissions would be priced into firms' activities and investment decisions.¹⁶ A fundamental problem for society is that the costs of climate change have different footprints—across individuals, across generations, across firms, and across nations. Environmental economists have long argued that these doom international action on climate change mitigation to failure because of free-rider problems.¹⁷ This dismal result is borne out in political inaction: Carbon pricing, for instance, has to date only been applied sporadically and with a “price” often set far too low compared

¹⁴ See *id.*; see also Zohar Goshen & Gideon Parchomovsky, *The Essential Role of Securities Regulation*, 55 DUKE L.J. 711, 720 (2006) (“Accurate pricing is essential for achieving efficient allocation of resources in the economy.” (footnote omitted)).

¹⁵ See, e.g., Harrison Hong, Frank Weikai Li & Jiangmin Xu, *Climate Risks and Market Efficiency* 208 J. ECONOMETRICS 265, 265–81 (2019); see also Heather Long, *This Is Not Controversial! Bipartisan Group of Economists Calls for Carbon Tax*, WASH. POST (Jan. 16, 2019), <https://www.washingtonpost.com/business/2019/01/17/this-is-not-controversial-bipartisan-group-economists-calls-carbon-tax/> [<https://perma.cc/H3XB-DNHU>]. In other words, the Coase Theorem is not applicable to climate change. See Inho Choi, *Global Climate Change and the Use of Economic Approaches*, 45 NAT. RES. J. 865, 883 (2005) (“There is no doubt the Coase Theorem has limits when applied to the field of environmental law.”).

¹⁶ See *What Is Carbon Pricing?*, WORLD BANK, <https://carbonpricingdashboard.worldbank.org/what-carbon-pricing> [<https://perma.cc/Z8U7-X3EX>] (last visited Dec. 18, 2021).

¹⁷ See, e.g., Carlo Carraro & Domenico Siniscalco, *The International Dimension of Environmental Policy*, 36 EUR. ECON. REV. 379, 384–85 (1992); Scott Barrett, *Self-Enforcing International Environmental Agreements*, OXFORD ECON. PAPERS 878, 886–88, 887 tbls. 5–6 (1994); Scott Barrett, *Climate Treaties and “Breakthrough” Technologies*, AM. ECON. REV., May 2006, at 22, 22–25.

to the social cost of emissions.¹⁸ The average carbon price is currently \$3 per ton of CO₂, while studies suggest a price of between at least \$40-80 per ton (when combined appropriately with other policies) is required.¹⁹ Indeed, the political economy of carbon taxes is now so deeply quagmired that lobbyists for U.S. oil giant ExxonMobil, as they were themselves caught boasting, are backing the idea as a public relations ploy intended to stall other measures that have a better chance of being enacted.²⁰

A second-best, but now widely endorsed, strategy is to encourage bottom-up engagement by firms and investors.²¹ The incentives for such engagement vary, depending on what type of action might be involved. Most obviously, *adaptation* to climate change involves adjusting activities so as to minimize the costs associated with the expected level of global warming.²² Firms will internalize the benefits of investments they make in adaptation to climate change, because these investments will reduce the costs of climate change at the firm level.²³ However, investment in adaptation will not affect firms' stock prices unless investors appreciate and price the risks and opportunities associated with climate change for

¹⁸ See, e.g., David Klenert et al., Perspective, *Making Carbon Pricing Work for Citizens*, 8 NATURE CLIMATE CHANGE 669, 669, 675 (2018).

¹⁹ *Id.* at 669; Vitor Gaspar & Ian Parry, *A Proposal To Scale Up Global Carbon Pricing*, IMF BLOG (June 18, 2021), <https://blogs.imf.org/2021/06/18/a-proposal-to-scale-up-global-carbon-pricing/> (on file with the Columbia Business Law Review).

²⁰ See Chris McGreal, *ExxonMobil Lobbyists Filmed Saying Oil Giant's Support for Carbon Tax a PR Ploy*, GUARDIAN (June 30, 2021, 3:00 PM), <https://www.theguardian.com/us-news/2021/jun/30/exxonmobil-lobbyists-oil-giant-carbon-tax-pr-ploy> [<https://perma.cc/QQF2-3ZUK>].

²¹ See Maria L. Banda, *The Bottom-Up Alternative: The Mitigation Potential of Private Climate Governance After the Paris Agreement*, 42 HARV. ENV'T L. REV. 325, 340 (2018) ("Where public authorities have been unable, unwilling, or too slow to act, private actors have at times filled the regulatory gap[.]"). In fact, the Paris Agreement takes a bottom-up approach. *Id.* at 327.

²² See FRANCES G. SUSSMAN & J. RANDALL FREED, ADAPTING TO CLIMATE CHANGE: A BUSINESS APPROACH 4 (2008).

²³ *Id.* at 7-10.

particular firms.²⁴ Yet, to do so investors need information about companies' climate risk exposures that they currently lack.²⁵ The result is mispricing²⁶ and a resulting misallocation of capital,²⁷ which harms investors and hampers the transition to a net-zero economy.

The Paris Agreement and net-zero targets are primarily concerned with *mitigation* of climate change—that is, lowering carbon emissions to reduce the extent of global warming. Here, the firm-level incentives are less obvious. This is because the distribution of emissions at the firm level is highly skewed: A small number of firms are disproportionately responsible for a large share of overall emissions.²⁸ For these firms, the emissions are externalities that do not affect their profits unless and until carbon taxes are introduced—which, as we have discussed, currently seems unlikely. More disclosures may, however, channel engagement from investors who have an interest—financial or otherwise—in controlling these externalities. These could

²⁴ See, e.g., Mark Carney, Governor, Bank of Eng., Chairman, Fin. Stability Bd., Address at Lloyd's of London: Breaking the Tragedy of the Horizon – Climate Change and Financial Stability 12–13 (Sept. 29, 2015), <https://www.bankofengland.co.uk/-/media/boe/files/speech/2015/breaking-the-tragedy-of-the-horizon-climate-change-and-financial-stability.pdf> [<https://perma.cc/7TEQ-LZAX>].

²⁵ See, e.g., Madison Condon, *Market Myopia's Climate Bubble*, UTAH L. REV. (forthcoming 2021) (manuscript at 1), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3782675 (on file with the Columbia Business Law Review).

²⁶ E.g., *id.*; Zacharias Sautner et al., *Pricing Climate Change Exposure* 31 (TRR 266 Accounting for Transparency Working Paper Series, Working Paper No. 49, 2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3792366 (on file with the Columbia Business Law Review); Emirhan Ilhan, Zacharias Sautner & Grigory Vilkov, *Carbon Tail Risk*, 34 REV. FIN. STUD. 1540, 1541 (2021).

²⁷ See, e.g., J.-F. Mercure et al., Letters, *Macroeconomic Impact of Stranded Fossil Fuel Assets*, 8 NATURE CLIMATE CHANGE, 588, 588–93 (2018).

²⁸ See Douglas Starr, *Just 90 Companies Are to Blame for Most Climate Change, This 'Carbon Accountant' Says*, SCI. (Aug. 25, 2016), <https://www.science.org/news/2016/08/just-90-companies-are-blame-most-climate-change-carbon-accountant-says> [<https://perma.cc/C3M5-DXWW>].

include index funds, which stand to suffer financially from the externalities,²⁹ and environmental, social, and corporate governance (ESG) funds, whose end-investors may be willing to trade off some level of financial returns against progress in emissions reduction.³⁰

Climate risk pricing is still in its infancy and is rapidly evolving. This makes it difficult to define what types of information would need to be available for effective pricing by investors, and through what channels. We do not yet fully understand the nature of climate risks or how to quantify them in financial terms. This makes it hard to specify with any certainty the scope of information relevant to assessing these risks. And for information we can agree to be within-scope, there is a further question: how best to produce it. To be sure, much information can be disseminated without any action by companies.³¹ But the decision-relevant information set would be highly incomplete without private corporate information, which few firms share voluntarily. This calls attention to the importance of mandatory corporate climate disclosures.

The widely accepted rationales for mandating corporate disclosures in securities markets are two-fold. First, issuers and their agents, left to their own devices, lack incentives to disclose enough information: disclosure of more firm-specific information confers positive externalities on market participants, who are thus able to price all firms' idiosyncratic

²⁹ Madison Condon, *Externalities and the Common Owner*, 95 WASH. L. REV. 1, 10–18 (2020); Jeffrey N. Gordon, *Systemic Stewardship* 2–3 (Eur. Corp. Governance Inst., Law Working Paper No. 566, 2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3782814 (on file with the Columbia Business Law Review).

³⁰ Michal Barzuza, Quinn Curtis & David H. Webber, *Shareholder Value(s): Index Fund ESG Activism and the New Millennial Corporate Governance*, 93 S. CALIF. L. REV. 1243, 1291–92, 1294–95 (2020).

³¹ Climate-relevant data gathered by satellites, for example, could be used to estimate changes to flood risk as a result of climate change in specific regions. See Lara Hawchar et al., *A GIS-Based Framework for High-Level Climate Change Risk Assessment of Critical Infrastructure*, CLIMATE RISK MGMT., May 2020, at 1–2.

risk more accurately.³² In addition, issuers fear that competitors will use their disclosures to erode their competitive advantage.³³ Second, managers fear losing the rents made possible by information asymmetries.³⁴ Hence disclosure mandates compel issuers to disclose extensive information.

These rationales apply to corporate climate disclosures as well: individual issuers' disclosures on their climate risks help investors understand climate risks at other issuers, while managers may prefer not to disclose if markets are underpricing climate risks. The positive externalities stemming from climate-related disclosures are particularly relevant when it comes to transition risk, or the risk associated with adapting, or failing to adapt, a firm's strategy to government policies, changes in customer behavior, and technological advances, that make up the advancement (or lack thereof) towards a net-zero economy.³⁵ Impacts of the net-zero transition on a firm's business model are a function not just of idiosyncratic (or firm-level) factors, but also of the aggregate behavior of other actors, including other issuers.³⁶ Thus, the extent to which a firm needs to adjust its business model to accommodate the net-zero transition—and the associated risk from failure to do so—is a function of the extent to which, and how, governments, consumers, and other firms themselves transition. In sum, firm-specific transition risks depend on each firm's interplay with each other and with aggregate dynamics, which makes firm-level disclosures on these aspects more salient from a macro perspective.

³² See Merritt B. Fox et al., *Law, Share Price Accuracy, and Economic Performance: The New Evidence*, 102 MICH. L. REV. 331, 381 (2003).

³³ See *infra* 135–139 and accompanying text.

³⁴ See MADISON CONDON ET AL., MANDATING DISCLOSURE OF CLIMATE-RELATED FINANCIAL RISK 24 (2021), http://blogs.edf.org/climate411/files/2021/02/Mandating_Climate_Risk_Financial_Disclosures.pdf [<https://perma.cc/5QQX-3ZZA>]. See generally Paul G. Mahoney, *Mandatory Disclosure as a Solution to Agency Problems*, 62 U. CHI. L. REV. 1047 (1995).

³⁵ See *infra* notes 49–57 and accompanying text.

³⁶ See *id.*

This Article refrains from sketching out the contours of a comprehensive corporate climate disclosure framework or from providing recommendations for any particular jurisdiction. Instead, it characterizes the challenges associated with climate-related disclosures as critically informed by ongoing learning dynamics, articulates the rationales for making climate disclosures mandatory, and provides a blueprint for the design of climate-related disclosure regimes and the regulatory architecture that supports them.

Our focus is on *corporate* climate disclosures, that is, climate-related information that is provided directly by companies. Such information is useful on the theory that it is essential for markets to perform their price discovery function.³⁷ If climate-related information is reflected in share prices, markets themselves play a role in the (re-)allocation of capital that is required to finance the net-zero transition.³⁸ In addition to such corporate climate disclosures, regulators around the world—with the European Union leading the charge³⁹—are championing climate-related disclosures by financial intermediaries and third parties designed to mobilize the financing of sustainable investments as part of a broader sustainable finance agenda. The latter set of policies is more diverse in scope and can include environmental impact disclosures and “green label”⁴⁰ classifications of sustainable investments. While there are clear interrelations

³⁷ *Id.* at 27.

³⁸ See Tobias Tröger & Sebastian Steuer, *The Role of Disclosure in Green Finance* 14 (Eur. Corp. Governance Inst., Law Working Paper No. 604, 2021), https://ecgi.global/sites/default/files/working_papers/documents/trogersteuerfinal.pdf [<https://perma.cc/N39N-8FFM>] (“[G]reen’ labels that certify favorable climate impact properties of investment opportunities may add value in inducing a ‘green’ (re-)allocation of capital.”).

³⁹ See Council Regulation 2019/2088 of Nov. 17, 2019, Sustainability-Related Disclosures in the Financial Services Sector, 2019 O.J. (L 317) 2; Council Regulation 2020/852 of June 18, 2020, Establishment of a Framework To Facilitate Sustainable Investment, and Amending Regulation (EU) 2019/2088, 2020 O.J. (L 198) 13, 15.

⁴⁰ Tröger & Steuer, *supra* note 38.

between corporate climate disclosures and other climate disclosures—for example, corporate climate disclosures might help ground sustainable finance in sound risk-management practices—we leave disclosure policies instrumental to the promotion of sustainable investment for discussion elsewhere.

This Article proceeds as follows. Part II provides a primer on climate risks, outlining how they impact firms, investors, and other stakeholders. After surveying policy measures in the United States and Europe and describing some of the voluntary initiatives that have pushed the frontier of corporate climate disclosure practices in recent years, Part III outlines the rationales for making climate disclosures mandatory. Part IV discusses the core challenges policymakers face in designing a mandatory climate disclosure framework. Part V concludes.

II. CLIMATE RISKS AND THEIR RELEVANCE FOR THE PRICE DISCOVERY PROCESS

This Part provides a primer on climate risks, outlines the challenges of identifying and assessing them, and emphasizes how the correct pricing of climate risks is not only essential to efficient capital allocation but also to facilitate the transition to a net-zero economy and to lower the risks to financial stability.

A. Climate Risks and What We (Do Not) Know About Them

Emerging consensus distinguishes between two major categories of climate risks for firms: “physical risks” and “transition risks.”⁴¹

“Physical risks” are the risk of damage to assets or operations due to extreme and acute weather events such as droughts, bushfires, floods, and hurricanes, as well as longer-

⁴¹ See, e.g., TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, RECOMMENDATIONS OF THE TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES 5–6 (2017), <https://assets.bbhub.io/company/sites/60/2020/10/FINAL-2017-TCFD-Report-11052018.pdf> [<https://perma.cc/2W4N-J6DK>].

term climatic changes, such as rising sea levels.⁴² In early 2021 alone, examples of such extreme weather events that climate change likely affected include deadly flooding along the river Meuse in Western Europe⁴³ and extreme heat (with record temperatures) in Western North America.⁴⁴ Similarly, increasingly prolonged dry seasons and more intense evaporation have been significantly lowering water levels in Panama's Lake Gatun, a key part of the Panama Canal, threatening its status as a reliable corridor in international supply chains.⁴⁵ More dramatic estimates suggest that large parts of the world might, if climate change persists, become unsuitable for human habitation, potentially inviting large-scale migration.⁴⁶ Already, the scale of damage wrought by catastrophic weather events intensified by climate change is exceeding projections of future changes.⁴⁷ The effects of temperature change are already estimated to be affecting economic activity quite profoundly in many parts of the world.⁴⁸ Indirect costs that companies incur when adapting to

⁴² *Id.* at 6.

⁴³ See *Heavy Rainfall Which Led to Severe Flooding in Western Europe Made More Likely by Climate Change*, WORLD WEATHER ATTRIBUTION (Aug. 23, 2021), <https://www.worldweatherattribution.org/heavy-rainfall-which-led-to-severe-flooding-in-western-europe-made-more-likely-by-climate-change/> [<https://perma.cc/4VWM-JD6P>].

⁴⁴ *Western North American Extreme Heat Virtually Impossible Without Human-Caused Climate Change*, WORLD WEATHER ATTRIBUTION (July 7, 2021), <https://www.worldweatherattribution.org/western-north-american-extreme-heat-virtually-impossible-without-human-caused-climate-change/> [<https://perma.cc/RC2S-5B9W>].

⁴⁵ *Beyond Seasonable Drought: Climate Change Threatens the Panama Canal*, ECONOMIST, Sept. 21, 2019, at 53, <https://www.economist.com/the-americas/2019/09/21/climate-change-threatens-the-panama-canal> [<https://perma.cc/NTJ6-YPKG>].

⁴⁶ *E.g.*, Chi Xu et al., *Future of the Human Climate Niche*, 117 PROC. NAT'L ACAD. SCI. U.S. 11,350, 11,350 (2020), <https://www.pnas.org/content/117/21/11350> [<https://perma.cc/KCE4-96MS>].

⁴⁷ See David J. Frame et al., *The Economic Costs of Hurricane Harvey Attributable to Climate Change*, 160 CLIMATIC CHANGE 271, 278 (2020).

⁴⁸ See Marshall Burke, Solomon M. Hsiang & Edward Miguel, Letter, *Global Non-linear Effect of Temperature on Economic Production*, 527 NATURE 235, 236–37 (2015).

these circumstances, like heightened insurance premia or cost of capital, are similarly a materialization of physical risks.⁴⁹

“Transition risks” arise from society’s response to climate change⁵⁰ and encompass several subcategories, including policy risks (e.g., those stemming from the “potential introduction of stringent carbon-pricing policies that can affect the returns of assets related with carbon-intensive technologies or processes”⁵¹), technological risks (e.g., those arising from changes in the costs of clean energy technologies⁵²), market risks (e.g., related to increasing demand for sustainable products), liability risks (such as the risk of damages awards in connection with climate-related litigation,⁵³ or of having to change business model in line with a court ruling mandating emission cuts⁵⁴), and reputational risks⁵⁵ (e.g., the risk of being perceived by customers as doing less than competitors to tackle climate change). In short, the

⁴⁹ CONDON ET AL., *supra* note 34, at 3.

⁵⁰ TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, *supra* note 41, at 5.

⁵¹ Christos Karydas & Anastasios Xepapadeas, *Pricing Climate Change Risks: CAPM with Rare Disasters and Stochastic Probabilities* 1 (Ctr. of Econ. Rsch. at ETH Zurich, Working Paper No. 19/311, 2019), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3324499 (on file with the Columbia Business Law Review) (footnote omitted).

⁵² Rupert Way, Penny Mealy & J. Doyne Farmer, *Estimating the Costs of Energy Transition Scenarios Using Probabilistic Forecasting Methods* 10–12 (Inst. for New Econ. Thinking at Oxford Martin School, Working Paper No. 2021-01, 2020), https://www.inet.ox.ac.uk/files/energy_transition_cost_INET_working_paper_with_SI1.pdf [<https://perma.cc/V8XL-GXVW>].

⁵³ See, e.g., JOANA SETZER & CATHERINE HIGHAM, GLOBAL TRENDS IN CLIMATE CHANGE LITIGATION: 2021 SNAPSHOT 5–7 (2021), https://www.lse.ac.uk/granthaminstitute/wp-content/uploads/2021/07/Global-trends-in-climate-change-litigation_2021-snapshot.pdf [<https://perma.cc/4CVX-FP3M>] (providing an overview of global trends on climate litigation).

⁵⁴ On May 26, 2021, the Hague District Court ordered Royal Dutch Shell to cut its greenhouse gas emissions by forty-five percent by 2030 relative to 2019, across all activities. See Rb. Den Haag 26 mei 2021, NJ 2021, C/09/571932 m.nt. (Milieudefensie et al./ Royal Dutch Shell plc.) (Neth.).

⁵⁵ CONDON ET AL., *supra* note 34, at 6.

net-zero transition stipulated by the Paris Agreement is bound to create winners and losers. Companies' actions, and their relationship to the actions taken by others, will determine how each of them will fare. For instance, the combustion of fossil fuel reserves currently on the books of companies would emit more carbon into the atmosphere than transition pathways consistent with the Paris Agreement envisage⁵⁶ and there is a surplus of assets (e.g., refineries, power plants) that use them.⁵⁷ As progress is made in the direction of a net-zero economy, these assets are likely to become stranded.⁵⁸

Although investors and regulators acknowledge the salience of climate risks,⁵⁹ quantifying their financial impacts is complicated. In large part, this has to do with several distinctive features of climate risks, which also have a bearing

⁵⁶ See, e.g., Dan Welsby et al., *Unextractable Fossil Fuels in a 1.5 °C World*, 597 NATURE 230, 230–34 (2021); Cameron Hepburn et al., *Resilient and Inclusive Prosperity Within Planetary Boundaries*, CHINA & WORLD ECON., Sept–Oct. 2014, at 76, 81.

⁵⁷ See Alexander Pfeiffer et al., *The '2°C Capital Stock' for Electricity Generation: Committed Cumulative Carbon Emissions from the Electricity Generation Sector and the Transition to a Green Economy*, 179 APPLIED ENERGY 1395, 1395–96 (2016).

⁵⁸ See, e.g., Ben Caldecott, Editorial, *Introduction to Special Issue: Stranded Assets and the Environment*, 7 J. SUSTAINABLE FIN. & INV. (SPECIAL ISSUE) 1, 3 (2017); Mercure et al., *supra* note 27, at 591–92; Lucas Kruitwagen et al., *Asset-Level Transition Risk in the Global Coal, Oil, and Gas Supply Chains* 4 (Feb. 10, 2021) (unpublished manuscript), <https://ssrn.com/abstract=3783412> (on file with the Columbia Business Law Review).

⁵⁹ See, e.g., Tchrs. Ins. & Annuity Assoc. of Am., *Comment Letter on Public Input Welcomed on Climate Change Disclosures* (June 11, 2021), <https://www.sec.gov/comments/climate-disclosure/c112-8907502-244231.pdf> [<https://perma.cc/MP5L-QUKK>] (“[W]e believe that climate risk is inherently material and related to a company’s financial health[.]”); Allison Herren Lee, *Statement: Public Input Welcomed on Climate Change Disclosures*, U.S. SEC & EXCH. COMM’N (Mar. 15, 2021) <https://www.sec.gov/news/public-statement/lee-climate-change-disclosures> [<https://perma.cc/ES5V-BL97>].

on why and how firms' exposure to them should be disclosed.⁶⁰ Four such features stand out.

First, climate risks will play out over long time horizons, exceeding those used in traditional business and investment planning.⁶¹ While action to tackle climate change is needed now, its' disastrous effects will materialize over decades and centuries. Combined with the uncertainty of outcomes, both in terms of the magnitude (which depends on future emissions) and the location of impacts,⁶² distance in time makes any attempt to incorporate the full extent of climate risks into stock prices extremely difficult.

Second, climate risks are exceedingly difficult to model. They are characterized by significant feedback and threshold effects, non-linearities, fat-tailed distributions of outcomes, and non-equilibrium (often chaotic) dynamics.⁶³ Particularly in a context of transition, both climate and social systems may exhibit tipping points that can lead to large, long-term, abrupt and possibly irreversible changes.⁶⁴ The transition pathway, in particular, is a function of itself—there are bound to be strong economic feedback effects driven, for example, by economic complementarities or learning effects. To illustrate, while fossil fuel prices have remained roughly constant in real terms for more than a century, the cost of renewable energy has become substantially cheaper as the technology matures, with the real costs of photovoltaic energy declining more than a thousand-fold since its introduction in 1958.⁶⁵ Accurately

⁶⁰ See TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, GUIDANCE ON RISK MANAGEMENT INTEGRATION AND DISCLOSURE 5 (2020), https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Guidance-Risk-Management-Integration-and-Disclosure.pdf [<https://perma.cc/5MZX-BJR3>].

⁶¹ See, e.g., Carney, *supra* note 24, at 4.

⁶² See, e.g., Tanya Fiedler et al., Perspective, *Business Risk and the Emergence of Climate Analytics*, 11 NATURE CLIMATE CHANGE 87, 90 (2021).

⁶³ Hepburn et al., *supra* note 56, at 84–85.

⁶⁴ See, e.g., Timothy M. Lenton et al., *Tipping Elements in the Earth's Climate System*, 105 PROC. NAT'L ACAD. SCI. 1786, 1786 (2008); J. Doyne Farmer et al., *Sensitive Intervention Points in the Post-Carbon Transition*, 364 SCI. 132, 132 (2019).

⁶⁵ See, e.g., Way et al., *supra* note 52, at 3.

modeling these dynamics is a major challenge and not one for which traditional micro- and macroeconomic tools (rational expectations, market equilibrium, and representative agents) are well-equipped.⁶⁶ To compound matters, the number of known unknowns characterizing the transition is daunting: to name but a few, transition policies, adaptation strategies, development of critical technologies, changing markets, changing consumer preferences make patterns of transition extremely hard to anticipate.

Third, climate risks are interconnected across physical space, socio-economic networks and financial systems, with complex relationships between and within all of them.⁶⁷ Intuitively, the more effectively we manage the transition to net-zero emissions, the less likely it is that the climate will change further. While that would likely imply higher transition risks and correspondingly lower physical risks, any intermediate outcome during the transition process is likely to imply not only the materialization of both risks but also hard-to-predict ways in which one type of risk will affect the other. Making matters worse, the climate risks facing different economies, geographies, sectors, and firms vary, meaning that each of these actors will likely be affected differently. These qualities aggravate the already daunting modeling challenges, because they can only be handled with an integrated modeling approach across systems and scales that, so far, has not been developed.⁶⁸

Fourth, the phenomena underlying climate risks are novel. Many of their effects are without precedent—historical data is not necessarily a useful predictor for future probabilities.⁶⁹

⁶⁶ See, e.g., J. Doyne Farmer et al., *A Third Wave in the Economics of Climate Change*, 62 ENV'T RES. ECON. 329, 334, 336–37 (2015).

⁶⁷ TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, *supra* note 60, at 5 tbl.C1 (“Such interconnected risks are often characterized by knock-on effects and systemic effects, requiring a multidimensional perspective to assess the short-, medium-, and long-term implications for a company.”); see also Kruitwagen et al., *supra* note 58, at 2.

⁶⁸ See, e.g., Farmer et al., *supra* note 52, at 334, 336–37.

⁶⁹ See, e.g., Carney, *supra* note 24, at 8 (“[P]ast is not prologue and . . . the catastrophic norms of the future can be seen in the tail risks of today.”).

In short, uncertainty in the sense first described by Frank Knight (whereby it is not possible to assign a probability to a future state)⁷⁰ is a core characteristic of climate change and the net-zero transition. This makes reliance on probabilistic modeling methods problematic,⁷¹ complicating efforts to put a price on climate risks.⁷² Ultimately, although climate risks are economically significant, there is scientific uncertainty compounded by economic and policy uncertainty about when, how, and to what degree climate change will affect individual firms, not to mention the world and our economies. And while our understanding of these issues is rapidly advancing, our sense of the desired information set to evaluate corporate climate risks will remain as dynamic as the risks themselves.

That does not mean climate risks are currently impossible to assess and should be assumed away when pricing securities. While markets may fail to correctly price any sufficiently new and impactful phenomenon, (more) information about it is no less relevant. On the contrary, greater levels of disclosure will both be valuable in their own right and, perhaps as importantly, increase the speed of the learning process. Having richer and more comprehensive information on climate risks can only improve our understanding of such risks' economic implications and narrow uncertainties about the magnitude of these risks.

B. Do Markets Price Climate Risks?

Given these characteristics of climate risks (long time horizon, novelty, complexity, non-linearity and dynamic nature), it is unsurprising that markets struggle to price them correctly. The Network for Greening the Financial System, a coalition of Central Banks and Supervisors, published a report

⁷⁰ FRANK H. KNIGHT, RISK, UNCERTAINTY AND PROFIT 225 (1921).

⁷¹ See, e.g., Cameron Hepburn & J. Doyme Farmer, *Less Precision, More Truth: Uncertainty in Climate Economics and Macroeconomic Policy*, in HANDBOOK ON THE ECONOMICS OF CLIMATE CHANGE 420, 435 (Graciela Chichilnisky & Armon Rezai eds., 2020).

⁷² See, e.g., Ilhan et al., *supra* note 26, at 1540 (noting that the financial impact of future climate regulation is difficult to quantify).

in 2019 noting that there is “a strong risk that climate-related financial risks are not fully reflected in asset valuations.”⁷³ Isabel Schnabel, an Executive Board Member of the European Central Bank, similarly emphasized that there is “broad agreement that climate risks continue to be mispriced in financial markets.”⁷⁴ Leaders of the largest financial institutions, like BlackRock’s Larry Fink,⁷⁵ agree. Investors have voiced concerns about the lack of climate data they can access and financial intermediaries have started improving their climate risk data and models.⁷⁶ Empirical analyses, too, have found repeatedly that financial markets do not accurately price climate risks.⁷⁷ It is worth pointing out that

⁷³ CENT. BANKS & SUPERVISORS NETWORK FOR GREENING THE FIN. SYS., A CALL FOR ACTION: CLIMATE CHANGE AS A SOURCE OF FINANCIAL RISK 2 (2019), https://www.ngfs.net/sites/default/files/medias/documents/synthese_ngfs-2019_-_17042019_0.pdf [<https://perma.cc/Q5CH-PHUZ>].

⁷⁴ Isabel Schnabel, Member of Exec. Bd., Eur. Cent. Bank., Speech at the European Sustainable Finance Summit: When Markets Fail—The Need for Collective Action in Tackling Climate Change (Sept. 28, 2020), https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200928_1~268b0b672f.en.html [<https://perma.cc/EPL4-RKH5>].

⁷⁵ See, e.g., Letter from Larry Fink, Chairman & Chief Exec. Officer, BlackRock, to CEOs (Jan. 26, 2021), <https://www.blackrock.com/corporate/investor-relations/larry-fink-ceo-letter> [<https://perma.cc/UN6E-LQPG>].

⁷⁶ See, e.g., Billy Nauman & Anna Gross, *Credit Rating Agencies Focus on Rising Green Risks*, FIN. TIMES (Nov. 26, 2019), <https://www.ft.com/content/45d721ee-1036-11ea-a7e6-62bf4f9e548a> (on file with the Columbia Business Law Review).

⁷⁷ See Condon, *supra* note 25, at 12–13 (describing various empirical analyses); see also Sautner et al., *supra* note 26, at 1 (“[A]dditional evidence is needed to more fully understand how climate-related risks and opportunities affect stock returns and risks.”); Ilhan et al., *supra* note 26 (“[U]ncertainty makes it difficult for investors to quantify the impact that future climate regulation will have on firms in terms of large drops in stock prices or general increases in volatility.”). However, some degree of pricing of carbon emissions does appear already to take place. See Patrick Bolton & Marcin Kacperczyk, *Do Investors Care About Carbon Risk?*, 142 J. FIN. ECON. 517, 548 (2021) (reporting that stocks of firms with higher carbon emissions earn higher returns, not explicable by other known return predictors).

evidence of mispricing goes both ways, with some pockets of the market underestimating climate risks⁷⁸ and others overestimating it.⁷⁹ This may be because of the uncertainties that impede the quantification of climate risks.⁸⁰ But uncertainty is not the whole story; even climate risks that are known or could be known appear not fully to be priced. In a recent article, Madison Condon forcefully argues that a lack of asset-level data and appropriate modeling techniques are part of the problem.⁸¹

C. The Functions of Corporate Climate Disclosures

Mispricing harms investors and leads to misallocation of capital.⁸² That, in turn, affects the net-zero transition—the full pricing of both climate change effects and the timing and outcomes of the transition to carbon neutrality would avoid overinvestment in projects that are unprofitable or unsustainable.⁸³ Further, better pricing and capital allocation would support the innovation that is needed to realize a net-zero transition. Transition risk scenario planning, for example, would help market participants identify opportunities for investment in transition-related services.⁸⁴

⁷⁸ Hong et al., *supra* note 15, at 280 (finding that food stock prices underreact to climate change risks).

⁷⁹ Shashwat Alok, Nitin Kumar & Russ Wermers, *Do Fund Managers Misestimate Climate Disaster Risk?*, 33 REV. FIN. STUD. 1146, 1146 (2020) (finding that “managers within a major disaster region underweight disaster zone stocks to a much greater degree than distant managers and that this aversion to disaster zone stocks is related to a salience bias that decreases over time and distance from the disaster, rather than to superior information possessed by close managers”).

⁸⁰ See *supra* Section II.A.

⁸¹ Condon, *supra* note 25, at 16–18. Other factors include model risk and latent risk, misaligned incentives of corporate leadership, myopic shareholders and market structure, misinformation and biases, and political opposition and regulatory capture. *Id.* at 17–39.

⁸² See, e.g., Mercure et al., *supra* note 27, at 591.

⁸³ Condon, *supra* note 34, at 40–42 (2020).

⁸⁴ See TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, THE USE OF SCENARIO ANALYSIS IN DISCLOSURE OF CLIMATE-RELATED RISKS AND OPPORTUNITIES 2–4 (2017),

Finally, better pricing and capital allocation mean that financial markets can amplify the effectiveness of climate policies and of firms' transition plans.⁸⁵

Improved insight into climate risks would also promote financial stability.⁸⁶ Climate risks may pose direct risks to financial stability—for example, if a climate tipping point causes a sudden change in climate conditions which causes extreme weather, leading to large and correlated drops in economic output.⁸⁷ However, as research from the U.S. Federal Reserve has pointed out, climate risks may also pose indirect risks to financial stability by “increas[ing] financial-system vulnerabilities through losses to levered financial intermediaries, disruption in financial market functioning, or sudden repricing of large classes of assets.”⁸⁸ Mark Carney, former Governor of the Bank of England and current United Nations Special Envoy for Climate Action and Finance, has referred to the latter risk as a climate-induced “Minsky moment.”⁸⁹ If climate risks were to be suddenly recognized, for example, because of some external (climate change or policy-

<https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Technical-Supplement-062917.pdf> [<https://perma.cc/9FKE-LFUR>].

⁸⁵ Incidentally, disclosures can themselves contribute to the feedback effects that are needed to push governments and markets in the direction of carbon neutrality by revealing information to markets about the costs of inaction. See Farmer et al., *supra* note 52, at 132–33.

⁸⁶ See FIN. STABILITY BD., THE AVAILABILITY OF DATA WITH WHICH TO MONITOR AND ASSESS CLIMATE-RELATED RISKS TO FINANCIAL STABILITY 5 (2021), <https://www.fsb.org/wp-content/uploads/P070721-3.pdf> [<https://perma.cc/69AV-V9W8>].

⁸⁷ See, e.g., Celso Brunetti et al., *Climate Change and Financial Stability*, BD. OF GOVERNORS OF THE FED. RESV. SYS. (Mar. 19, 2021), <https://www.federalreserve.gov/econres/notes/feds-notes/climate-change-and-financial-stability-20210319.htm> [<https://perma.cc/6D7C-HMMH>].

⁸⁸ *Id.*

⁸⁹ See Open Letter from Mark Carney, Governor, Bank of Eng., François Villeroy de Galhau, Governor, Banque de France & Frank Elderson, Chair, Network for Greening the Fin.Serv. (Apr. 17, 2019), <https://www.bankofengland.co.uk/news/2019/april/open-letter-on-climate-related-financial-risks> [<https://perma.cc/J4P9-ZUUW>].

induced) shock,⁹⁰ a large-scale asset revaluation might ensue, which in turn might disrupt the valuation and operations of key financial institutions, threatening financial stability.⁹¹ “A lack of transparency across [market] participants . . . could cause climate-related risks to build up in hidden pockets, embedding vulnerabilities that could result in cascading losses in the event of large-scale adverse weather outcomes or other shocks to asset valuations.”⁹² Greater disclosure on climate risk could help smoothen the adjustment pathway and avoid such valuation cliff edges—or at the very least help markets and supervisors prepare for a range of potential contingencies.

Finally, climate-related disclosures can be a catalyst of (or even a prerequisite for) the much-needed learning dynamics on climate risk. By inducing companies to gather and share climate information to the market, disclosures will raise further questions with market participants and policymakers and further increase the demand for climate disclosures.⁹³

* * * *

To recap, climate risks are understood to be material, even if scientific and policy uncertainties remain around their exact manifestation. These uncertainties are themselves aggravated by insufficient data availability. Understanding climate risks is important for investors and other corporate stakeholders. Without appropriate levels of corporate climate risk information, the pricing mechanism does not function adequately and capital is misallocated. The salient question thus becomes: how can we make sure that sufficient

⁹⁰ See Lael Brainard, Member, Bd. Of Governors of the Fed. Rsrv. Sys., Remarks at Transform Tomorrow Today Conference: Financial Stability Implications of Climate Change 1 (Mar. 23, 2021), <https://www.federalreserve.gov/newsevents/speech/files/brainard20210323a.pdf> [<https://perma.cc/J4P9-ZUUW>].

⁹¹ See, e.g., Mark Carney, *Fifty Shades of Green*, FIN. & DEV., Dec. 2019, at 13. For several financial stability implications of climate change, see Brainard, *supra* note 90, at 1, 5.

⁹² Brainard, *supra* note 90, at 6.

⁹³ Farmer et al., *supra* note 52, at 132-133 (listing climate disclosures as a potential “sensitive intervention point[]”).

information on corporate climate risks is available for these goals?

III. THE CASE FOR MANDATORY CORPORATE CLIMATE DISCLOSURES

Because of its unique characteristics, climate risk analysis requires data that is unusual in financial analysis.⁹⁴ Some of this data is publicly available from newspapers, social media, or scientific analysis. Other relevant data, while not readily available to investors, can be obtained without assistance from companies. One example is geospatial satellite data, which can be used to spot the location of assets, which in turn enables localized climate risk analysis.⁹⁵ Such analysis is useful to evaluate both physical climate risks like flooding (is this factory located in a prospective flood zone?), bushfires (could the supply to and from this factory be inhibited in the dry season?), or water temperatures (does this power plant have access to enough water of a sufficiently cool temperature to be able to cool its equipment?), and transition risks (firms lacking emissions abatement that are located in regions with high population density and serious air pollution face a higher risk of being regulated, required to install abatement technologies, or forced to cease operations).⁹⁶

Most information necessary to evaluate corporate climate risks, however, can only be made available by the company itself. Think, for example, about the pricing assumptions that underpin a company's strategies⁹⁷ or its emissions levels. In

⁹⁴ Condon, *supra* note 25, at 4–5.

⁹⁵ See SUSTAINABLE FIN. PROGRAMME, CLIMATE RISK ANALYSIS FROM SPACE: REMOTE SENSING, MACHINE LEARNING, AND THE FUTURE OF MEASURING CLIMATE-RELATED RISK 21 (2018) <https://www.smithschool.ox.ac.uk/research/sustainable-finance/publications/Remote-sensing-data-and-machine-learning-in-climate-risk-analysis.pdf> [<https://perma.cc/8AUY-XN6G>].

⁹⁶ *Id.* at 10.

⁹⁷ To illustrate this point, a report from Sarasin & Partners suggested that European oil and gas companies might systemically overstate the capital and profits because they assume overly optimistic long-term oil price developments that are not aligned with international commitments to phase

this Part, we first briefly describe the current regulatory framework on corporate climate disclosures in the United States and Europe, as well as the most important voluntary reporting frameworks—particularly the one devised by the Task Force on Climate-related Financial Disclosures (TCFD). We show that these regulatory and voluntary frameworks fall short, with the implication that the information environment around corporate climate risks is incomplete. This leads us to make the case for (broader) mandatory climate-related disclosures—a case that is grounded both in arguments that are typically associated with disclosure mandates for issuers of securities and in broader social welfare considerations associated with the net-zero transition.

A. Corporate Climate Disclosures: The State of the Art

The state of the art in corporate climate disclosures varies across jurisdictions, both in terms of scope and contents and in the degree to which they bind issuers in practice. In the United States, the Securities and Exchange Commission's (SEC) first attempt to integrate climate risks into financial disclosures was through its 2010 Climate Disclosure Guidance.⁹⁸ However, the SEC's Guidance shied away from introducing any well-defined requirements for climate disclosures. Rather than designing a new set of specific climate-related disclosure mandates, the Guidance invoked the open-ended concept of "materiality"—its relevance for a reasonable investor in making an investment decision—to

out fossil fuels. *See* NATASHA LANDELL-MILLS, SARASIN & PARTNERS, ARE OIL AND GAS COMPANIES OVERSTATING THEIR POSITION? UNDERPINNING COMPANY BALANCE SHEETS 2 (2018), <https://sarasinandpartners.com/wp-content/uploads/2020/06/NLM-Are-oil-and-gas-companies-overstating-NB.pdf> [<https://perma.cc/J88V-Q5C4>].

⁹⁸ Commission Guidance Regarding Disclosure Related to Climate Change, Securitas Act Release No. 9106, Exchange Act Release No. 61,469, 75 Fed. Reg. 6290, 6290 (Feb. 8, 2010). Investors have long called for the SEC to issue such guidance. *See* Cal. Pub. Emps. Retirement Sys. et al., Petition for Interpretive Guidance on Climate Risk Disclosure (Sept. 20, 2007), <https://www.sec.gov/rules/petitions/2007/petn4-547.pdf> [<https://perma.cc/5AC2-GGXJ>].

remind issuers of the need for discussion of all risks, including the climate-related ones, that meet the materiality threshold.⁹⁹ Intuitively, climate risks may qualify as material—and some commentators argue that they indeed do.¹⁰⁰ Yet, the traditional concept of materiality may fail to capture climate risks.¹⁰¹ The complex and uncertain nature of climate risks hampers efforts to accurately quantify them in order to determine their materiality, particularly given the limits in the available data and in our knowledge of the

⁹⁹ Commission Guidance Regarding Disclosure Related to Climate Change, 75 Fed. Reg. at 62,95–96.

¹⁰⁰ See, e.g., Amir Amel-Zadeh, *The Financial Materiality of Climate Change: Evidence from a Global Survey* 27 tbl.3 (Jul. 8, 2021) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3295184 (on file with the Columbia Business Law Review) (reporting that 73.5% of institutional investors surveyed agreed that climate change possess a material risk to companies in that investor’s portfolio); Jeffery M. McFarland, *Warming Up to Climate Change Risk Disclosure*, 14 FORDHAM J. CORP. & FIN. L. 281, 292 (2009) (“[I]t certainly is arguable that climate change risk disclosure fits the materiality standard if evaluated solely by its economic effects.”); Aisha I. Saad & Diane Strauss, *The New “Reasonable Investor” and Changing Frontiers of Materiality: Increasing Investor Reliance on ESG Disclosures and Implications for Securities Litigation*, 17 BERKELEY BUS. L.J. 391, 393 (2020) (“[A] host of scholars, have been arguing that ESG data is relevant to effective asset management, and thus, that it is legally ‘material[.]’” (footnote omitted)).

¹⁰¹ See Alan R. Palmiter, *Climate Change Disclosure: A Failed SEC Mandate* 71–72 (Mar. 15, 2017) (unpublished manuscript), <https://ssrn.com/abstract=2639181> [<https://perma.cc/XPS3-EQD9>] (explaining the difficulty in determining materiality); Rick E. Hansen, *Climate Change Disclosure by SEC Registrants: Revisiting the SEC’s 2010 Interpretive Release*, 6 BROOK. J. CORP. FIN. & COM. L. 487, 502 (2012) (reporting on the effects of SEC Guidance on issuers’ disclosures); Virginia Harper Ho, *Nonfinancial Risk Disclosure and the Costs of Private Ordering*, 55 AM. BUS. L.J. 407, 430 (2018) (“The limited amount of material ESG information contained in most firms’ financial reports is due in part to the fact that federal securities law does not require issuers to disclose all material information within periodic reporting.” (footnote omitted)); see also *New York v. Exxon Mobil Corp.*, No. 452044, 2019 WL 6795771 (N.Y. Sup. Ct. 2019) (alleged misstatement regarding climate change planning not shown to be material).

physical phenomena.¹⁰² Companies (and directors or executives trained to assess financial risks) must choose from competing scientific approaches to assess the materiality of climate risks for their own individual companies,¹⁰³ broadening the already wide discretion inherent in firms' materiality assessments.

Similarly, in the United Kingdom, several reporting requirements and guidance instruments enacted throughout the 2010s can be interpreted as requiring companies, according to their individual circumstances, to provide periodic information about their climate risks.¹⁰⁴ Yet, a generally applicable mandate appears not to be in place.¹⁰⁵ One important exception to the United Kingdom's hortative approach is the requirement, dating back to 2013, for all domestic companies listed on a major stock exchange¹⁰⁶ to report their greenhouse gas (GHG) emissions as part of the annual Directors' Report.¹⁰⁷ Emissions were defined as comprising those "from activities for which that company is responsible including (a) the combustion of fuel; and (b) the operation of any facility"¹⁰⁸ (scope 1 emissions) and those "resulting from the purchase of electricity, heat, steam or

¹⁰² See *supra* Section II.A; see also Jeffrey A. Smith, Matthew Morreale & Michael E. Mariani, *Climate Change Disclosure: Moving Towards a Brave New World*, 3 *CAP. MKTS. L.J.* 469, 483 (2008) ("Determining the materiality of an issue is difficult, particularly without numerical standards and bright line tests. The complex and uncertain nature of climate change makes the task harder."); Palmiter, *supra* note 101, at 71–72 (explaining the difficulty in determining materiality).

¹⁰³ Palmiter, *supra* note 101, at 72.

¹⁰⁴ See Emily Webster, *Information Disclosure and the Transition to a Low-Carbon Economy: Climate-Related Risk in the UK and France*, 32 *J. ENV'T L.* 279, 291–97 (2019).

¹⁰⁵ *Id.* at 299.

¹⁰⁶ Including on the New York Stock Exchange and NASDAQ. See Companies Act 2006 c. 46, § 385(2)(c) (Eng.).

¹⁰⁷ The Companies Act 2006 (Strategic Report and Directors' Report) Regulations 2013, SI 2013/1970, pt. 7, ¶¶ 15, 20 (Eng.).

¹⁰⁸ Large and Medium-Sized Companies and Groups (Accounts and Reports) Regulations 2008, SI 2008/410, pt. 7, ¶ 15 (Eng.).

cooling by the company for its own use”¹⁰⁹ (scope 2 emissions).¹¹⁰

France, in turn, seems to have been an early mover in the direction of requiring climate risk disclosures. Its Energy Transition Law of 2015 imposes a duty on large listed companies to disclose their climate risk exposures, the measures taken to mitigate such risks, and the impact of their activity, including not only scope 1 and 2 but also scope 3 emissions (namely, all emissions that occur in a company’s value chain, both upstream and downstream), on climate change.¹¹¹ Yet, this requirement applies only on a comply or explain basis.¹¹² In other words, companies either provide such disclosures or explain why they choose not to.

While national policymakers engaged in these timid experiments with climate-related disclosures, investors, policymakers and other stakeholders around the world have been championing the creation and adoption of more ambitious but *voluntary* climate risks disclosure standards. Most consequentially, in 2017 the TCFD, a body set up by the Financial Stability Board, issued the most comprehensive

¹⁰⁹ *Id.*

¹¹⁰ The categorization of the “scope” of emissions follows the pioneering classification of Greenhouse Gas Protocol, a partnership between the World Resources Institute (WRI) and the Business Council for Sustainable Development (WBCSD). See MARY SOTOS, GREENHOUSE GAS PROTOCOL, GHG PROTOCOL SCOPE 2 GUIDANCE 5 (2020), https://ghgprotocol.org/sites/default/files/standards/Scope%202%20Guidance_Final_Sept26.pdf (on file with the Columbia Business Law Review).

¹¹¹ Code de commerce [C. com.] [Commercial Code] art. L. 225-102-1, R. 225-104, R. 225-105 (Fr.).

¹¹² Loi 2015-992 du 17 août 2015 relative à la transition énergétique pour la croissance verte [Law 2015-992 of August 17, 2015 on Energy Transition for Green Growth], JOURNAL OFFICIEL DE LA REPUBLIQUE FRANÇAIS [J.O.] [OFFICIAL GAZETTE OF FRANCE], Aug. 17, 2015, art. 173-III, IV; Code de commerce [C. com.] [Commercial Code] art. L. 225-102-1, R. 225-104, R. 225-105 (Fr.); see Webster, *supra* note 104, at 301–06.

framework for such disclosures,¹¹³ with the goal of replacing over 400 existing initiatives.¹¹⁴

The TCFD recommendations encompass both transition and physical climate risks and aim to establish a framework that will facilitate the disclosure of “clear, comparable and consistent information about the risks and opportunities presented by climate change.”¹¹⁵ Recommended disclosures include information about the board’s oversight of climate-related risks; the climate-related risks and opportunities the organization has identified over the short, medium, and long term; the impact of such risks on the organization’s strategy; the resilience of the organization’s strategy considering different climate-related scenarios; and climate risk management.¹¹⁶ In addition, disclosure is recommended on GHG emissions, the related risks, and the targets and metrics used by the organization to manage climate-related risks.¹¹⁷

The TCFD paved the way for a deluge of initiatives across the globe pushing for action based on these recommendations. Governments and international standard-setting bodies followed suit.¹¹⁸ To mention but a few:

- The United Kingdom’s Financial Conduct Authority (FCA) brought in a new Listing Rule to

¹¹³ TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, *supra* note 41, at iii–iv.

¹¹⁴ FIN. STABILITY BD., PROPOSAL FOR A DISCLOSURE TASK FORCE ON CLIMATE-RELATED RISKS 2 (Nov. 9, 2015), <https://www.fsb.org/wp-content/uploads/Disclosure-task-force-on-climate-related-risks.pdf> [<https://perma.cc/PCX3-BXAD>] (“[I]t has been estimated that there are almost 400 information disclosure schemes relating to climate or sustainability in existence[.]”). These include frameworks developed by the Carbon Disclosure Project (CDP), the Climate Disclosure Standards Board (CDSB), the Global Reporting Initiative (GRI), and the Sustainability Accounting Standards Board (SASB). For an overview, see TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, *supra* note 41, app. 4.

¹¹⁵ TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, *supra* note 41, at i.

¹¹⁶ *Id.* at 19–21.

¹¹⁷ *Id.* at 36.

¹¹⁸ For an overview, see JANIS SARRA, FROM IDEAS TO ACTION, 145–98 (2020).

increase transparency in the way companies address climate-related risks.¹¹⁹ This rule applies to Premium-listed commercial companies and requires the disclosure of information in annual reports in line with the TCFD recommendations,¹²⁰ albeit only on a comply or explain basis.

- In the European Union, a European Commission Communication provides guidelines on climate-related reporting¹²¹ broadly in line with the TCFD recommendations, within the framework of the E.U. Non-Financial Reporting Directive.¹²²
- The International Accounting Standards Board, which is the body in charge of setting the International Financial Reporting Standards (IFRS) on behalf of the IFRS Foundation, has issued a statement and educational materials to clarify how climate change risks could be addressed through the existing IFRS,¹²³ the accounting standards applying to listed firms in fifteen out of

¹¹⁹ FIN. CONDUCT AUTH., PROPOSALS TO ENHANCE CLIMATE-RELATED DISCLOSURES BY LISTED ISSUERS AND CLARIFICATION OF EXISTING DISCLOSURE OBLIGATIONS 3 (2020), <https://www.fca.org.uk/publication/policy/ps20-17.pdf> [<https://perma.cc/4RQN-TR26>].

¹²⁰ See SARRA, *supra* note 118, at 158.

¹²¹ EUR. COMM'N, GUIDELINES ON NON-FINANCIAL REPORTING: SUPPLEMENT ON REPORTING CLIMATE-RELATED INFORMATION 6–26 (2019) https://ec.europa.eu/finance/docs/policy/190618-climate-related-information-reporting-guidelines_en.pdf [<https://perma.cc/KE4F-PTDE>]. Note that a Communication is a non-binding legal instrument which represents the European Commission's interpretation of E.U. rules and is therefore binding vis-à-vis neither the member states' governments and courts nor private parties. See *Communication*, EU MONITOR, <https://www.eumonitor.eu/9353000/1/j9vvik7m1c3gyxp/vh7dtp45uyn> [<https://perma.cc/8FE8-J2VV>] (last visited Dec. 15, 2021).

¹²² See Directive 2014/95/EU, of the European Parliament and of the Council of 22 October 2014 Amending Directive 2013/34/EU, 2014 O.J. (L 330) 1.

¹²³ NICK ANDERSON, CLIMATE-RELATED AND OTHER EMERGING RISKS DISCLOSURES: ASSESSING FINANCIAL STATEMENT MATERIALITY (2019), <https://www.ifrs.org/content/dam/ifrs/news/2019/november/in-brief-climate-change-nick-anderson.pdf> [<https://perma.cc/T7Q4-XHBX>].

the countries comprising the Group of Twenty (or G20).¹²⁴ In addition, the Trustees of the IFRS Foundation published a consultation paper in September 2020.¹²⁵ The IFRS Foundation's proposal may lead to the establishment of a Sustainability Standards Board.¹²⁶

The TCFD has attracted widespread support from market players, particularly in the financial sector, with over 1,340 companies with a total market capitalization of \$12.6 trillion backing it as of 2020.¹²⁷ But to express support for an initiative does not necessarily imply that firms also diligently follow its prescriptions, let alone that these steps are sufficient. Ultimately, the litmus test for the impact of this voluntary initiative will be whether it leads to disclosures that are considered sufficient by market participants. In 2019, three quarters of users of climate disclosures said that more information is needed on the financial impact of climate risks.¹²⁸ Similarly, the 2020 TCFD status report has documented that while disclosure of climate-related financial

¹²⁴ *Who Uses IFRS Standards?*, INT'L FIN. REPORTING STANDARDS FOUND. (Jan. 12, 2018), <https://www.ifrs.org/use-around-the-world/use-of-ifrs-standards-by-jurisdiction/#analysis-of-the-profiles-of-g20-jurisdictions> [<https://perma.cc/6C2P-LVCF>].

¹²⁵ INT'L FIN. REPORTING STANDARDS FOUND., CONSULTATION PAPER ON SUSTAINABILITY REPORTING (2020), <https://www.ifrs.org/content/dam/ifrs/project/sustainability-reporting/consultation-paper-on-sustainability-reporting.pdf> [<https://perma.cc/M5JL-S7BJ>].

¹²⁶ *IFRS Foundation Trustees Announce Working Group to Accelerate Convergence in Global Sustainability Reporting Standards Focused on Enterprise Value*, INT'L FIN. REPORTING STANDARDS FOUND. (March 22, 2021), <https://www.ifrs.org/news-and-events/news/2021/03/trustees-announce-working-group/> [<https://perma.cc/4VZP-DWP5>].

¹²⁷ TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, 2020 STATUS REPORT 2 (2020) https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Status-Report.pdf [<https://perma.cc/D44E-SXEW>].

¹²⁸ Mark Carney, Governor, Bank of Eng., Speech at TCFD Summit: TCFD: Strengthening the Foundations of Sustainable Finance 6 (Oct. 8, 2019), <https://www.bankofengland.co.uk/-/media/boe/files/speech/2019/tcfd-strengthening-the-foundations-of-sustainable-finance-speech-by-mark-carney.pdf?la=en&hash=DAF8> [<https://perma.cc/QRN6-NFNT>].

information has increased, “companies’ disclosures of the potential financial impact of climate change on their businesses and strategies remains low,”¹²⁹ particularly in financial reports.¹³⁰ Relatedly, a recent study found that firms that have signed up to the TCFD primarily report non-material climate risk information.¹³¹ In the United Kingdom, the Financial Reporting Council’s thematic review had similar findings.¹³² Drawing on the results of this thematic review, the FCA notes that there is considerable room for improvement on the way U.K. companies implement the TCFD recommendations.¹³³ Given their voluntary nature, the tepid implementation of these disclosure requirements comes as no surprise.

Alongside the TCFD’s endeavors, several other networks and intermediaries have contributed to improving disclosures around climate risks. First, there are the voluntary network initiatives for climate-related disclosures that have developed in recent years. Amongst the most significant of these is the CDP (formerly, the Carbon Disclosure Project), a non-profit that operates a global voluntary climate disclosure

¹²⁹ TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, *supra* note 127, at 4.

¹³⁰ See *id.* at 12; see also Robyn Bishop, Comment, *Investing in the Future: Why the SEC Should Require a Uniform Climate Change Disclosure Framework To Protect Investors and Mitigate U.S. Financial Instability*, 48 ENV’T L. 491, 500–01 (2018) (“[M]any companies that do have significant exposure to climate change, like oil and gas companies, currently include a boilerplate disclosure recognizing climate change as a risk, but say nothing about its impacts on a particular business.” (footnote omitted)).

¹³¹ Julia Anna Bingler, Mathias Kraus & Markus Leippold, Cheap Talk and Cherry-Picking: What ClimateBert Has To Say on Corporate Climate Risk Disclosures 18–19 (Mar. 2, 2021) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3796152 (on file with the Columbia Business Law Review).

¹³² FIN. REPORTING COUNCIL, CLIMATE THEMATIC REPORTING – HOW ARE COMPANIES DEVELOPING THEIR REPORTING ON CLIMATE-RELATED CHALLENGES? 7–9 (2020), <https://www.frc.org.uk/getattachment/ab63c220-6e2b-47e6-924e-8f369512e0a6/Summary-FINAL.pdf> [<https://perma.cc/3YM2-SEXS>].

¹³³ FIN. CONDUCT AUTH., *supra* note 119, at 10.

network.¹³⁴ Nearly 10,000 companies (including more than fifteen percent of all listed companies) now submit disclosures in line with the Project's guidelines.¹³⁵ Their main focus is on GHG emissions, but participating firms are also invited to submit narrative information about the impact of climate risk planning on their business strategy, the price of carbon (if any) that they use for planning purposes, their governance arrangements in respect of climate risk and any third-party verification that has been undertaken of their emissions data.¹³⁶ Various information intermediaries have also developed metrics for estimating firms' GHG emissions, regardless of whether they disclose. For example, Trucost, an ESG assessment firm acquired by S&P Dow Jones Indices LLC in 2016, publishes a Carbon Metrics suite that contains a decade's worth of GHG emissions data for companies and supply chains representing ninety-three percent of global markets by market capitalization.¹³⁷ By amassing data, identifying gaps, promoting best practices, and analyzing the implications of climate risks for companies, such networks and intermediaries help develop a better climate risk information environment.

Despite the importance of all these steps, the consensus is that the voluntary nature of disclosures straitjackets the

¹³⁴ CDP, <https://www.cdp.net/en> [<https://perma.cc/FS4E-CL7B>] (last visited Dec. 15, 2021).

¹³⁵ *CDP Reporting Record: Almost 10,000 Companies Disclose Environmental Data in 2020*, GREENBIZ (Nov. 18, 2020), <https://www.greenbiz.com/article/cdp-reporting-record-almost-10000-companies-disclose-environmental-data-2020> [<https://perma.cc/C4T6-NWZB>].

¹³⁶ *Climate Change 2021 Questionnaire*, CDP <https://guidance.cdp.net/en/guidance?cid=18&ctype=theme&idtype=ThemeID&incchild=1µsite=0&otype=Questionnaire&tags=TAG-646%2CTAG-605%2CTAG-600> [<https://perma.cc/8P68-QQMJ>] (last visited Dec. 15, 2021).

¹³⁷ SARAH AIRD, STEVEN BULLOCK & CLAIRE CURTIS, S&P DOW JONES INDICES, *COMPLETING THE PICTURE: MEASURING ENVIRONMENTAL PERFORMANCE ACROSS MULTI-ASSET INVESTMENT STRATEGIES* 5 (2017), <https://www.spglobal.com/spdji/en/documents/research/research-completing-the-picture.pdf> (on file with the Columbia Business Law Review).

extent to which they can make a difference. Voluntary disclosure initiatives fail to ensure that corporate climate disclosures are consistent across firms.¹³⁸ They also invite opportunistic disclosure—firms can selectively paint the greenest possible picture of how they contribute to climate change and how climate change and transition scenarios affect them.¹³⁹

B. Traditional Securities Law Rationales for Climate Disclosures Mandates

The levels and contents of climate-related information disclosure, in the absence of legal requirements, are likely to be suboptimal from society's perspective.¹⁴⁰

To start with, disclosures may have positive externalities. Disclosures of firm A's climate risks will help the market in its assessment of the climate risks of firms B, C, D, and so on. For example, in pricing shares market analysts compare each firm to similar ones. Hence, price accuracy for all firms will improve if all of them disclose.¹⁴¹ Yet, each firm would rather

¹³⁸ See, e.g., Leslie Hook & Matthew Vincent, *Green Business Reporting Rules at Risk of Pale Response*, FIN. TIMES (Nov. 12, 2020), <https://www.ft.com/content/ad01f2c9-9eb0-4db6-9898-220c688d16c2> (on file with the Columbia Business Law Review) (“While more than 1,500 groups globally have signed up to adopt TCFD rules, only a minority have been able to comply with all of its recommendations, which include board-level oversight of climate risks, and creating climate risk management processes.”).

¹³⁹ See, e.g., Jill E. Fisch, *Making Sustainability Disclosure Sustainable*, 107 GEO. L.J. 923, 947–48 (2019) (referencing ESG disclosures in general).

¹⁴⁰ See, e.g., Robert G. Eccles et al., *The Need for Sector-Specific Materiality and Sustainability Reporting Standards*, J. APPLIED CORP. FIN., Spring 2012, at 65, 71 (2012); see also Ruth Jebe, *The Convergence of Financial and ESG Materiality: Taking Sustainability Mainstream*, 56 AM. BUS. L.J. 645, 669 (2019) (“The SEC’s failure to include ESG factors in the mandatory reporting framework ignores the market signals of the importance of these issues and hampers progress toward more sustainable business[.]”).

¹⁴¹ See generally Douglas W. Diamond & Robert E. Verrecchia, *Disclosure, Liquidity, and the Cost of Capital*, 46 J. FIN. 1325, 1326, 1338

free ride on others' disclosures than incur the costs of making disclosures themselves.¹⁴²

Relatedly, disclosures are valuable not only to investors but also to a firm's competitors.¹⁴³ If climate-related disclosures give away information about firm A's strategy, competitors B, C, and D could benefit, weakening any competitive advantage enjoyed by A. But this is only a private cost to A because its loss is balanced by gains enjoyed by B, C, and D. Consequently, there is no net change for society (or diversified investors) as a whole.¹⁴⁴

Intuitively, this logic applies to disclosure of climate-related information, because the public, and therefore actual and potential competitors, are thereby fed with valuable information about a firm's strategies and direction of travel.¹⁴⁵ Take physical risk as an example: granular disclosure on the flood risks of specific properties may be useful for competitors to understand supply chain dynamics and the disclosing firm's operational risks. Consequently, firms will prefer not to disclose information that may be essential to gauge physical risk.

One arena in which this may occur is in relation to market share in "dirty" products. Firms that delay shifting out of carbon-intensive products—relative to their peers—may capture market share in the short run, enjoying a larger slice of a dwindling pie. Another context is free-riding on the transition efforts of early adopters. A firm that is a first mover in transitioning within a sector or industry will likely incur

(1991); David Easley & Maureen O'Hara, *Information and the Cost of Capital*, 59 J. FIN. 1553, 1572–73 (2004).

¹⁴² See, e.g., Frank H. Easterbrook & Daniel R. Fischel, *Mandatory Disclosure and the Protection of Investors*, 70 VA. L. REV. 669, 686 (1984).

¹⁴³ Robert E. Verrecchia, *Discretionary Disclosure*, 5 J. ACCT. & ECON. 179, 181–82 (1983).

¹⁴⁴ See Merritt B. Fox, *Retaining Mandatory Securities Disclosure: Why Issuer Choice Is Not Investor Empowerment*, 85 VA. L. REV. 1335, 1345–46 (1999) (also noting that this reasoning does not consider the effect of disclosure on individual firms' incentives to innovate and therefore its effects on dynamic efficiency).

¹⁴⁵ Verrecchia, *supra* note 143; see also Robert E. Verrecchia, *Essays on Disclosure*, 32 J. ACCT. & ECON. 97, 141 (2001).

prospecting costs. If it discloses what it is doing, then its competitors may free-ride on the first-mover's investments. In both contexts, disclosure might trigger windfalls for competitors, and consequently loss of value—reflected in a lower share price—for the disclosing firm.¹⁴⁶

A traditional counterargument to these rationales for mandatory disclosure is that failure to disclose may lead market participants to assume the worst, depressing a firm's share price.¹⁴⁷ Firms can then avoid this by voluntarily disclosing information (e.g., by committing to and implementing the TCFD framework) in what is known in the economics literature as “unravelling.”¹⁴⁸

In the case of climate-risk disclosures, though, unravelling might not take place. In particular, there might be other reasons for non-disclosure apart from the information being “bad.” for example, because the firm faces losses from granting competitors access to the revealed information,¹⁴⁹ or because there is uncertainty as to whether the information in question is even known to the firm,¹⁵⁰ it would not be rational for market participants to assume the worst from non-disclosure, but rather to apply a blended pricing estimate that encompasses all the possible reasons for non-disclosure.¹⁵¹ Under these circumstances, those with higher-than-average risks can take advantage of a lower cost of capital than they would face were investors fully aware of their position. They consequently have no incentive to disclose. While those with lower-than-average risks will face a higher cost of capital than

¹⁴⁶ Under-disclosure of climate-related information, as Steuer and Tröger observe, may also be the product of “fears of a backlash” from stakeholders such as “NGOs, third-party data providers, the media, consumers, environmental regulators.” TRÖGER & STEUER, *supra* note 28, at 39–40.

¹⁴⁷ Frank H. Easterbrook & Daniel R. Fischel, *supra* note 142, 683.

¹⁴⁸ See, e.g., Ronald A. Dye, *Optimal Disclosure Decisions When There Are Penalties for Nondisclosure*, 48 RAND J. ECON. 704, 704–07 (2017) (overviewing the literature on unravelling).

¹⁴⁹ Verrecchia, *supra* note 143.

¹⁵⁰ Ronald A. Dye, *Disclosure of Nonproprietary Information*, 23 J. ACCT. RES. 123, 125–26 (1985).

¹⁵¹ See, e.g. *id.* at 128.

they would were investors fully aware of their position, such firms will only have an incentive to disclose if the resultant lower cost of capital outweighs the direct costs of the disclosures and the losses ensuing from their competitors' access to the revealed information. The signaling value of disclosure is muted and non-disclosure will still reflect a (partial) pooling equilibrium.

Emerging evidence is supportive of these theoretical claims about the trade-offs firms face in undertaking disclosure. In a recent contribution, Bolton and Kacperczyk study the impact of carbon disclosure mandates in the United Kingdom.¹⁵² A group of U.K. public companies had already been making voluntary disclosures before mandatory disclosure of GHG emissions was introduced for all public companies from 2013 onwards.¹⁵³ Bolton and Kacperczyk use a difference-in-difference framework to compare the impact of the rule's introduction on firms that were already disclosing voluntarily beforehand (the control group) with firms that the rule compelled to disclose for the first time (the treatment group).¹⁵⁴ Mandated reports produced by the treatment group displayed some divergence from estimates produced using information previously available,¹⁵⁵ suggesting that the new disclosures conveyed new information.¹⁵⁶ For treatment firms for which the mandated reports indicated significantly higher GHG emissions than had previously been imputed, stock returns increased, implying these firms faced a higher cost of capital.¹⁵⁷ This is consistent with non-disclosure by these firms under the prior, voluntary, regime having reflected a

¹⁵² Patrick Bolton & Marcin Kacperczyk, Carbon Disclosure and the Cost of Capital (Nov. 15, 2020) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3755613 [<https://perma.cc/3EUB-S77U>].

¹⁵³ Specifically, the introduction in 2013 of a requirement for firms to disclose their GHG emissions. *See supra* note 106 and accompanying text.

¹⁵⁴ Bolton & Kacperczyk, *supra* note 152, at 22.

¹⁵⁵ Nonprofits such as Trucost estimate GHG emissions for public companies even in the absence of disclosure. *Id.* at 3 n.4, 5.

¹⁵⁶ *Id.* at 6.

¹⁵⁷ *Id.*

pooling equilibrium. Moreover, Bolton and Kacperczyk also report that the average stock returns, volatility, and turnover of firms disclosing for the first time went down, strongly suggesting that disclosure had reduced uncertainty in pricing.¹⁵⁸

A broader question, and one that sheds light on the quality of the information environment, is whether markets are currently fully pricing climate-related risks.¹⁵⁹ As previously mentioned, evidence shows that markets are underestimating such risks.¹⁶⁰ If that is the case, increased disclosures may lead to a downward re-adjustment of the stock price, which managers will be loath to cause by voluntarily providing additional information.¹⁶¹

Finally, the current framework of voluntary disclosures gives rise to a number of competing standards for disclosure.¹⁶² This allows issuers to pick and choose, making

¹⁵⁸ *Id.* For a review of the literature on the effects of climate change perceptions on asset prices, see Ilhan et al., *supra* note 26, at 1545–46.

¹⁵⁹ That markets appear to be sensitive to carbon emissions levels does not mean that they have the information needed to assess and price all climate-related risks: a firm's physical risk is uncorrelated with its emissions, while emissions and their changes to-date are just two of the many elements for the assessment of transition risk. *Cf.* Sautner et al., *supra* note 26, at 1 (“Carbon emissions primarily capture downside regulatory (or transition) risks but do not capture physical risks or climate opportunities. In addition, they reflect firms’ historic business models [and] do not allow researchers to distinguish between ‘good’ and ‘bad’ emissions[.]”).

¹⁶⁰ See *supra* Section II.B. For evidence of mispricing compare, see Philipp Krueger et al., *The Effects of Mandatory ESG Disclosure Around the World* (Eur. Corp. Governance Inst., Fin. Working Paper 754/2021, 2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3832745 (on file with the Columbia Business Law Review) (discussing how mandatory ESG reporting leads to more accurate analysts’ earnings forecasts and lower risk of stock price crash).

¹⁶¹ Condon, *supra* note 25, at 22–26. On managers’ aversion to disclose bad news, see Reinier Kraakman, *Disclosure and Corporate Governance: An Overview Essay*, in REFORMING COMPANY AND TAKEOVER LAW IN EUROPE 99–100 (Guido Ferrarini et al. eds., 2004).

¹⁶² Fisch, *supra* note 139, at 947.

it difficult for users to make meaningful comparisons across firms.¹⁶³

C. The Specific Positive Externalities of Climate Disclosures

The previous Section has shown why issuers may provide less climate-related information than would be optimal for the efficient functioning of capital markets. Externalities arising from information relating to climate change go much beyond the microcosm of capital markets. Climate change-related disclosures have the peculiarity of having a positive impact on broader economic and societal dynamics, particularly in relation to the speed and pathway of the net-zero transition. These positive effects will be ignored by issuers (and their managers) when deciding whether to disclose climate change-related information.

The proposition that positive externalities of individual issuers' disclosures go beyond their contribution to better pricing of climate risks is especially true with transition risks and net-zero pledges, for which interdependencies and feedback loops between the actions of various companies are intuitively significant. More generally, information about emissions from major carbon emitters facilitate the macro-assessment of climate risks, which in turn feed back into micro-level assessments. In other words, information about emissions and future emission pathways (especially from those responsible for a large part of them) will allow markets to make better assessments of the (future) pace of global warming, thereby also allowing for more accurate estimates

¹⁶³ *Id.* For evidence showing the real and financial effects of mandatory standardized emissions disclosures, see Valentin Jouvenot & Philipp Krueger, Mandatory Corporate Carbon Disclosure: Evidence from a Natural Experiment (July 13, 2021) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3434490 (on file with the Columbia Business Law Review) (showing that firms that already voluntarily disclosed their emissions prior to the United Kingdom made such disclosures mandatory and standardized subsequently reduced their emissions in response to equity markets' reaction to the disclosed information).

of physical risk and informing evaluations of individual issuers' (including major carbon emitters' and their suppliers') transition risks.

Increased availability of information about individual firms' behavior affecting climate change may also influence investor and corporate choices. For example, when the United Kingdom introduced a carbon reporting mandate in 2013, requiring listed companies to report their GHG emissions for their entire organization in their annual financial reports, the affected firms lowered their emissions.¹⁶⁴ Peer benchmarking¹⁶⁵ and investor pressure¹⁶⁶ could act as mechanisms to drive such change.

Finally, a standardized, structured climate risk disclosure framework has the potential not just to track the evolution of the relevant phenomena, but also to actually accelerate our understanding thereof. Comprehensive information about corporate risks and actions can be used not just by professional traders to more accurately price securities, but also by scientists, governments, and others to understand the aggregate picture and issue (or pressure for) better-informed policies. In other words, mandatory disclosure can *jumpstart a learning process* about climate change and collective human

¹⁶⁴ See Hans B. Christensen, Luzi Hail & Christian Leuz, *Mandatory CSR and Sustainability Reporting: Economic Analysis and Literature Review*, 26 REV. ACCT. STUD. 1176, 1214 (2021) (discussing empirical studies that find that the affected firms lowered their emissions by ten to eighteen percent).

¹⁶⁵ See Sorabh Tomar, Greenhouse Gas Disclosure and Emissions Benchmarking 26 (Oct. 27, 2021) (unpublished manuscript), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3448904 (on file with the Columbia Business Law Review) (finding that emission reductions are correlated with disclosure of information, which may support peer benchmarking). Tomar notes, however, that such correlation could be caused by technological convergence or mean-reversion, not disclosure. *Id.* In this context, peer benchmarking is the theory that firms assess their own GHG emissions in the context of peer companies' emission levels. *Id.* at 3. Thus, firms that realize their emissions are greater than those of their peers will attempt to reduce their firm's emissions. *Id.*

¹⁶⁶ See Jouvenot & Krueger, *supra* note 160, at 3.

behavior affecting it.¹⁶⁷ For instance, with better access to relevant information, investors can ask companies better questions, which in turn will yield additional fruitful information, creating a demand for methods to analyze it, and so on. This virtuous cycle, importantly, will also feed into the process of making policies to tackle climate change generally and into mandatory disclosure rulemaking more specifically.

* * * *

To conclude, the current framework, leaving companies with wide discretion on what to disclose about climate-related risks, is insufficient. The question remains as to how policymakers can do a good job at identifying what information is required, given the uncertainties surrounding climate change, the evolving nature of the underlying phenomena and the legitimate doubts about what is relevant for information users to know. The next parts will explore this last question and explain how regulatory governance can help ensure that the disclosure framework evolves in lockstep with the progress of climate science and the changes in the factors affecting it.

IV. DESIGNING CLIMATE-RELATED DISCLOSURE MANDATES

In the previous Part we reviewed the various rationales justifying regulatory action to make climate-related disclosures mandatory. As a matter of fact, many major jurisdictions have already moved, however cautiously,¹⁶⁸ in this direction.¹⁶⁹ Some jurisdictions are currently considering

¹⁶⁷ Cf. Christensen et al., *supra* note 164, at 1217 (noting that CSR reporting mandates could make it less costly for stakeholders to acquire and process relevant CSR information).

¹⁶⁸ See *supra* Section III.A.

¹⁶⁹ See TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, *supra* note 127, 110, at 2–3 (“[Over 110 regulators and governmental entities from around the world support the TCFD . . . [and] central banks and supervisors from across the globe—through the Network for Greening the Financial System—have encouraged companies issuing public debt or

making disclosures based on the TCFD framework mandatory.

For instance, as we write, several policy measures are in the process of being enacted in the United Kingdom.¹⁷⁰ Rishi Sunak, the Chancellor of the Exchequer, has proclaimed that these will set the United Kingdom on the path to be the first G20 nation to mandate TCFD-style climate disclosures.¹⁷¹ The most comprehensive of these initiatives is led by the Department for Business, Energy & Industrial Strategy (BEIS).¹⁷² It seemingly requires large companies to include TCFD-styled disclosures in their strategic report, but then specifies that they will be exempt from doing so if they can explain “why climate change is not expected to materially affect the company’s business model or strategy.”¹⁷³ In other words, climate-related disclosures would still be subject to a firm-level, self-assessed materiality test, much like under the 2010 U.S. SEC guidance and the current U.K. FCA disclosure framework,, making one wonder whether the U.K. Government’s proposal amounts to much more than an exercise in policy greenwashing.

equity to disclose in line with the TCFD recommendations” (footnote omitted)).

¹⁷⁰ See *Sunak Says U.K. Will Lead on Green Finance: Green Summit Update*, BLOOMBERG N. (Nov. 9, 2020, 11:57 AM), <https://www.bloomberg.com/news/articles/2020-11-09/boe-to-start-climate-stress-tests-in-june-green-summit-update> [<https://perma.cc/4HP4-SE29>].

¹⁷¹ *Id.*

¹⁷² See DEP’T FOR BUS., ENERGY & INDUS. STRATEGY, CONSULTATION ON REQUIRING MANDATORY CLIMATE-RELATED FINANCIAL DISCLOSURES BY PUBLICLY QUOTED COMPANIES, LARGE PRIVATE COMPANIES AND LIMITED LIABILITY PARTNERS (LLPs) 14 (2021), https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/972422/Consultation_on_BEIS_mandatory_climate-related_disclosure_requirements.pdf [<https://perma.cc/J5JR-S6XW>].

¹⁷³ *Id.* at 26. For a critique of this approach see Virginia E. Harper Ho, *Modernizing ESG Disclosure*, 2022 U. ILL. L. REV. (forthcoming), (manuscript at 51–52), <https://ssrn.com/abstract=3845145> [on file with the Columbia Business Law Review].

In the United States, the SEC is expected to issue a proposal on climate disclosures by the end of the year,¹⁷⁴ after a consultation process based on the ESG Subcommittee of the SEC Asset Management Advisory Committee's recommendations, which included proposals to require not only "the adoption of standards by which corporate issuers disclose material ESG risks" but also "that material ESG risks be disclosed in a manner consistent with the presentation of other financial disclosures."¹⁷⁵ The SEC's Chair has signaled that, while the TCFD framework will provide inspiration in drafting the proposal, the SEC will go its own way whenever that is more appropriate for U.S. markets.¹⁷⁶

In the European Union, the current non-binding framework¹⁷⁷ will be replaced by more prescriptive mandates, although a specific proposal is still months away.¹⁷⁸ It is

¹⁷⁴ See Gary Gensler, *SEC Chair Gensler Speaks on Climate Risk and Disclosure*, CLS BLUE SKY BLOG (July 29, 2021), <https://clsbluesky.law.columbia.edu/2021/07/29/sec-chair-gensler-speaks-on-climate-risk-and-disclosure/> [<https://perma.cc/TSF6-LKVY>].

¹⁷⁵ See ASSET MGMT. ADVISORY CMT., U.S. SEC & EXCH. CMT. DISCUSSION DRAFT: *POTENTIAL RECOMMENDATIONS OF ESG SUBCOMMITTEE* 5–6 (2020) <https://www.sec.gov/files/potential-recommendations-of-the-esg-subcommittee-12012020.pdf> [<https://perma.cc/ZL2K-UQCT>]. As part of its consultation process, the SEC has sought public input in relation to various aspects of those recommendations, including, among other things, the regulation, monitoring, reviewing, and guidance of climate change disclosure, the development of disclosure standards (including who should be involved, whether standards should incorporate existing frameworks, and whether the standards should be incorporated into existing SEC Rules), and the advantages and disadvantages of developing a single set of global standards applicable to countries around the world. See Herren Lee, *supra* note 59.

¹⁷⁶ See Gensler, *supra* note 174 ("I've asked staff to learn from and be inspired by [the Task Force on Climate-related Financial Disclosures]. I believe, though, we should move forward to write rules and establish the appropriate climate risk disclosure regime for our markets, as we have in prior generations for other disclosure regimes.").

¹⁷⁷ *Supra* note 121 and accompanying text.

¹⁷⁸ See *Commission Proposal for a Directive of the European Parliament and of the Council Amending Directive 2013/34/EU, Directive 2004/109/EC, Directive 2006/43/EC and Regulation (EU) No 537/2014*, at 45–47, COM (2021) 189 final (Apr. 21, 2021) (delegating the Commission

uncertain whether the European Union will implement the TCFD framework or go beyond its recommendations. The development of detailed sustainability reporting standards has been referred to a sustainability taskforce of the European Financial Reporting Advisory Group (EFRAG).¹⁷⁹ A key innovation in their thinking is the concept of “double materiality,” that is, mandating disclosure of climate risk information not only where it is material to investors because of the financial implications for firms, but also where its impact on society is material.¹⁸⁰

As we write, policymakers both in the United States and Europe are in the process of issuing rules on climate-related disclosures. In lockstep with such developments, G7 finance ministers have endorsed the move towards mandatory climate-related financial disclosures.¹⁸¹ At the global level, one of the goals for the 2021 COP26 summit in Glasgow was to spearhead the adoption of mandatory climate-related disclosures on a global scale, setting the stage for the rapid development of new corporate climate disclosure regimes.¹⁸² Leaving aside the political challenges of enacting meaningful disclosures, the technical challenges are also considerable, given the unpredictable nature of climate change and our still limited understanding both of the phenomenon and of how

to issue “sustainability reporting standards” that will include information on climate change mitigation and adaptation).

¹⁷⁹ See EUR. FIN. REPORTING ADVISORY GRP., FINAL REPORT: PROPOSALS FOR A RELEVANT AND DYNAMIC EU SUSTAINABILITY REPORTING STANDARD (2021).

¹⁸⁰ *Id.* at 8.

¹⁸¹ Press Release, G7 Finance Ministers & Central Bank Governors, G7 Finance Ministers & Central Bank Governors Communiqué 1 (June 5, 2021), <https://home.treasury.gov/news/press-releases/jy0215> [<https://perma.cc/K9QZ-VLEA>] (“We support moving towards mandatory climate-related financial disclosures that provide consistent and decision-useful information for market participants and that are based on the Task Force on Climate-related Financial Disclosures (TCFD) framework, in line with domestic regulatory frameworks.”).

¹⁸² See MARK CARNEY, BUILDING A PRIVATE FINANCE SYSTEM FOR NET ZERO PRIORITIES: PRIORITIES FOR PRIVATE FINANCE FOR COP26, at 14–16 (2020), https://ukcop26.org/wp-content/uploads/2020/11/COP26-Private-Finance-Hub-Strategy_Nov-2020v4.1.pdf [<https://perma.cc/F5JP-9JWC>].

best to have it reflected in a company's statements. Given this uncertainty, we refrain from comprehensively sketching out a comprehensive framework for climate-related disclosures. Rather, we focus on the main challenges and core choices that policymakers face, highlighting some areas where regulatory action beyond the TCFD recommendations would be consistent with the functions and rationales of climate-related disclosure mandates.

A. The Challenge of Cost-Benefit Analysis

The dynamic nature of the phenomena underlying climate risks creates a challenge for the application of cost-benefit analysis (CBA) to policy proposals in this field. Regulators responsible for issuer disclosure in the United States, United Kingdom, and European Union are required to produce cost-benefit analyses of proposed actions such as rulemaking.¹⁸³

In general, attempts at quantifying the costs and benefits of disclosure regulation are imperfect at best.¹⁸⁴ Yet for climate-related disclosure obligations, there is likely to be a structural asymmetry in the ability to assess costs and benefits. The costs are likely to be immediate and relatively straightforward for issuers to determine. Guidance can be sought by extrapolating from the costs of existing disclosure requirements. In contrast, the benefits of climate risk disclosure are much harder to assess. They are likely to be spread over the medium to long term, raising well-known

¹⁸³ CBA was first mandated for U.S. agencies by President Reagan in 1981. See Exec. Order No. 12,291, 3 C.F.R. § 3(d) (1981). For the SEC, CBA is required more specifically by the National Securities Markets Improvement Act of 1996 § 106, Pub. L. No. 104-290, 110 Stat. 3416. See also Financial Services and Markets Act 2000, c. 8, § 3B(1) (Eng.).

¹⁸⁴ Christian Leuz & Peter D. Wysocki, *The Economics of Disclosure and Financial Reporting Regulation: Evidence and Suggestions for Future Research*, 54 J. ACCT. RSCH. 525, 529–30 (2016) (reviewing the empirical evidence on the costs and benefits of mandatory disclosures and concluding that “we are still far from being able to perform *quantitative* cost-benefit analyses”).

issues about the appropriate discount rate.¹⁸⁵ They are not captured solely by issuers but are spread diffusely across capital markets and beyond. And they are broader than the benefits associated with existing disclosure obligations, which are limited to the efficiency of capital markets.¹⁸⁶

When conducting a CBA, the direct and indirect costs of providing climate-related disclosures should be compared not only to its benefits in terms of increased informational efficiency but also to those stemming from their contribution to better capital allocation decisions that fully account for climate-related risks. We should also consider the hard-to-measure benefit of our increased understanding of how companies' conduct affects climate change.

The extent to which inability to fully quantify benefits poses a challenge to rulemaking varies by jurisdiction. In the United Kingdom, the relevant legislation states expressly that if, in the FCA's opinion, costs or benefits cannot reasonably be estimated, then the FCA need not actually estimate them in its CBA prior to rulemaking but may simply include a statement of the FCA's opinion and an explanation.¹⁸⁷ This makes clear that CBA is to be used as a regulatory heuristic, but difficulty in estimation should not be viewed as limiting the FCA's jurisdiction to implement rules. In contrast, U.S. court decisions have engaged in review of not only the existence but also the adequacy of cost-benefit analysis produced by the SEC and other financial regulators,¹⁸⁸ taking the view that incomplete CBA renders rulemaking "arbitrary and capricious" under the Administrative Procedure Act, and

¹⁸⁵ Wilfred Beckerman & Cameron Hepburn, *Ethics of the Discount Rate in the Stern Review on the Economics of Climate Change*, WORLD ECON. Jan–Mar. 2007, 187, 190–92.

¹⁸⁶ These benefits are typically measured in the empirical literature with variables such as market liquidity and price volatility. See Leuz & Wysocki, *supra* note 184, at 532–35 (surveying the empirical literature on the effects of mandatory disclosures).

¹⁸⁷ See, e.g., Financial Services and Markets Act 2000, c.8, § 65(11a) (Eng.).

¹⁸⁸ See *Bus. Roundtable v. SEC*, 647 F.3d 1144, 1148–49 (D.C. Cir. 2011); *MetLife Inc. v. Fin. Stability Oversight Council*, 177 F. Supp. 3d 219, 239–42 (D.C. 2016).

hence invalid.¹⁸⁹ Thus, complete quantification of costs and benefits is a precondition for rulemaking in the United States.

Considering the difficulty of quantifying diffuse benefits in highly dynamic and evolving contexts, many scholars are highly critical of the approach taken by the D.C. Circuit to CBA in financial sector rulemaking.¹⁹⁰ These issues are at least as pronounced in regard to climate change. Critics assert that making quantified CBA a precondition for rulemaking stymies regulators' ability to respond because of the asymmetry between the ease in quantifying benefits and costs.¹⁹¹ However, the issue is perhaps not so much with the application of CBA per se, but with the need to find effective ways to accommodate estimates of diffuse and dynamic costs or benefits, so as to avoid a structural bias against rulemaking in such contexts.¹⁹²

In applying CBA to highly uncertain or dynamic circumstances, a number of scholars have called for what might be termed a "Bayesian" approach to quantification of costs and benefits.¹⁹³ This approach has two essential elements. The first is that where evidence is incomplete, quantifications based on the *best available* (albeit imperfect) evidence should be taken at face value. This facilitates rulemaking in response to real problems where costs and benefits are uncertain or dynamic. The corollary of this, however, is that estimates of such costs and benefits will evolve as new evidence emerges.¹⁹⁴ The second essential

¹⁸⁹ See *Chamber of Com. v. SEC*, 412 F.3d 133, 143–44 (D.C. Cir. 2005).

¹⁹⁰ See, e.g., John C. Coates IV, *Cost-Benefit Analysis of Financial Regulation: Case Studies and Implications*, 124 YALE L.J. 882, 912–20 (2015); Jeffrey N. Gordon, *The Empty Call for Benefit-Cost Analysis in Financial Regulation*, 43 J. LEGAL STUD. (SPECIAL ISSUE) S351, S375 (2014).

¹⁹¹ See Coates, *supra* note 190, at 998–99.

¹⁹² Jonathan S. Masur & Eric A. Posner, *Cost-Benefit Analysis and the Judicial Role*, 85 U. CHI. L. REV. 935, 939–40 (2018).

¹⁹³ Robert P. Bartlett III, *The Institutional Framework for Cost-Benefit Analysis in Financial Regulation: A Tale of Four Paradigms?*, 43 J. LEGAL STUD. (SPECIAL ISSUE) S379, S397–98 (2014); Stephen Charest, *Bayesian Approaches to the Precautionary Principle*, 12 DUKE ENV'T'L L. & POL'Y F. 265, 270–72 (2002).

¹⁹⁴ See Charest, *supra* note 193, at 272.

element follows from this: where rules are made under such circumstances, the agency must commit to updating its assessment—and any regulatory intervention—in light of subsequently emerging evidence.¹⁹⁵ Together, these aspects of the framework would manage both the risk that irreparable social harms may be caused during a period in which agencies lack comprehensive evidence on which to base intervention and the risk that regulatory intervention may impose costs on actors that are not justified by countervailing benefits.

B. Subjective and Territorial Reach

One fundamental choice for policymakers in designing the disclosure framework is which entities should be subject to it. For regular financial disclosures, which seek to promote more accurate pricing in capital markets, this scope encompasses mainly publicly traded firms, as private firms' securities are not traded in public markets.¹⁹⁶ But for climate disclosures, the specific policy goals and rationales extend beyond capital markets, as we have discussed.¹⁹⁷ Moreover, if the footprint of climate disclosure obligations were limited only to public firms, this would create an incentive for firms to “go dark” by delisting in order to avoid having to make such disclosure,¹⁹⁸ or for high-emission activities to switch from listed to private firms.¹⁹⁹ Similar to the scope of non-financial disclosures

¹⁹⁵ See generally Cass R. Sunstein, *The Regulatory Lookback*, 94 B.U. L. REV. 579 (2014).

¹⁹⁶ See Allison Herren Lee, Comm'r, U.S. Sec & Exch. Comm'n, Remarks at The SEC Speaks in 2021: Going Dark: The Growth of Private Markets and the Impact on Investors and the Economy (Oct. 12, 2021) (“[Private companies] are not required to file periodic reports or make the disclosures required in proxy statements. They are not even required to obtain, much less distribute, audited financial statements.”).

¹⁹⁷ See *supra* Sections II.C, III.C.

¹⁹⁸ See Paul G. Mahoney & Julia D. Mahoney, *The New Separation of Ownership and Control: Institutional Investors and ESG*, 2021 COLUM. BUS. L. REV. 841, 873 (2021).

¹⁹⁹ Cf. Christensen et al., *Mandatory CSR and Sustainability Reporting*, *supra* note 164, at 1216 (noting that activities that are problematic for risky from a CSR perspective might shift from SEC-

within the European Union,²⁰⁰ and partly in line with the traditional approach in the United States (where mandatory disclosure rules also apply to large companies, albeit subject to their having a high number of shareholders), climate-related disclosures should be imposed on not only listed but also non-listed entities that meet relevant size thresholds.²⁰¹ Size thresholds in disclosure obligations are typically proxied by asset values, turnover, or number of employees.²⁰² These parameters are likely only loosely correlated with a firm's impact on climate. A closer match to that impact might be achieved if emissions themselves were used to set the thresholds. This in turn implies that not all public companies should necessarily be required to disclose, if they fall below the relevant size test.²⁰³

Policymakers should also consider the territorial reach of their rules, as emissions do not respect borders. Domestic firms subject to climate reporting requirements should be expected to consolidate their global climate risks, to avoid asset reallocation abroad being used to evade disclosure. However, a functionally equivalent result might still be achieved by firms that move their registered office or headquarters to another country. Consequently, policymakers should consider applying domestic climate disclosure rules to all firms that do business there, regardless of where they are headquartered or incorporated. Like certain financial market

registered firms to unregulated (private) firms to avoid the application of mandatory CSR standards).

²⁰⁰ See Directive 2014/95/EU, of the European Parliament and of the Council of 22 October 2014 Amending Directive 2013/34/EU, 2014 O.J. (L330) 1, 4–5.

²⁰¹ Size thresholds can in this context be understood as a proxy for the aggregate level of economic activity being undertaken in the firm. To be sure, smaller firms also face climate risks. The justification for exempting them would be that the costs of disclosure are disproportionately high for smaller firms.

²⁰² See, e.g., 15 U.S.C. § 78l(g) (2018) (mandating disclosure based on asset value and number of shareholders).

²⁰³ The burdens on smaller listed companies could be excessive whenever their impact on climate change via emissions is limited. See EUR. FIN. REPORTING ADVISORY GRP., *supra* note 179, at 53–54.

rules with an extraterritorial reach,²⁰⁴ a mechanism of “substituted compliance” should be available to avoid unnecessary duplication.

C. Going Beyond the Task Force on Climate-Related Disclosure Recommendations

We now move on to identify some areas where, based on the functions and rationales of climate-related disclosures identified in Parts II and III, there appears to be a case for disclosure mandates that go beyond the TCFD Recommendations.

1. Raw Asset-Level Data

One first disclosure item, which appears to be critical to assess physical risks and on which TCFD Recommendations are insufficiently prescriptive, is asset ownership.²⁰⁵ Ownership is neither physically observable nor, even where publicly available in theory, practically accessible, because formal ownership is often registered to subsidiaries and therefore hard to attribute to an individual issuer. Making data on ownership publicly available via firms’ disclosures would allow market participants, and possibly specialized information intermediaries,²⁰⁶ to combine it with geospatial

²⁰⁴ See, e.g., Alexey Artamonov, *Cross-Border Application of OTC Derivatives Rules: Revisiting the Substituted Compliance Approach*, 1 J. FIN. REG. 206, 207–12 (2015) (describing the extraterritorial reach of the over-the-counter derivatives provisions in the Dodd-Frank Act and the mechanism of substitute compliance).

²⁰⁵ See, e.g., TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, FINAL REPORT: RECOMMENDATIONS OF THE TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES 9 fig.2 (2017), <https://assets.bbhub.io/company/sites/60/2020/10/FINAL-2017-TCFD-Report-11052018.pdf> [<https://perma.cc/QNH8-7RTL>] (recognizing that assets “may be particularly affected by climate related issues” but only recommending that firms “provide an indication of the potential climate-related impact on their assets and liabilities, particularly long-lived assets.”).

²⁰⁶ See, e.g., *About OxEO*, OXFORD EARTH OBSERVATION, <https://www.oxfordeo.com/about> [<https://perma.cc/7NPD-3LDW>] (last

and other data as well as with emerging local models of climate risk to deliver an assessment of an individual firm's exposure. It is the key that can tie assessments of asset-level risk, for example about flood risk around a specific factory, back to companies' balance sheets.

A question naturally posed by this discussion is whether it is necessary for firms to be required to disclose their asset ownership information, or whether a private ordering solution might exist. Such a solution might involve companies hiring an information intermediary—perhaps styled as a “climate risks assessor”—which would combine the (public-domain) geospatial data and emerging climate science with proprietary information supplied by the firm about its ownership of assets. The firm could then disclose the third party's analysis of its physical risks without giving away details about asset ownership that could be commercially sensitive.

The problem with an information intermediary model is that there would be no easy way for investors to verify the quality of the assessor's analysis, particularly given that climate risks assessors would model mostly long-tail events. The product sold by such an intermediary would be a credence good. Its market would function poorly because firms stand to benefit from analyses that predict lower (rather than higher) risks, and investors would have no way to verify the quality of the analysis. The inherent conflict of interest of issuer-paid information intermediaries is well understood in other contexts, such as credit ratings and audit services.²⁰⁷ It would be difficult to build a reputation for reliable physical risks analyses: as discussed in Part II, climate risks services are a new product, the relevant variables are constantly changing, there are no accepted methodologies to deploy, and the time

visited Dec. 15, 2021) (using remote-sensing data to identify and measure the sustainability risk exposure of real assets).

²⁰⁷ See, e.g., Ramin P. Baghai & Bo Becker, *Non-Rating Revenue and Conflicts of Interest*, 127 J. FIN. ECON. 94, 95–96 (2018); Samuel B. Bonsall et al., *Conflicts of Interest in Subscriber-Paid Credit Ratings 2* (Sept. 26, 2021), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3931024 (on file with the Columbia Business Law Review).

horizon for users to consider in order to compare outcomes with predictions is very long. It may well be that a market for such services will develop in the future, but it would be putting the cart before the horse if regulators required companies to hire climate risk assessors before the latter gain a reputation in the market for doing a good job. The “regulatory license” problem, which hampers the informational value of rating agencies,²⁰⁸ would characterize this market from its very start.

2. Standardized Scenarios for Climate Stress Tests

Because of the uncertainty around the timing, magnitude, and nature of climate risks, and in particular transition risks,²⁰⁹ companies and their investors struggle to evaluate how these risks might affect them. This motivates a fundamental concern with climate risk disclosures: that issuers’ lack of understanding, or differences of interpretation, of the climate trajectory might mean that disclosures about climate risk are either mis-specified, non-comparable, or both.

One way to deal with this uncertainty is to use “stress tests,” a tool adopted by regulators around the world in the aftermath of the 2007-2009 financial crisis to evaluate the resilience of financial institutions to financial stability risks.²¹⁰ At its core, a stress test involves a review of how a firm’s activities would be affected by hypothetical scenarios that represent possible future states of the world.²¹¹ However, those setting the scenarios do not assign any particular probability to one state or another. The powerful virtue of this methodology is that it provides a way of holding constant, for the purposes of the disclosure exercise, all the many variables

²⁰⁸ See Frank Partnoy, *The Siskel and Ebert of Financial Markets?: Two Thumbs Down for the Credit Rating Agencies*, 77 WASH. U.L.Q. 619, 681–703 (1999) (describing how the regulatory license of credit rating agencies affects the quality of their service).

²⁰⁹ See *supra* Section II.A.

²¹⁰ Martin Čihák, Hiroko Oura & Liliana Schumacher, *What Is Stress Testing?*, FIN. & DEV., Sept. 2019, at 52.

²¹¹ *Id.*

that might affect a firm's risks. This means that the disclosures are meaningfully comparable, and differences between them reflect differences in how each scenario affects the firm's activities, as opposed to how, in our setting, firms interpret the future trajectory of climate change. Of course, the utility of the exercise depends on the scenario having some bearing on the actual trajectory of climate change. To try to ensure this, a calibrated range of scenarios can be set, the results of which investors and others can then use to assess various firms' responses to different climate pathways.

The TCFD incorporates scenario analysis as a way for companies and investors to generate forward-looking information about climate risks. According to the TCFD recommendations, companies develop their own scenarios and report on the risks (and opportunities) they would face.²¹² Scenarios should cover plausible public policy developments, technological advances, and pathways of physical and transition risks.²¹³ The flaw with this approach is that the scenarios developed are not the same across firms, leading to non-comparable outputs.

But TCFD-aligned scenario analysis has so far failed for more fundamental reasons. According to a 2020 TCFD status report, only one in fifteen of the public companies surveyed used scenario analysis to evaluate the resilience of their strategies and even fewer disclosed them.²¹⁴ Of those disclosing, only a few revealed the assumptions and parameters used in the analysis or reported on the risks and opportunities faced in these scenarios.²¹⁵ In part, this can be explained by the complexity of formulating a coherent, plausible scenario and the lack of available data to calibrate analyses.²¹⁶ The TCFD has responded to this challenge by

²¹² TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, TECHNICAL SUPPLEMENT: THE USE OF SCENARIO ANALYSIS IN DISCLOSURE OF CLIMATE-RELATED RISKS AND OPPORTUNITIES 1–5 (2017).

²¹³ *Id.*

²¹⁴ TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, *supra* note 127, at 12.

²¹⁵ *Id.*

²¹⁶ *Id.* at 50–51.

setting up a “Knowledge Hub” that provides guidance, research, tools, standards, and frameworks that companies can use to inform their own processes.²¹⁷ However, there are at least two serious challenges that the TCFD framework does not resolve, many of which stem from coordination problems. First, the scenarios may be designed opportunistically, to paint an artificially rosy picture of the companies’ expected fortunes. Second, if firms use different scenarios when disclosing their transition risks, the comparability of disclosures suffers, which lowers their information value.

One way to make progress is to require the use of standardized scenarios for firms’ analyses. As is the case with stress tests in the financial system,²¹⁸ the relevant public authority should be charged with the task of periodically setting out the scenarios for transition risk assessment. Central banks already collaborate on the development of such scenarios for supervisory purposes,²¹⁹ which they could continue to do for disclosure purposes to ensure cross-sector consistency. Such coordinated scenarios would lower implementation costs for issuers, ensure alignment with policy-relevant transition pathways, and facilitate comparability of disclosures across companies. A centralized approach could also enhance consistency across disclosure demands from financial regulators and other authorities and thereby help ensure coherence in disclosure requirements along the investment chain (from issuers to asset managers

²¹⁷ TCFD KNOWLEDGE HUB, TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES, <https://www.tcfdhub.org> [<https://perma.cc/7PRG-R2A2>] (last visited Dec. 15, 2021).

²¹⁸ *Stress Tests and Capital Planning*, FED. RESRV. (last updated Aug. 5, 2021), <https://www.federalreserve.gov/supervisionreg/stress-tests-capital-planning.htm> [<https://perma.cc/8D5W-8ZQ5>].

²¹⁹ See, e.g., NETWORK FOR GREENING THE FIN. SYS., *NGFS Climate Scenarios Portal: The Future Is Uncertain*, <https://www.ngfs.net/ngfs-scenarios-portal/> [<https://perma.cc/TG4Y-A8G7>] (last visited Dec. 16, 2021) (“[Climate scenarios] have been adapted by the NGFS to help central banks and supervisors explore the possible impacts on the economy and financial system.”).

and asset owners).²²⁰ But companies would still be able (and in fact be encouraged) to concomitantly publish their own scenarios on a voluntary basis, as some of them already do.²²¹

3. Emissions

The TFCF recommends that firms always disclose scope 1 and scope 2 emissions, while scope 3 emissions are only recommended “where appropriate,” leaving the judgment over “appropriateness” to individual firms,²²² possibly in recognition of the difficulties in estimating such type of emissions.²²³ The Transition Pathway Initiative, which assesses companies’ progress on the transition to a low-carbon economy, noted in its 2021 report that only fifty-nine percent of the companies surveyed disclose (some of) their scope 3 emissions, and only forty-three percent disclose use of product emissions.²²⁴ Moreover, disclosure practices vary widely across sectors.²²⁵

Since the recognition of human-induced climate change, most global carbon emissions can be traced to a small number of corporate and state entities. A small subset of companies

²²⁰ See FIN. CONDUCT AUTH., *supra* note 119, at 36 (advocating for an international reporting standard).

²²¹ See, e.g., TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, *supra* note 127, at 52–66 (detailing case studies of three financial sector organizations describing their respective experiences in implementing the TCFD recommendations).

²²² See TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, *supra* note 41, at 22.

²²³ See *id.* at 36; see also Robert S. Kaplan & Karthik Ramanna, *Accounting for Climate Change*, HARV. BUS. REV., Nov.-Dec. 2021, at 120, 123 (highlighting “the difficulty of tracking emissions from multiple suppliers and customers across multitier value chains[, which] makes it virtually impossible for a company to reliably estimate its Scope 3 numbers.”).

²²⁴ See TRANSITION PATHWAY INITIATIVE, TPI STATE OF TRANSITION REPORT 2021, at 15 (2021), <https://www.transitionpathwayinitiative.org/publications/82.pdf?type=Publication> [<https://perma.cc/WEJ3-GAXN>]. Note that, according to the Report’s methodology, a company can qualify as disclosing scope 3 emissions even if it only discloses “some” of its scope 3 emissions. *Id.* at 38.

²²⁵ *Id.* at 40 app. 2.

makes a disproportionate contribution to total anthropogenic carbon emissions.²²⁶ It stands to reason that these “Systemically Important Carbon Emitters” (SICEs)²²⁷ should not be given the discretion to determine whether disclosure of scope 3 emissions is “appropriate” for them, given their relevance for understanding both the phenomenon and the dynamics of climate change and individual SICEs’ transition risk. Additionally, requiring scope 3 emissions disclosure will reduce the risk of disclosure rules avoidance by outsourcing “dirty” activities along a SICE’s supply chain, most likely in the poorest countries with the least advanced corporate climate disclosures. Put in positive terms, comprehensive corporate climate disclosures adopted in advanced economies could aid the decarbonization process across global supply chains.²²⁸

4. Net-Zero Pledges

SICEs will be linchpins in the transition towards a lower-emissions world. On the one hand, they will be heavily exposed to it. On the other hand, they can catalyze it with their strategic choices. These characteristics suggest that a special reporting regime, one that not only covers financial risks and emissions but also makes explicit the transition plans that companies may or may not have, will be valuable to investors and society. The TCFD recommends that firms “describe their key climate-related targets such as those

²²⁶ Studies estimate that up to two-thirds of emissions may have originated in about ninety companies. See, e.g., Richard Heede, *Tracing Anthropogenic Carbon Dioxide and Methane Emissions to Fossil Fuel and Cement Producers, 1854-2010*, 122 CLIMATE CHANGE 229, 231 (2014); Douglas Starr, *supra* note 28.

²²⁷ John Armour, Luca Enriques & Thom Wetzer, *Corporate Carbon Reduction Pledges: Beyond Greenwashing*, UNIV. OF OXFORD FACULTY OF L.: OXFORD BUS. L. BLOG (July 2, 2021), <https://www.law.ox.ac.uk/business-law-blog/blog/2021/07/corporate-carbon-reduction-pledges-beyond-greenwashing> [<https://perma.cc/NYV3-Q5AY>] (defining SICEs as a category of the relatively small number of companies that contribute to the majority of global carbon emissions.)

²²⁸ MARK CARNEY, VALUE(S): BUILDING A BETTER WORLD FOR ALL 330 (2021).

related to GHG emissions, water usage, energy usage, etc., in line with anticipated regulatory requirements or market constraints or other goals.”²²⁹ The reference to “targets” creates some ambiguity: is a target just something you aspire to or, more meaningfully, something you commit to? Companies may exploit such ambiguity for greenwashing purposes.

To reduce this risk, SICEs should be required to disclose, in addition to their (emissions) *targets*, whether they have a plan to achieve those targets, and if so, what that plan looks like, to what extent they have made progress towards achieving their targets and how they have committed to that plan. An increasing number of companies—including those that would likely be designated as SICEs—do provide some information about their targets and the strategies to pursue them,²³⁰ which at first glance may seem to obviate the need for mandatory disclosure in this area. But a closer look at these disclosures reveals that, even when targets are presented as plans, they lack specifics and interim milestones. Particularly when the plans involve “net-zero” targets that allow for negative emissions to offset emissions, they tend to rely heavily on unproven technology, rendering it difficult for third parties to track the company’s progress or to assess whether such plans are realistic.²³¹

²²⁹ TASK FORCE ON CLIMATE-RELATED FIN. DISCLOSURES, IMPLEMENTING THE RECOMMENDATIONS OF THE TASK FORCE ON CLIMATE-RELATED FINANCIAL DISCLOSURES 18 (2017) <https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Annex-Amended-121517.pdf> [<https://perma.cc/7QJF-WPT7>].

²³⁰ See Armour et al., *supra* note 227.

²³¹ For example, ExxonMobil’s plans rely heavily on carbon capture to offset emissions. See ExxonMobil, *ExxonMobil Low Carbon Solutions to Commercialize Emission-Reduction Technology*, Press Release, Feb 1, 2021, https://corporate.exxonmobil.com/News/Newsroom/News-releases/2021/0201_ExxonMobil-Low-Carbon-Solutions-to-commercialize-emission-reduction-technology. In theory, carbon capture would permit the firm to retain its existing fossil-fuel based business model but have the net emissions reduced to zero. However, carbon capture relies on untested and unproven technology, the developmental track record of which has so far been disappointingly slow. This suggests that reliance primarily on carbon capture, without major change in the emissions associated with

A mandatory reporting regime can be instrumental to enabling outsiders to distinguish between companies credibly committed to net-zero targets and greenwashing ones. The first element of this regime is a requirement that companies disclose whether they have undertaken an emission-reduction commitment, for example, one that is aligned with the goals of the Paris Agreement. If the company does not have a commitment that meets the threshold, it should be required to explain why it does not have such a plan in place. Companies that indicate they do have a commitment will have to specify their plans for meeting it, which should include interim milestones, a financial analysis showing how the plan ties in with its business strategy, and an explanation of the assumptions upon which the plan is premised. Finally, the company will have to disclose how it commits to delivering on the plan and what the consequences are, if any, of failing to meet milestones or abandoning the plan. For example, the securities issued to finance the plan could include clauses, again tied to interim milestones, that hike interest rates when the company does not deliver on its promises.²³²

The transparency and consistency of this regime would lower the incentives for companies to make meaningless promises to reduce emissions, thereby creating a separating equilibrium that would help investors more easily distinguish between credible and non-credible commitments. A counterargument could be that these requirements may dissuade many companies from making any emission-reduction commitments at all. This outcome, though depressing, would be entirely consistent with our goal of

ExxonMobil's underlying business model, will not put the company in a position to deliver net zero by 2050. *See* Letter from Engine No. 1 LLC to Bd. of Dirs., Exxon Mobil Corp. (Feb. 22, 2021), <https://reenergizexom.com/materials/letter-to-the-board-of-directors-february-22> [<https://perma.cc/SLJ9-KPG6>]. This suggests that reliance primarily on carbon capture, without major change in the emissions associated with ExxonMobil's underlying business model, will not put the company in a position to deliver net zero by 2050. *See id.*

²³² *See, e.g.*, John Armour, Luca Enriques & Thom Wetzer, Green Pills: Making Corporate Climate Commitments Credible (Nov. 17, 2021) (unpublished manuscript) (on file with the Columbia Business Law Review).

helping investors screen out greenwashing. It would pull back the veneer of comfort that weak commitments create and re-emphasize, now with the requisite urgency, the challenge that the climate transition entails.

D. Implications for the Regulatory Architecture

Effective implementation of the disclosure framework we envision places heavy demands on the relevant regulatory bodies. The appropriate set of information to be disclosed in relation to climate risks is a moving target. The phenomenon of climate change is evolving in real time, and so too is our understanding of it. Moreover, climate risks are themselves nonstationary, functions not only of the climate itself but also of the collective human response thereto (including government policy, firm investment and research and development decisions, consumer choices, and feedback between all of these). Hence, while it is necessary to identify the “best” information set for climate risk disclosures, a one-time specification is insufficient. The disclosure regime needs to have a built-in dynamic component to ensure it is updated rapidly to incorporate emerging physical, scientific, and socio-economic insights.

Regulatory competence will also be key. Implementing corporate climate disclosure policies places high institutional demands for expertise, information, and analysis on regulators: operating in an uncertain and rapidly evolving landscape, they need to stay informed of scientific developments across fields ranging from climate science and geospatial data to finance. They also need to be responsive to the (interacting) needs and actions of investors, issuers, and the system-wide implications for risk management and the net-zero transition. All of this will, finally, require enormous amounts of data and novel ways of modeling.²³³

²³³ See *supra* Section II.A. See generally J. Doyne Farmer, Alissa M. Kleinnijenhuis & Thom Wetzer, *Stress Testing in the Financial Macrococosm*, in *HANDBOOK OF FINANCIAL STRESS TESTING* (J. Doyne Farmer et al., eds.) (forthcoming Jan. 2022) (manuscript at 23–25),

In that sense, the regulatory challenge presented by corporate climate disclosures is akin to that faced by macroprudential agencies. Their goal is to ensure the resilience of financial institutions to systemic risk that materializes as a function of system-wide dynamics and to enhance and protect the resilience of the financial system in its entirety. Like climate risks, systemic risk in the financial system reflects a dynamic set of issues, characterized by uncertainty and contingent on complex interactions between market participants.²³⁴

As the 2007-2009 financial crisis revealed, regulators focused on market operations alone do not have the appropriate expertise to assess the stability of the financial system.²³⁵ That is why the introduction of the macroprudential approach was accompanied by institutional reform. New “macroprudential agencies,” such as the U.S. Financial Stability Oversight Council and the U.K. Bank of England’s Financial Policy Committee, were created to monitor and assess developments in the financial sector for the purpose of preserving financial stability. Like the approach we advocate for climate disclosure policies, these agencies view financial stability from the dynamic perspective of business and credit cycles in the economy rather than the classical static framework. Such macro-monitoring capabilities require access to high-quality information and research—in the United States, delivered through the Office of Financial Research and in the United Kingdom, by the research functions of the Bank of England.²³⁶ This then feeds into the specification and design of flexible macroprudential policies, like stress tests, that leave these agencies flexibility to respond to current and emerging risks. In our view, this widespread deployment of macro-prudential oversight as a regulatory technique illustrates the feasibility of a dynamic,

https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3913749 (on file with the Columbia Business Law Review).

²³⁴ See *supra* Section II.A.

²³⁵ See, e.g., JOHN ARMOUR ET. AL., PRINCIPLES OF FINANCIAL REGULATION 409, 411 (2016).

²³⁶ *Id.* at 425–29.

as opposed to static, approach to responses to a collective problem characterized by uncertainty.

Clearly, the analogy between macroprudential policy and climate disclosure is imperfect: the institutional demands required for successful development of climate risk disclosures differ from macro-prudential oversight. Nevertheless, we may doubt whether institutions that were not well-equipped to evaluate system-wide financial dynamics would be able to master the complexities of climate change and transition dynamics—a challenge that is arguably more complex.²³⁷ Whatever agency is designated to take up this task will therefore have to develop the analytical competencies and culture, as well as the access to data, necessary to shoulder it. This challenge is perhaps most evident in our recommendation that corporate climate disclosures include stress tests around standardized transition scenarios as a way to create a common frame of reference in a fast-evolving risk environment.²³⁸

The precise configuration of the scenarios will vary and will likely take place in coordination with the government agency responsible for transition planning. At the same time, many of the risks associated with climate change are beginning to receive extensive attention from central banks, whose research departments are consequently building the relevant expertise.²³⁹ These are likely to be good sources of insight into the economic consequences of transitioning to a low-carbon economy for actors in the financial system and for the economy at large.

²³⁷ Farmer et al., *supra* note 52, at 339, 343, 346.

²³⁸ See *supra* Section IV.C.2.

²³⁹ See, e.g., Press Release, Eur. Cent. Bank, ECB Sets Up Climate Change Centre (Jan. 25, 2021), https://www.ecb.europa.eu/press/pr/date/2021/html/ecb.pr210125_1~3fc4eb4c6.en.html [<https://perma.cc/KP76-H5AW>] (creating a climate center within the ECB that “will shape and steer the ECB’s climate agenda internally and externally”); Pete Schroeder, *U.S. Fed Taps Official To Lead New Climate Change Team*, REUTERS (Jan. 25, 2021, 4:38 PM) <https://www.reuters.com/article/usa-fed-climate-idUSL1N2K02GM> [<https://perma.cc/HG54-7WNR>] (creating a new team in the U.S. Federal Reserve “focused specifically on financial risks posed by climate change”).

A distinct, but similarly non-trivial, challenge for the regulatory architecture concerns enforcement. To the extent that mandated disclosures are material to investors, then private enforcement is a possibility. But to the extent that disclosures are mandated of information that is not material to investors—as with, for example, the European Union’s concept of “double materiality”²⁴⁰—then private enforcement cannot be taken for granted. It will be necessary therefore for public enforcement to be of sufficient intensity to support the regime’s functioning.

V. CONCLUSION

Mitigating the worst consequences of climate change by transitioning to a net-zero economy requires investment on a large scale. Directly pricing emissions, the first-best solution to drive capital reallocation, is considered politically infeasible—so policymakers instead put their currency towards facilitating the pricing of climate risk by investors. Yet, investors, faced with scientific and policy uncertainty around climate risks compounded by a lack of information about companies’ exposures, struggle to do just that. Current disclosure policies do not require companies to disclose the information that investors need to price climate risk, and voluntary frameworks like the TCFD—important as they are—have failed to turn the tide. The result is mispricing and a misallocation of capital, which harms investors and hampers the net-zero transition.

Based on traditional securities regulation rationales and the net-zero imperative, we conclude that there is a case for mandatory corporate climate disclosures. But what should these policies look like? As governments increasingly consider mandating corporate climate disclosures, articulating guiding principles against which their proposals can be evaluated becomes important both to support their efforts and to call out policy greenwashing. The principles we have outlined go beyond the emerging consensus by extending disclosure requirements to raw asset-level data, standardizing

²⁴⁰ See *supra* note 180 and accompanying text.

transition scenarios for climate stress tests, and—for SICEs—demanding disclosure of scope 3 emissions and more information about their net-zero pledges. Even if appropriately implemented through a regulatory architecture that is sufficiently dynamic and adaptive, improved corporate climate disclosures are no silver bullet. However, they may contribute to a learning process that leaves issuers, investors, the market, and society at large better attuned to the challenges and opportunities of the net-zero transition.