The Role of Disclosure in Green Finance

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Abstract

We study the design features of disclosure regulations that seek to trigger the green transition of the global economy and ask whether such regulatory interventions are likely to bring about sufficient market discipline to achieve socially optimal climate targets. We combine a granular institutional analysis with theoretical and empirical insights from economics and finance. Finance theory and empirical evidence suggest that investors may prefer “green” over “dirty” assets for both financial and non-financial reasons and may thus demand higher returns from environmentally-harmful investment opportunities. Investor-led market discipline based on such a cost-of-capital effects can indeed benefit from mandatory transparency requirements and their rigid (public) enforcement, because these requirements prevent an underproduction of the standardized high-quality information that investors need in order to allocate capital according to their preferences.

We categorize the transparency obligations stipulated in green finance regulation as either compelling the standardized disclosure of raw data, or providing quality labels that signal desirable green characteristics of investment products based on a uniform methodology. Both categories of transparency requirements can be imposed at activity, issuer, and portfolio level. The normative arguments for stipulating different categories of transparency obligations on different levels depend on the sophistication of investors and their capacity to process and evaluate information, with “green” labels being particularly attractive not only for retail investors.

We also identify many forces that may prevent markets from achieving socially optimal equilibria, corporate governance problems and other agency conflicts in intermediated investment chains among them. Therefore, disclosure-centered green finance legislation is a second best to more direct forms of regulatory intervention like global carbon taxation and emissions trading schemes. However, inherently transnational market-based green finance concepts can play a supporting role in the sustainable transition, which is particularly important as long as first-best solutions remain politically unavailable.

Keywords: green finance, sustainable finance, ESG, mandatory disclosure, taxonomies, benchmarks, labels, asset pricing, market discipline, climate change, climate risk

JEL Classifications: D4, D6, G1, G3, G4, K2

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The Role of Disclosure in Green Finance

A critical assessment of transparency-centered regulatory interventions that seek to unleash market forces to support the transition to a carbon-neutral economy

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A critical assessment of transparency-centered regulatory interventions that seek to unleash market forces to support the transition to a carbon-neutral economy

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1 Introduction

Anthropogenic climate change is a reality that will impact incrementally on all areas of human life, including economic activity and the social welfare it creates.[1] The *Dynamic Integrated model of Climate and the Economy* (DICE model) developed by Nobel laureate William D. Nordhaus[2] shows that global warming caused by the use of fossil energy leads to a rise in climate-induced damages relative to total output before a harmful event, and therefore precipitates a decrease in the net output of the economy.[3] Furthermore, the increasing average temperature slows the growth rate of an economy's capital stock,[4] that is the inventory of assets that facilitate production. Finally, it augments the stochastic risk[5] of climate-induced natural disasters.[6]

In the wake of the financial crisis of 2007 and 2008, commentators reemphasized the fundamental function of the financial system in capitalist economies: it should channel capital flows to investment opportunities that create the maximum benefit for society as a whole.[7] From this angle, it is no wonder that policy makers have attempted to tackle the threat climate change poses to social welfare and ultimately human existence, including through regulatory interventions that seek to align the allocative function of financial markets with sustainability objectives. Global initiatives indeed tend to envision significant efforts to rebalance economic activities in market economies to make them ecologically (and socially) more sustainable. The most important statements of intent in this direction include the UN 2030 Agenda for Sustainable Development[8] and the Paris Agreement[9] that entered into force in 2016 and designates greening the financial system as one of three primary objectives alongside the temperature objective itself.[10] These documents constitute points of reference for many policy initiatives that deliberately aim at influencing the market mechanism to achieve climate protection goals

[1] See only Brett R. Scheffers et al., 'The broad footprint of climate change from genes to biomes to people' (2016) 354 (6313) Science 719.

[2] For the seminal contribution see William D. Nordhaus, 'An Optimal Transition Path for Controlling Greenhouse Gases' (1992) 258 Science 1315.

[3] William D. Nordhaus, 'Revisiting the social cost of carbon' (2017) 114 PNAS 1518; for evidence on the significant rise of economic losses from extreme weather events between 2007 und 2016 see Nick Watts et al., 'The Lancet Countdown on health and climate change: from 25 years on inaction to a global transformation for public health' (2018) 391 Lancet 581.

[4] Melissa Dell, Benjamin F. Jones, and Benjamin A. Olken, 'Temperature and Income: Reconciling New Cross-Sectional and Panel Estimates' (2009) 99 AER 198; Melissa Dell, Benjamin F. Jones, and Benjamin A. Olken, 'Temperature Shocks and Economic Growth: Evidence from the Last Half Century' (2012) 4 AEJ:Macro 66.

[5] In particular, insurance companies use the so called Poisson-process to estimate the respective probabilities, see generally Sheldon M. Ross, *Stochastic Processes* (Wiley 2d ed. 1996) 59-96.

[6] Ravi Bansal, Marcelo Ochoa, and Dana Kiku, 'Climate Change and Growth Risk' (2016) NBER Working Paper No 23009 <http://www.nber.org/papers/w23009.pdf> accessed 30 March 2021; Christos Karydas and Anastasios Xepapadeas, 'Climate change risks: pricing and portfolio allocation' (2019) CER-ETH Economics Working Paper 19/327 <https://www.ethz.ch/content/dam/ethz/special-interest/mtec/cer-eth/cer-eth-dam/documents/working-papers/WP-19-327.pdf> accessed 30 March 2021.

[7] See Robert J. Shiller, *Finance and the Good Society* (Princeton University Press 2012) 7; John Kay, *Other People's Money* (PublicAffairs 2016) 5-6; Joseph A. Stiglitz, *The Stiglitz Report* (New Press 2010) 57; see also, John Cochrane, 'Finance: Function Matters, Not Size' (2013) 27 JEP 29, 29-30, 48 (focusing on functional aberrations).

[8] G.A. Res. 70 (25 Sep. 2015) <http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E> accessed 29 November 2021.

[9] [2016] OJ L 282/4.

[10] Paris Agreement, art. 2(1)(c).

without directly intervening in market outcomes through activity-restricting regulation or Pigouvian taxation.[11] The posterchild in this regards is the European sustainable finance workstream under the so-called 'Green Deal' initiative.[12] The European Commission's ultimate objective here is nothing less than tweaking the whole financial system in a new direction by stimulating market participants' assumed appetite for "green" financial instruments.[13] The primary tool here is an abundance of disclosure obligations. These obligations pursue the overarching objective of providing deeper and more comparable information on the climate impact of investments, broadly understood. Rational investors receive a superior knowledge base upon which to make informed decisions, which would channel more capital into "green" activities and de-fund "dirty" ones, ultimately leading to a transformation of the economy induced by market discipline. High-quality transparency would allow investors to identify both firms with high climate-risk exposures *and* firms with green opportunities (i.e. those that would prosper in an economy more geared towards sustainability). The regulatory intervention is aimed at unhinging the steady state and ushering in a new, "greener" equilibrium by inducing a shift in capital supply. Decreasing the amount of "dirty" activities also creates positive externalities beyond the immediately affected firms because it reduces climate risks that could negatively impact upon other firms. At the same time, greater transparency of the environmental characteristics of a company's real-world economic activities might help to quantify climate risks on the books of financial institutions, and thereby limit the potential impact of future climate-related shocks on financial stability.[14]

This "light touch" interference with a politically and fiscally quasi-neutral activation of market forces arguably avoids conflicts that arise from the distributional consequences of direct regulation and taxes, particularly in a global context in which there are severe imbalances across economies. Yet, the idea of jolting the transition to a decarbonized economy through market discipline rests on strong assumptions as to how financial markets work and allocate resources. More specifically, it depends pivotally on how heterogeneous investor preferences could translate into aggregate demand for "green" assets and how issuers would in turn respond – pro- or retro-actively – to shifts in demand to retain access to capital under favorable conditions. Further complications arise too here, because real-world investment transactions rarely occur in the form of bilateral exchanges, but instead typically involve various

[11] For the standard economic recommendations on how to deal with activities that entail environmental externalities see William Baumol, 'On Taxation and the Control of Externalities' (1972) 62 AER 307; for a summary of the key determinants in instrument choice see Donald N. Deewes, 'Instrument Choice in Environmental Policy' (1983) 21 Economic Inquiry 53; Donald N. Deewes, Frank Mathewson, and Michael Trebilcock, 'The Rationale for Government Regulations of Quality and Policy Alternatives in Quality Regulation', in Donald N. Deewes (ed.), *Markets for Insurance: A Selective Survey of Economic Issues* (Butterworth 1983); for a recent account see J. Doyne Farmer et al., 'Sensitive Intervention Points in the Post-Carbon Transition' (2019) 364 (6435) Science 132 (looking into the context dependent, relative effectiveness of regulatory interventions to induce the decarbonization of the economy).

[12] For an overview, see European Commission, 'Overview of sustainable finance' <https://ec.europa.eu/info/business-economy-euro/banking-and-finance/sustainable-finance/overview-sustainable-finance_en> accessed 8 May 2021. We highlight similar initiatives pursued around the globe below 2.1.

[13] See e.g. European Commission, Action Plan: Financing Sustainable Growth (8 March 2018), COM(2018) 97 final, 2 (aiming to "reorient capital flows towards sustainable investment in order to achieve sustainable and inclusive growth" and identifying "a lack of clarity among investors regarding what constitutes a sustainable investment" as a "contributing factor" behind the investment gap).

[14] For a discussion of potential systemic consequences, see e.g. European Systemic Risk Board (ESRB), 'Too late, too sudden: Transition to a low-carbon economy and systemic risk' (2016) Reports of the ESRG Advisory Scientific Committee No 6.

intermediaries. Moreover, these transactions require collective decision-making at least on the side of issuers who are typically complex organizations. Therefore, in the real world, the investment process is fraught with agency conflicts that may account for significant deviations from micro-economic and finance models.

This paper analyzes the preconditions under which a disclosure-centered approach to green finance could stimulate capital market discipline and achieve sustainability objectives. Its key contribution is to synthesize a deep institutional understanding of the structure of "green" transparency requirements with both theoretical and empirical insights from economics and finance on how markets price assets and allocate capital. This synthesis yields a contextualized understanding of the promises and limitations of market-centered green finance that also allows inferences on how to best design "green" disclosure obligations. The paper is divided into three parts.

In the first part, we illustrate the regulatory model (see section 2 below). We start by proposing a two-dimensional framework to categorize different transparency measures according to the type of information (raw data or label) and the level of the investment chain that they pertain to (activity, issuer, or portfolio). Recognizing that there is no uniform notion of "green information" helps when navigating the increasingly complex legal landscape of climate-related transparency initiatives. It also allows for better tailoring of economic policy analyses to the rules and regulations that social planners actually promulgate or are considering to adopt. We continue with illustrating the explanatory power of our distinction by providing an overview of some recent regulatory initiatives that aim to improve transparency in the area of green finance. We focus on private and public initiatives in key jurisdictions that share the regulatory objective of market-centered green finance.

In the second part, we examine the theoretical consistency and empirical plausibility of the approach towards green finance which puts increased transparency in center-stage (see section 3 below). As a first step, we ask under which conditions financial markets may reallocate capital from "dirty" to "green" activities. Building on recent contributions to the theoretical and empirical finance literature, we analyze through which channels "green" considerations may enter an investor's calculations and may eventually affect equilibrium outcomes. Overall, our review confirms that financial as well as non-financial considerations might increase demand for "green" assets. Such a shift in demand is, at the outset, apt to induce at least some decarbonization of economic activities, yet, we also identify severe challenges which may impede the transition to a net-zero carbon-emission economy. As a second step, we ask why and to what extent there is a role to play for government intervention in fostering the production of information which investors may need to make investment decisions that will result in the desired re-routing of capital. We argue that climate-related disclosure should be mandatory and publicly enforced because both theory and recent empirical findings suggest that market forces do not suffice in overcoming the fundamental information asymmetry in green finance due to the public good characteristics of high quality standardized information. Building on our two-dimensional distinction for regulatory initiatives, we also emphasize how arguments for and against transparency rules deserve different weight for different types and levels of information. We round off the discussion by sketching how the various agency relationships in real-world investment chains may compromise the effectiveness of "green" market discipline, although we believe these forces ultimately do not completely invalidate the approach.

In the third part, we conclude by briefly commenting on the policy implications of our analysis (see section 4 below). Despite all the provisos we identify, we see an information-centered approach to green finance as a viable policy option. Yet, not least, the many challenges we see lead us to emphasize that all arguments in favor of such policies are subject to the caveat that they cannot and should not be a substitute for more direct regulatory interventions to tackle the fundamental externalities problem that underlies climate change. That said, the less likely it is to achieve superior solutions such as a comprehensive global carbon emissions trading scheme or a carbon tax in the political arena, the stronger the case becomes for second-best market-based – and at the outset transnational – solutions. Of course, cost-benefit analysis remains a challenge for any government interference. Yet, although we concur with the basic notion that regulators should not adopt measures if these interventions do not increase welfare, we caution against insisting on all-too-formal, quantitative cost-benefit analyses of green finance policies: realistically, such analyses are simply not feasible. Instead, qualitative considerations such as the precautionary principle may serve as viable guideposts when it comes to practical policy decisions, alongside the existing partial empirical evidence.

2 The market-based regulatory approach to green finance: An overview

In this section, we sketch the regulatory concept that underpins the transparency-centered approaches to green finance. The overarching objective of these approaches is to unleash market forces and induce market discipline to propel the transition to a net-zero carbon-emission economy. The main tool, that is deployed with due variation, is enhanced transparency, allowing all actors in the investment chain to make informed decisions that reflect an accurate assessment of their activity's climate impact.

We specify this concept that unites all market-based initiatives in green finance by looking at the main functional building blocks of the regulatory approach that puts standardized disclosure obligations at the heart of the legislative intervention in order to activate market forces to de-carbonize the economy. We start by introducing a conceptual distinction between the disclosure of climate impact raw data on the one hand and the evaluating classification of economic activities through transparent climate impact labels (quality signals) on the other; both categories of transparency requirements can occur at different levels of aggregation (activity, issuer, and portfolio) (infra 2.1). We also illustrate our functional mapping of the regulatory tools deployed in the market-based approach to green finance by presenting real-world examples of strategies that legislators pursue in key jurisdictions along the lines of our analysis (infra 2.2).

2.1 Categories and levels of "green" transparency requirements

In this subsection, we introduce the basic categories and levels of disclosure obligations in green finance (infra 2.1.1) and describe the basic features of each type (infra 2.1.2) and layer (infra 2.1.3) of the respective transparency requirements.

2.1.1 Basic, two-dimensional distinction

In recent years, the information landscape in green finance has grown fairly complex. Today, it spans a wide array of instruments, some provided by governments, some by private organizations. At a very high level of abstraction, all these instrument aim to reduce information asymmetries in relation to

climate-related aspects of investment opportunities. On a more detailed level, however, the transparency instruments employed by regulators and other actors are quite diverse. Different measures aim to cater different kinds of information to different audiences. Lumping all "green" (or even more generally, environmental, social and governance (ESG) issues)[15] transparency initiatives together therefore risks comparing apples and oranges.

We find it useful to analyze the legal, economic and policy questions in green finance against the backdrop of a simple, two-dimensional conceptual framework. The first dimension differentiates between two information categories: unevaluated quantitative or qualitative information ("raw data"), and information that encodes a normative assessment ("labels") (below 2.1.2). The second dimension differentiates between three levels to which information of either category may pertain: economic activities, issuers of financial instruments, and portfolios of such instruments (below 2.1.3). This two-dimensional distinction allows us to discuss more succinctly the content and relationship of different legislative interventions (below 2.2), and to analyze in more detail the functional rationales of green finance disclosures (below 3.2.3). Table 1 summarizes these basic distinctions and Table 2 (below 2.3) reverts to our metric and visualizes how different regulatory and private initiatives that we will discuss in this section (below 2.2) map onto our basic framework.

	Raw data **unevaluated information to allow informed investment decisions**	**Labels** **Evaluation of "green" characteristics based on fixed set of criteria (seal of quality; scores)**
Economic activity	Emissions etc.	Taxonomies: • metric for identification of "green" properties of activity; and • disclosure of alignment with specifications.
Firm (Issuer)	Aggregate emissions of firms; Percentage of aligned activities	Seals, ratings, index inclusion, etc.
Portfolio	Weighted average emissions, etc.; Weighted percentage of activities aligned with (lower-level) labels etc.	Seals, ratings, indices, etc.

2.1.2 Information categories

The distinction between label-type and raw data information is neither new nor specific to the world of investing. In fact, it is well-established in the area of environmental information concerning non-

[15] While our main interest in this article is climate-related transparency, we recognize that the line between climate-related and "other" environmental or social matters is neither in theory nor in practice clear cut. The analytical framework that we provide is a general one that can seamlessly be extended to any other real-world phenomenon that information can pertain to. However, the persuasiveness of functional rationales for regulatory intervention and the balance of costs and benefits may vary within the ESG universe.

financial products and services.[16] Most prominently, the International Organization for Standardization (ISO) distinguishes between seal-type, consumer-facing environmental labels that indicate the overall environmental preferability based on a multi-criteria approach (so-called Type I labels)[17], and environmental declarations that provide "quantified environmental data using predetermined parameters" and are primarily intended for use in wholesale markets (so-called Type III declarations).[18]

Within our framework, we understand "raw data" to include the entirety of information that might be relevant for an economic actor's own assessment of the "greenness" of an economic activity, issuer or portfolio. Throughout our analysis, we use metrics measuring carbon emissions as the chief example of "raw data." It should be noted, however, that in our framework the "raw data" can in principle also be forward-looking (e.g. an emissions reduction target), binary (e.g. membership in a certain organization) or qualitative (e.g. a strategy description), so long as they do not encode a judgment of relative "greenness" based on normative criteria developed by a regulator or a private actor.

Labels, on the other hand, compress one or more pre-defined objective indicators, based on a clear, technical definition or a specific methodology, into a label-type quality signal, such as a seal,[19] a rating, or a ranking. These labels aim to express the desirability or preferability of certain characteristics of the item that they pertain to. They explicitly or implicitly encode an evaluation or judgment: "green" or "dirty," "good" or "bad," more or less environmentally friendly, etc. By design, labels are inherently subjective. The criteria and thresholds used in the labeling methodology will, at least to some extent, always be debatable. This arbitrariness of labeling frameworks, however, should be seen as a feature, not as a bug.

On ideal neo-classical markets, where fully rational agents can process even the most complex information without any costs and transact with each other without frictions, there would be no need for the provision of labels: actors could just look directly at the raw data that underpin the labels and then form their own opinion on the absolute or relative "greenness" of the relevant object. In accordance with the fundamental assumption of the efficient capital market hypothesis (ECMH),[20] (fully) rational investors would process all available information adequately and thus reflect all disclosed raw data in their pricing of financial instruments. On real world markets, however, bounded rationality and transaction costs can impede such outcomes. Quality labels respond to limitations, which might prevent some investors from efficiently translating publicly available information into prices and ultimately investment decisions aligned with their preferences. Under these preconditions, "green" labels that signal favorable climate impact properties of investment opportunities may add value in inducing a

[16] See e.g. Nikolay Minkov, Annekatrin Lehmann, Lisa Winter, and Matthias Finkbeiner, 'Characterization of environmental labels beyond the criteria of ISO 14020 series' (2020) 25 Int J Life Cycle Ass 840 (developing a multi-dimension characterization scheme for the provision of environmental product information).

[17] ISO, Environmental labels and declarations: Type I environmental labelling, Principles and Procedures, ISO 14024:2018, para. 3.1.

[18] ISO, Environmental labels and declarations: Type III environmental declarations, Principles and procedures, ISO 14025:2006, introduction and para. 3.2.

[19] The latter represents a binary qualification where objects either receive the quality seal or not.

[20] See Eugene F. Fama, 'Efficient Capital Markets: A Review of Theory and Empirical Work' (1970) 25 JF 383; for the seminal discussion of the regulatory implications of the ECMH see Ronald J. Gilson and Reinier H. Kraakman, 'The Mechanisms of Market Efficiency' (1984) 70 Va. L. Rev. 549.

"green" (re-)allocation of capital, by transforming hard-to-assess "credence" qualities of investment opportunities into simple "search" qualities.[21]

2.1.3 Information Levels

One of the main differences between environmental information regarding non-financial products or services on the one hand and financial instruments that fund the provision of these goods on the other is that the climate impact of the latter can typically be assessed on multiple levels. The interconnections within the financial sector, the varying lengths of real-world intermediation chains, and the multitude of organizational arrangements for conducting business, requires sacrificing some granularity and accepting a certain degree of simplification if the phenomena in the investment universe are assigned to a small number of levels. Yet still, we believe that distinguishing three different levels at which regulators could stipulate transparency obligations enhances our conceptual understanding of market based green finance.

The lowest level is that of an economic activity that may receive funding from an investor. Consider, for example, the production of a certain type of car. In order to evaluate the "greenness" of this activity, one could look at several raw data indicators along the entire value chain, from the carbon emissions during the production process, to energy consumption during the vehicle's use (fossil fuel or electricity), to the recyclability of its parts at the end of the life-cycle. Some or all of these indicators may also form the basis for an easier-to-digest label of the car production's overall "greenness". This label could, for example, come in the form of a binary qualification, where the activity receives a "green seal" if it fulfils certain criteria, in the form of a ranking that compares the environmental performance of the production lines of different types of cars, or in the form of a rating that computes a "green score" based on the manifestation of certain raw data indicators.

The intermediate level is that of an individual issuer of a financial instrument, such as an equity or (general purpose[22]) debt security. The prototype of such an issuer is a corporation that engages in a variety of different activities and/or outsources certain activities at various stages of production. For instance, a manufacturer of electric vehicles might also be in the business of manufacturing vehicles with combustion engines, and may have outsourced various stages of production with a just-in-time organization. Climate-related raw data reported at the level of such an issuer might include, for example, data on greenhouse gas (GHG) emissions or relevant reduction targets. As regards GHG emissions, it is common to distinguish between three scopes: Scope 1 emissions are those directly emitted by the company or its subsidiaries, Scope 2 are those from the production of purchased energy (electricity, steam, heat, cooling), and Scope 3 includes all other emissions that occur along the corporate value chain (both up-stream and downstream).[23] These and other climate-impact-related disclosures at the level of individual issuers can be thought of as an extension of more traditional corporate disclosures

[21] Generally on the distinction between search, experience and credence qualities of consumer goods see Michael R. Darby and Edi Karni, 'Free Competition and the Optimal Amount of Fraud' (1973) 16 J L & Econ 67, 68-70; see also John Thøgersen, Pernille Haugaard, and Anja Olesen, 'Consumer responses to ecolabels' (2010) 44 Eur J Marketing 1787, 1788 (noting that ecolabels „transform credence attributes to search attributes").

[22] On the special case of green bonds see below 2.2.2.1.

[23] The scope classifications follow from the carbon accounting standards of the GHG Protocol, in particular the Corporate Standard and the Corporate Value Chain (Scope 3) Standard, available along with further documentation at <https://ghgprotocol.org/standards> accessed 31 May 2021. See also below 3.2.2.1.

(balance sheets, P&L, cash flow statements, etc.), serving the information needs of current and prospective investors by providing standardized (and hence comparable) information that might[24] be useful for the recipients' investment decisions.[25] As with the activity-level, issuer-level raw data may also form the basis for various types of labels that compress emissions and other data into simple seals, rankings, or scores.

The highest level is that of a portfolio that combines financial instruments of different issuers. Today, many investment relationships involve specialized intermediaries that collect and invest capital on behalf of the ultimate beneficiaries.[26] Asset managers and other institutional investors allow investors to acquire prepackaged portfolios of financial instruments, most prominently in the form of mutual fund shares (including exchange traded funds (ETFs)). For green finance, this adds an additional layer at which transparency requirements might be instituted. The information at the portfolio level can again come in the form of raw data (e.g. value-weighted averages of issuer-level emission information by scope), or in the form of labels.

2.2 Regulatory interventions in key jurisdictions

In this subsection, we illustrate our functional mapping of the regulatory tools by classifying real-world examples of such strategies that legislators pursue in key jurisdictions along the lines of our distinctions. We first look at transparency-centered green finance initiatives that compel the disclosure of standardized raw data at the issuer level and at the level of investment intermediaries and index administrators who provide portfolio-based financial products or benchmarks that inform investment decisions (infra2.2.1). We then provide an overview of initiatives where regulators aim to provide rigidly regulated "green" quality labels at the activity and the portfolio level (infra 2.2.2). We round off our illustration by discussing examples of activity level raw data disclosures and issuer-level frameworks for "green" labels beyond the domain of financial regulation (infra 2.2.3).

2.2.1 Disclosure of climate impact raw data

2.2.1.1 Issuer level: Sustainability Reporting

At the international level, an array of voluntary issuer-level reporting frameworks for climate impact and other ESG matters exists, including the recommendations of the Task Force on Climate-related Financial Disclosures (TCFD), the Carbon Disclosure Project (CDP), and the Global Reporting Initiative

[24] We discuss the role that climate-related information may play in investment decisions below 3.1.

[25] Although the optimal level of standardization is a matter of dispute, the consensus view is that some degree of standardization in accounting standards is efficient, see e.g. Thomas D. Fields, Thomas Z. Lys, and Linda Vincent, 'Empirical research on accounting choice' (2001) 31 JAE 255; Geoff Meeks and G.M. Peter Swann, 'Accounting standards and the economics of standards' (2009) 39 Acc't and Bus Res 191; see also Frank H. Easterbrook and Daniel R. Fischel, *The Economic Structure of Corporate Law* (Harvard University Press 1991) 276-314. For a more detailed discussion of the law and economics of mandatory disclosure rules see below 3.2.1.

[26] See e.g. Adriana De La Cruz, Alejandra Medina, and Yun Tang, 'Owners of the World's Listed Companies', (2019) OECD Capital Market Series Report, 11 <https://www.oecd.org/corporate/Owners-of-the-Worlds-Listed-Companies.htm> accessed 16 July 2021 (indicating that institutional investors held 72% of outstanding listed stock in the US, and 38% in Europe).

(GRI).[27] Frequently, such frameworks build on one another. For example, for details of emissions reporting, all said frameworks refer to the carbon accounting standards developed by the GHG Protocol.[28] The business press have characterized the informal sustainability reporting frameworks as an "alphabet soup,"[29] that is, a patchwork of different standards that can be difficult to navigate through for both information providers and consumers. To better harmonize international issuer-level reporting practices, the International Financial Reporting Standards (IFRS) Foundation will establish a new International Sustainability Standards Board (ISSB), which will be tasked with developing sustainability reporting standards akin to the widely used financial reporting standards under the IFRS umbrella.[30]

At the European level, efforts to mandate sustainability disclosures date back as far as 2014, when the co-legislators broke new ground by appending a set of high-level sustainability reporting requirements to the Accounting Directive.[31] However, the amendments of the Non-Financial Reporting Directive (NFRD)[32] largely proved to be a toothless tiger in practice.[33] The NFRD did not mandate any quantitative, standardized disclosures of specific ESG indicators (such as ex post emissions data or relevant targets),[34] and left the imposition of audit requirements to the discretion of the Member States.[35] Moreover, the personal scope of NFRD reporting was limited to include only large, listed companies with more than 500 employees and certain other 'public-interest entities' such as banks and insurance undertakings.[36] To correct these shortcomings, the Commission recently published a long-awaited proposal for a revision of the NFRD framework through the Corporate Sustainability Reporting Directive

[27] For an overview of leading frameworks, and their differences in approach and design, see CDP et al., Statement of Intent to Work Together Towards Comprehensive Corporate Reporting (Sep. 2020), <https://29kjwb3armds2g3gi4lq2sx1-wpengine.netdna-ssl.com/wp-content/uploads/Statement-of-Intent-to-Work-Together-Towards-Comprehensive-Corporate-Reporting.pdf> accessed 20 July 2021.

[28] See TCFD, Implementing the Recommendations of the Task Force on Climate-related Financial Disclosures (June 2017), 17 <https://assets.bbhub.io/company/sites/60/2020/10/FINAL-TCFD-Annex-Amended-121517.pdf> accessed 31 May 2021; CDP, Guidance for Companies – Climate Change 2021 <https://www.cdp.net/en/guidance/guidance-for-companies> accessed 31 May 2021. GRI, GRI 305: Emissions, 4 < https://www.globalreporting.org/standards/media/1012/gri-305-emissions-2016.pdf > accessed 1 June 2021.

[29] See e.g. Patrick Temple-West, 'Companies struggle to digest 'alphabet soup' of ESG arbiters', *Financial Times* (London, 6 October 2019) <https://www.ft.com/content/b9bdd50c-f669-3f9c-a5f4-c2cf531a35b5> accessed 4 June 2021.

[30] See IFRS Foundation, 'IFRS Foundation announces International Sustainability Standards Board, consolidation with CDSB and VRF, and publication of prototype disclosure requirements' (November 2021) <https://www.ifrs.org/news-and-events/news/2021/11/ifrs-foundation-announces-issb-consolidation-with-cdsb-vrf-publication-of-prototypes/> accessed 7 November 2021.

[31] Directive 2013/34/EU of the European Parliament and of the Council of 26 June 2013 on the annual financial statements, consolidated financial statements and related reports of certain types of undertakings, amending Directive 2006/43/EC of the European Parliament and of the Council and repealing Council Directives 78/660/EEC and 83/349/EEC, [2013] OJ L 182/19.

[32] Directive 2014/95/EU of the European Parliament and of the Council of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups, [2014] OJ L 330/1.

[33] See also below 3.2.2.1.

[34] See NFRD, recital 7; European Commission, Guidelines on non-financial reporting, [2017] OJ C 215/1, and Guidelines non-financial reporting: Supplement on reporting climate-related information, [2019] OJ C 209/01 (setting out *non-binding* guidelines for the practical implementation of high-level NFRD requirements, and limiting recommendations for the use standardized quantitative performance indicators to certain climate metrics).

[35] Accounting Directive, art. 19a(6), 29a(6).

[36] Accounting Directive, art. 2(1), 3(4), 19a(1), 29a(1).

(CSRD).[37] If adopted as proposed, the CSRD would extend the personal scope of reporting requirements to all large companies irrespective of listing status and, by 2026, also to small- and medium-sized listed companies.[38] It would introduce a more comprehensive assurance requirement[39] and task the Commission with developing detailed, technical sustainability reporting standards building on the advice of the European Financial Reporting Advisory Group (EFRAG).[40] Sustainability reporting under the CSRD framework would expressly have qualitative *and* quantitative components.[41] In particular, the to-be-developed standards would have to cater specifically to the information needs of financial intermediaries and benchmark administrators under the regulatory frameworks discussed below, and take into account the work of global standard-setting initiatives such as the TCFD or future standards developed by the ISSB under the umbrella of the IFRS Foundation.[42]

Already in 2013, the UK introduced a quantitative emissions reporting requirement for listed companies.[43] Moreover, in pursuit of the UK's Green Finance Strategy,[44] the Financial Conduct Authority (FCA) recently adopted a new listing rule requiring premium-listed issuers to disclose, on a comply-or-explain basis as part of their annual reports (for financial years 2021 and beyond), whether their climate-related disclosures are in line with the entirety of the TCFD recommendations.[45] In October 2021, following a public consultation,[46] the UK Department for Business, Energy & Industrial Strategy (BEIS) announced plans for additional regulations that will mandate climate risk disclosures in line with the four high-level TCFD principles for all listed companies and large private companies (for financial years starting after 6 April 2022).[47]

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[37] European Commission, Proposal for a Directive … as regards corporate sustainability reporting, COM(2021) 189 final.

[38] ibid. 42, 49 (proposal for revised Accounting Directive, art. 19a(1), 29a(1)).

[39] ibid. 52 (proposal for revised Accounting Directive, art. 34(1)[2](aa)).

[40] ibid. 45-47 (proposal for revised Accounting Directive, art. 19b)).

[41] ibid. 43, 50 (proposals for revised Accounting Directive, art. 19a(3)[1], 29a(3)[1]).

[42] ibid. 46 (proposal for revised Accounting Directive, art. 19b(3)).

[43] The Companies Act 2006 (Strategic Report and Directors' Report) Regulations 2013 (inserting Large and Medium-sized Companies and Groups (Accounts and Reports) Regulations 2008, Part 7); extended by the Companies (Directors' Report) and Limited Liability Partnerships (Energy and Carbon Report) Regulations 2018.

[44] HM Government, Green Finance Strategy (July 2019) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/820284/190716_BEIS_Green_Finance_Strategy_Accessible_Final.pdf> accessed 1 June 2021.

[45] LR 9.8.6(8); for a discussion of the details *see* FCA, Policy Statement PS20/17: Proposals to enhance climate-related disclosures by listed issuers and clarification of existing disclosure obligations (Dec. 2020) <https://www.fca.org.uk/publication/policy/ps20-17.pdf> accessed 1 June 2021.

[46] Department for Business, Energy & Industrial Strategy, Consultation on requiring mandatory climate-related financial disclosures by publicly quoted companies, large private companies and Limited Liability Partnerships (LLPs) (March 2021) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/972422/Consultation_on_BEIS_mandatory_climate-related_disclosure_requirements.pdf> accessed 31 May 2021.

[47] Department for Business, Energy & Industrial Strategy, Consultation response: Mandatory climate-related financial disclosures by publicly quoted companies, large private companies and LLPs (October 2021) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1029354/tcfd-consultation-government-response.pdf> accessed 7 November 2021.

In the US, the SEC requested public input on a revision of its approach to climate disclosures in early 2021[48] and public testimony of key personnel suggests that a formal rulemaking proposal on this topic is imminent.[49] The questions posed indicate that the SEC under the Biden administration is open to mandate the disclosure of standardized data, such as GHG emissions.[50] Moreover, the SEC established an Enforcement Task Force on climate and ESG issues whose "initial focus will be to identify any material gaps or misstatements in issuers' disclosure of climate risks under existing rules."[51] In June 2021, the House of Representatives passed, by a one-vote margin, a bill that would mandate listed companies to disclose comprehensive information on their exposure to climate transition and physical risks as well as other ESG metrics, as defined by future SEC rules.[52] While commentators believe it is unlikely that the bill will also pass the (split) Senate, the legislative proposal might nevertheless influence the design of the disclosure mandates that the SEC might adopt under its existing mandates.[53]

2.2.1.2 Portfolio level I: Disclosure obligations for investment intermediaries

In line with investment intermediaries' central role in capital allocation (see above 2.1.3), the TCFD recommends that sustainability considerations should also be reflected in the disclosures that asset managers and asset owners (life insurers and pension funds) make vis-à-vis their clients and beneficiaries.[54] According to the TCFD's supplementary guidance, these intermediaries should make climate risk disclosures not only at the level of the intermediary (i.e. in the intermediary's annual report to its shareholders), but also at the level of each product, fund, scheme or investment strategy that the intermediary manages.[55] In addition to qualitative elaborations on their consideration of climate risks, these fund-level disclosures should also provide, where possible, weighted average carbon intensities and other raw data metrics that might be useful for their clients' investment decisions.[56]

At the European level, the functional hard law equivalent to these initiatives which build on voluntary adaption is the Sustainable Finance Disclosure Regulation (SFDR)[57], which stipulates various disclosure obligations for asset managers, pension fund managers, life insurers, and certain other intermediaries who are in the business of managing investment portfolios on the account of third parties. At the entity

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[48] SEC, Public Statement by Acting Chair Allisson Herren Lee: Public Input Welcomed on Climate Change Disclosures (15 March 2021) <https://www.sec.gov/news/public-statement/lee-climate-change-disclosures> accessed 31 May 2021.

[49] See e.g. Chair Gary Gensler, Testimony Before the United States Senate Committee on Banking, Housing and Urban Affairs (14 September 2021) < https://www.sec.gov/news/testimony/gensler-2021-09-14> accessed 7 November 2021 (indicating that SEC staff are preparing proposals on climate risk disclosures, among other things).

[50] *Id.*

[51] SEC, Press Release: SEC Announces Enforcement Task Force Focused on Climate and ESG Issues (4 March 2021) <https://www.sec.gov/news/press-release/2021-42> accessed 31 May 2021. See also SEC, Sample Letter to Companies Regarding Climate Change Disclosures (22 September 2021) < https://www.sec.gov/corpfin/sample-letter-climate-change-disclosures> accessed 7 November 2021.

[52] Corporate Governance Improvement and Investor Protection Act, H.R. 1187, 117th Cong. (2021).

[53] See J. Paul Forrester, The U.S. Moving Toward Adopting New Climate Change Disclosures, Harvard Law School Forum on Corporate Governance (9 July 2021) <https://corpgov.law.harvard.edu/2021/07/09/the-u-s-moving-toward-adopting-new-climate-disclosures/> accessed 7 November 2021.

[54] TCFD (n 28) 33, 38.

[55] ibid. 33-44.

[56] ibid. 37, 42.

[57] Regulation (EU) 2019/2088 of the European Parliament and of the Council of 27 November 2019 on sustainability-related disclosures in the financial services sector, [2019] OJ L 317/1.

level, the SFDR requires these 'financial market participants' (FMPs)[58] to report how they integrate sustainability risks and sustainability impacts in their risk management and remuneration processes.[59] Under the prospective Regulatory Technical Standards (RTS),[60] large FMPs will also have to disclose a set of standardized ESG indicators at the consolidated level of the FMP, that is, aggregated over all financial products the FMP issues or manages (e.g. the entire fund family).[61] At the level of 'financial products'[62] – such as shares in mutual funds – the SFDR requires a statement in the pre-contractual materials (in the case of a mutual fund: the prospectus) as to whether or not the strategy of that product incorporates sustainability-related considerations.[63] For products with a sustainability dimension, additional pre-contractual and periodic disclosure requirements apply.[64]

Regulators in other jurisdictions have also recognized the import of financial intermediaries in the process of greening capital markets. Already in 2015, the French Energy Transition Law included a provision requiring comprehensive climate risk disclosure from various institutional investors, albeit on a comply-or-explain basis.[65] In the UK, regulations requiring occupational pension schemes to prepare TCFD-aligned climate change reports came into force on 1 October 2021.[66] Further regulations requiring comparable disclosures from asset managers and other asset owners have recently been under

[58] SFDR, art. 2(1).

[59] SFDR, art. 3-5. These obligations also apply to financial advisers within the meaning of Art. 2(11) SFDR provided they have at least three employees, SFDR, art. 17. Similar disclosure duties regarding executive compensation exist for listed EU companies in general, see Directive 2007/36/EC of the European Parliament and of the Council of 11 July 2007 on the exercise of certain rights of shareholders in listed companies, art. 9a(6), [2007] OJ L 184/17 as amended.

[60] RTS are binding legal instruments that specify the requirements of directives and regulations adopted by the co-legislators in more detail. They are drafted by the European Supervisory Authorities (ESAs) and subsequently endorsed by the European Commission as delegated acts. See e.g. Regulation (EU) No 1095/2010 of the European Parliament and of the Council of 24 November 2010 establishing a European Supervisory Authority (European Securities and Markets Authority), [2010] OJ L 331/84, art. 10.

[61] Joint Committee of the ESAs, Draft Regulatory Technical Standards with regard to the content, methodologies and presentation of disclosures pursuant to Article 2a(3), Article 4(6) and (7), Article 8(3), Article 9(5), Article 10(2) and Article 11(4) of Regulation (EU) 2019/2088, JC 2021/03, art. 4-9 and annex I. The Commission announced that it will delay the endorsement of the RTS until after the ESAs-JC submit their final drafts for the additional taxonomy-related RTS, see Commission, Letter to the European Parliament of 8 July 2021, Ares(2021)4439157, copy available at <https://nrfregulationstomorrow.lexblogplatformthree.com/wp-content/uploads/sites/416/2021/07/SFDR-letter.pdf> accessed 14 July 2021. The ESAs delivered the latter RTS proposal on 22 October 2021, see Joint Committee of the ESAs, Final Report on draft Regulatory Technical Standards with regard to the content and presentation of disclosures pursuant to Article 8(4), 9(6) and 11(5) of Regulation (EU) 2019/2088, JC 2021/50.

[62] SFDR, art. 2(12).

[63] SFDR, art. 6(1).

[64] SFDR, art. 8-11, specified in Draft RTS (n 61), art. 13-73 and annexes II-V.

[65] LOI n° 2015-992 du 17 août 2015 relative à la transition énergétique pour la croissance verte, art. 173-VI. For a brief discussion of the background and content of the provision, see e.g. Jean-Stéphane Mésonnier and Benôit Nguyen, 'Showing off cleaner hands: mandatory climate-related disclosure by financial institutions and the financing of fossil energy' (2021) Banque de France Working Paper No. # 800, 6-8 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=38401826-8> accessed 28 June 2021.

[66] The Occupational Pension Schemes (Climate Change Governance and Reporting) Regulations 2021, sec. 6 and schedule part 2.

consultation.[67] The SEC seems to take more of a verification approach under which the market supervisor does not require any specific information disclosure but examines and questions the consistency of fund providers' voluntary sustainability claims and their actual practices.[68] Recently, however, SEC Chair Gary Gensler indicated he had "asked staff to consider recommendations about whether [ESG] fund managers should disclose the criteria and underlying data they use."[69]

2.2.1.3 Portfolio level II: Disclosure obligations of index providers and other benchmark administrators

Indices, reference rates, and other benchmarks represent an important determinant for investment decisions because they allow tracing a financial product's (relative) performance. In an information-based green finance approach, benchmarks with a sustainability dimension should convey high-quality information on the actual "green" performance of investment products as measured against the benchmark. With the growing trend towards "passive" investment strategies, another perhaps even more important view of ESG benchmark administrators is that they supply abstract portfolios, which can then be tracked by ETFs and other low-cost index-based products.[70] From this perspective, benchmark administrators fulfil a similar function as the investment intermediaries discussed in the previous section – an observation that has lately given rise to discussions among US legal scholars as to whether index administrators in fact do qualify as investment advisers under the federal securities laws.[71]

In the EU, however, benchmark administrators are regulated under the separate legal framework of the Benchmarks Regulation (BMR),[72] which was adopted as a response to the London Interbank Offered Rate (LIBOR) scandal. The EU's sustainable finance package included a set of ESG-related amendments to the BMR, which can be divided into two pillars. The first pillar consists of general disclosure requirements for all benchmarks with an ESG dimension. Administrators of such benchmarks have to

[67] See FCA, Enhancing climate-related disclosures by asset managers, life insurers and FCA-regulated pension providers (June 2021), CP 21/17. In addition to and building on these climate-risk disclosures, the FCA plans to develop a broader sustainability disclosure framework for asset managers and asset owners akin to that of the SFDR, see FCA, Sustainability Disclosure Requirements (SDR) and investment labels (November 2021), DP 21/4, 23-27.

[68] *See* SEC, Risk Alert: Review of ESG investing (9 April 2021) <https://www.sec.gov/files/esg-risk-alert.pdf>, accessed 31 May 2021; *see also* SEC, 2021 Examination Priorities, 28 <https://www.sec.gov/files/2021-exam-priorities.pdf> accessed 31 May 2021; SEC, 2020 Examination Priorities, 15 <https://www.sec.gov/about/offices/ocie/national-examination-program-priorities-2020.pdf> accessed 31 May 2021.

[69] Gary Gensler, Remarks at the Asset Management Advisory Committee Meeting, Harvard Law School Forum on Corporate Governance (11 July 2021) <https://corpgov.law.harvard.edu/2021/07/11/chair-genslers-remarks-at-the-asset-management-advisory-committee-meeting/> accessed 14 July 2021.

[70] On the growing role of index administrators in capital allocation see e.g. Johannes Petry, Jan Fichtner, and Eelke Heemskerk, 'Steering capital: the growing private authority of index providers in the age of passive asset management' (2021) 28 RIPE 152.

[71] See e.g. Paul G. Mahoney and Adriana Robertson, 'Advisers by Another Name' (2021) Virginia Law and Economics Research Paper No. 2021-01 <https://ssrn.com/abstract=3528239> accessed 25 May 2021.

[72] Regulation (EU) 2019/2089 of the European Parliament and of the Council of 27 November 2019 amending Regulation (EU) 2016/1011 as regards EU Climate Transition Benchmarks, EU Paris-aligned Benchmarks and sustainability-related disclosures for benchmarks, [2019] OJ L 317/17. For avoidance of doubt, citations to BMR are such to the consolidated regulation as amended.

explain ex ante how the methodology of the benchmark considers ESG factors.[73] Moreover, administrators have to report ex post, at least on an annual basis, on the ESG performance of the (hypothetical) portfolio implied by the benchmark, using a set of standardized metrics.[74] The second pillar consists of two special types of climate-related benchmarks and is further discussed infra 2.2.2.2. Notably, the EU's ESG benchmark rules entered into force before 31 December 2020 and therefore also apply in the UK as "onshored" direct EU legislation.[75]

2.2.2 Green Labels

2.2.2.1 Activity level: Taxonomies (and Green Bond Standards)

Reasonable minds may disagree on what exactly it means for an economic activity to be "green", "sustainable", or "climate-friendly". In recent years, so-called taxonomies have emerged as one important tool to overcome the notorious indeterminacy of these key terms. In essence, taxonomies aim to define a uniform metric for identifying the green properties of economic activities. They seek to provide a common language that market participants may rely on by providing a simple, often binary, label at the activity level. Various actors have developed such taxonomies to facilitate investments in "green" projects. An early example is the Climate Bonds Taxonomy, which was first released in 2013 by the Climate Bonds Initiative (CBI) and has been regularly updated since then.[76]

In recent years, there has also been an increasing interest among regulators to use formal rulemaking processes to draw up taxonomies,[77] and to use these taxonomies as a point of reference in other areas of financial regulation (e.g. by requiring various economic agents to disclose information on their activities' alignment with the taxonomy specifications). The objective is to create one uniform government-approved metric of sustainability that is comparable across the various business operations of corporate actors. Lawmakers, supervisors, self-regulatory bodies and others can then use this metric to specify issuers' or intermediaries' legal obligations, and to issue non-binding recommendations via legislative or administrative acts, private ordering, or other means.

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[73] BMR, art. 13(1)(d), specified in Commission Delegated Regulation (EU) 2020/1817 of 17 July 2020 supplementing Regulation (EU) 2016/1011 of the European Parliament and of the Council as regards the minimum content of the explanation on how environmental, social and governance factors are reflected in the benchmark methodology, [2020] OJ L 406/12.

[74] BMR, art. 27(2a), specified in Commission Delegated Regulation (EU) 2020/1816 of 17 July 2020 supplementing Regulation (EU) 2016/1011 of the European Parliament and of the Council as regards the explanation in the benchmark statement of how environmental, social and governance factors are reflected in each benchmark provided and published, [2020] OJ L 406/1.

[75] See European Union (Withdrawal) Act 2018, sec. 3, as amended by European Union (Withdrawal Agreement) Act 2020.

[76] Climate Bonds Initiative, Climate Bonds Taxonomy (Jan. 2021) <https://www.climatebonds.net/files/files/CBI_Taxonomy_Jan2021.pdf> accessed 2 June 2021.

[77] See e.g. HM Treasury, Build Back Better: our plan for growth (March 2021), 87 <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/968403/PfG_Final_Web_Accessible_Version.pdf> accessed 2 June 2021 (declaring intentions "to fully implement a 'Green Taxonomy' to provide a common standard for measuring firms' environmental impact"); see also HM Treasury, 'New independent group to help tackle 'greenwashing'' (9 June 2021), <https://www.gov.uk/government/news/new-independent-group-to-help-tackle-greenwashing> accessed 28 June 2021 (announcing the appointment of an expert group to support the UK government in developing the taxonomy).

The most developed taxonomy project is the EU's Taxonomy Regulation (TR).[78] At its core, the TR is nothing else but an elaborate definition of the notion of an "environmentally sustainable" economic activity that serves as a binary "green" label at the activity level.[79] While the TR itself sketches that definition only with a relatively broad brush, the actual technical criteria are spelled out over several hundreds of dense pages in a Delegated Regulation that the Commission adopted based on the recommendations of a Technical Expert Group.[80] The screening criteria for the production of transport technologies, for example, are mainly a function of the given vehicle's tailpipe emissions.[81] Importantly, the EU taxonomy itself is *not* a framework for labeling financial instruments or issuers of such instruments as sustainable. Instead, the TR defines a label of environmental sustainability at the *activity level*. Where an issuer of a financial instrument (common stock, general-purpose bonds, etc.) entertains many different activities, the activity-level measures can be aggregated to determine the *degree* to which the investment is environmentally sustainable.[82]

Most importantly for our analysis, the TR also introduced a new disclosure obligation for companies subject to the NFRD. From 2022 on, NFRD firms will have to disclose standardized quantitative metrics on the taxonomy alignment of their activities.[83] The information disclosed at the company level can then be used to compute measures of the taxonomy alignment of individual financial instruments or portfolios thereof. The additional disclosure obligations that FMPs face under the SFDR when they market products with a sustainability dimension, include quantitative information on the taxonomy alignment of portfolio companies' activities.[84]

Another use case for the taxonomy framework will be the (voluntary) EU Green Bond Standard which prescribes that proceeds of labeled bonds are used for projects that meet TR standards.[85] Green bonds

[78] Regulation (EU) 2020/852 of the European Parliament and of the Council of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088, [2020] OJ L 198/13.

[79] TR, art. 1(1). The TR requires that Member States and the Union will not refer to any other taxonomy when regulating in the area of green finance, TR, art. 4. Private parties, on the other hand, remain free to rely on any other sustainability definition when organizing their economic and legal relationships.

[80] Commission Delegated Regulation (EU) __/__ of 4 June 2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by establishing the technical screening criteria for determining the conditions under which an economic activity qualifies as contributing substantially to climate change mitigation or climate change adaptation and for determining whether that economic activity causes no significant harm to any of the other environmental objectives, C(2021) 2800 final.

[81] Commission Delegated Regulation (EU) __/__ (n 80) annex I section 3.3.

[82] TR, art. 1(1).

[83] TR, art. 8, specified in Delegated Regulation (EU) __/__ of 6 July 2021 supplementing Regulation (EU) 2020/852 of the European Parliament and of the Council by specifying the content and presentation of information to be disclosed by undertakings subject to Articles 19a or 29a of Directive 2013/34/EU concerning environmentally sustainable economic activities, and specifying the methodology to comply with that disclosure obligation, C(2021) 4987 final.

[84] TR, art. 5,6. The ESAs recently published their final proposal for the respective RTS proposal, see Joint Committee of the ESAs, JC 2021/50 (n 61) .

[85] See European Commission, Proposal for a Regulation … on European green bonds, COM(2021) 391 final, art. 6.

collect capital at the issuer level, but through their – heavily marketed – use-of-proceeds clauses,[86] they suggest that funding is provided directly at the activity level to benefit "green" investment opportunities. From this perspective, green bond standards could be interpreted as an additional activity-level label in our framework.[87] However, through the lens of two core principles in corporate finance theory – the Fisher separation theorem[88] and the Modigliani-Miller theorem[89] – green bonds in their economic substance remain an issuer-financing device and should not automatically be interpreted as funding specific activities. This is particularly true where the respective activities would have received funding anyway, as well as in the absence of green bond issuance. Even if some ring-fencing for green bond proceeds was feasible,[90] the free cash-flows that the new round of financing creates at the issuer level are still attributable to the green bond issuance and therefore indirectly also finance other, potentially "dirty" activities.

Our distinction of levels of labeling also has some traction from a related perspective. The flipside of accepting the green bond illusion is that other, general-purpose financing instruments of an issuer should no longer be regarded as funding the "green" activity (project) "financed" by the green bond. Where an issuer has outstanding green bonds, such funded activities therefore need to be subtracted when computing issuer-level quotas of taxonomy-aligned activities for the purpose of evaluating the "greenness" of general-purpose financings, and when computing taxonomy quotas for portfolios including such general-purpose financing devices.[91] This logic, however, is frequently ignored in practice, including in the draft-delegated requirements for the FMP's taxonomy-related reporting obligations.[92]

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[86] In the simplest form, issuers commit in green bond indentures to invest the proceeds of the bond issuance into specific "green" projects/assets, although the issuers' whole balance sheets back investors' claims, see for instance the European Investment Bank's (EIB) Climate Awareness Bonds Framework (2019) <https://www.eib.org/attachments/fi/eib-cab-framework-2019.pdf> accessed 16 July 2021.

[87] Yet, as long as the core criterion for labeling a debt instrument as "green bond" is in essence a requirement that a certain share of the proceeds flows to projects that are aligned with a taxonomy, green bonds could also be interpreted as an issuer-level financing device with a mere additional contractual obligation that references a pre-existing activity-level label.

[88] Irving Fisher, *The Theory of Interest* (MacMillan 1930) 269-275.

[89] Franco Modigliani and Merton H. Miller, 'The Cost of Capital, Corporation Finance and the Theory of Investment' (1958) 48 AER 261.

[90] For a brief discussion of the "ring-fencing" problem with green bonds, see JRC, Development of EU Ecolabel criteria for Retail Financial Products, Technical Report 3.0 (Oct. 2020) 65-66 <https://susproc.jrc.ec.europa.eu/product-bureau//sites/default/files/2020-11/Draft%20Technical%20Report%203%20-%20Retail%20financial%20products.pdf> accessed 4 June 2021.

[91] To illustrate this point, assume that a corporation has issued three securities that each account for one third of its enterprise value: a common stock, a green bond, and a traditional corporate bond. Assume further that 50% of the corporation's revenue is derived from taxonomy-aligned activities. If one maintains that the green bond "finances" 100% taxonomy-aligned activities, one can no longer at the same time maintain that the common stock and the traditional corporate bond "finance" activities that are 50% taxonomy-aligned – otherwise a portfolio of all financial instruments of the issuers would have a higher (value-weighted) taxonomy quota than the issuer itself (66.7%). By the logic of the green bond illusion, the general-purpose bond and the common stock would have to be treated as only 25% taxonomy-aligned each.

[92] Under ESAs' RTS proposal, green bonds financing taxonomy-compliant projects would count with up to 100% for the numerator of portfolio-level taxonomy quotas, whereas general purpose bonds and equity instruments would count with the issuer-level taxonomy quota *without correction* for any activities "financed" by green bonds, see Joint Committee of the ESAs, JC 2021/50 (n 61), proposed art. 16b. The same "greenwashing per methodology" occurs in the calculation of the Green Asset Ratio (GAR) as the key metric that banks will have to

As a minimum, the prescriptions on quota calculations should include rules on adequate deductions of activities financed through specifically designated green bonds – or, preferably, refrain from buying into the green bond illusion in the first place.

2.2.2.2 Portfolio level: Labels for Investment Products

Regulatory labeling as a device to facilitate green investments also occurs at the portfolio level for investment intermediaries. In the EU, significant work has gone, and is going, into the development of government-backed labels at the portfolio level in an effort to facilitate the identification of "green" portfolio products by retail investors. The Commission is currently developing a seal-type ecolabel for financial products under the umbrella of the EU Ecolabel Regulation.[93] According to the latest draft, one of the primary criteria for obtaining such a label would be a minimum threshold of portfolio "greenness" defined in terms of taxonomy-aligned turnover and capex of constituent companies.[94] Moreover, under the SFDR, the product-level disclosure requirements distinguish between the following three basic product categories: the "light green" or Art. 8 products; the "dark green" or Art. 9 products; and the "other" or traditional financial products. Beyond marking the perimeters of the applicable disclosure requirements, these categories arguably serve as additional high-level labels that distinguish financial products according to their relative "greenness."[95] The FCA recently announced plans to introduce a UK classification and labelling system for sustainable investment products that would build on the basic classifications under the SFDR.[96]

Similarly, benchmark providers can also resort to green labels supported by regulatory standards when constructing reference portfolios. The second pillar of the European BMR introduces two special types of 'EU climate benchmarks': the EU Climate Transition Benchmarks (EU CTBs) and the more ambitious EU Paris-aligned Benchmarks (EU PABs).[97] Functionally, these categories serve as a seal of quality for

use in their issuer-level disclosures under TR, art. 8, see Commission Delegated Regulation (EU) __/__ (n 83) annex V formula 1(c).

[93] Regulation (EC) 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel, [2010] OJ L 27/1.

[94] See Joint Research Committee (JRC), Draft Commission Decision establishing the EU Ecolabel criteria for retail financial products (9 March 2021), annex definitions 4-7 and section 1.1, available along with prior versions and explanatory documents at https://susproc.jrc.ec.europa.eu/product-bureau//product-groups/432/documents accessed 16 July 2021.

[95] The Commission's communications on the labelling dimension of the SFDR product categories appear somewhat inconsistent; compare e.g. Commission, Explanatory Memorandum to Delegated Regulation of 21 April 2021 amending Delegated Regulation (EU) 2017/565 as regards the integration of sustainability factors, risks and preferences into certain organisational requirements and operating conditions for investment firms, C(2021) 2616 final, 2 (explaining that the SFDR is "not a labelling regime") with Commission, Questions and Answers on sustainability-related disclosures in the financial services sector, 14 July 2021, Ares(2021)4556843, 5 (explaining that "[t]he two distinct product categories are key to determine the access of end investors to financial products that are ambitious enough to meet their sustainability preferences"). In line with a labelling objective, the ESAs regard it as "one of the main ways to differentiate the two categories of products" that under the relevant RTS (draft) provisions the pre-contractual documents carry different disclaimers, see Joint Committee of the ESAs, JC 2021/03 (n 61) 142.

[96] FCA, DP 21/4 (n 67), 12-22.

[97] BMR, art. 19a-19d and annex III. In the UK, these benchmarks are now formally known as "UK" benchmarks, see the amendments under the The Financial Services (Miscellaneous Amendments) (EU Exit) Regulations 2020, sec. 12, and The Markets in Financial Instruments, Benchmarks and Financial Promotions (Amendment) (EU Exit) Regulations 2021, sec. 5-6.

benchmarks representing portfolios with relatively good climate performance. To qualify as an EU CTB or an EU PAB, the reference portfolios underlying the benchmarks need to conform with certain climate impact indicators, including weighted average GHG emissions 30% (EU CTBs) or 50% (EU PABs) lower than the respective emissions of the investable universe.[98]

2.2.3 "Green" transparency beyond financial regulation

The two-dimensional distinction of categories and levels of "green" information also enhances our awareness that relevant transparency frameworks may exist outside of financial regulation and informs our understanding of key design features.

For example, while the labeling in the form of taxonomies is becoming more and more popular, financial regulators in key jurisdictions exhibit little to no interest in also requiring the disclosure of climate-related raw data at the activity level. However, this is not because raw data disclosure obligations at a level below that of individual issuers (the level at which traditional financial reporting and its "green" extensions focus) are conceptually impossible. In fact, issuer level transparency requirements typically aggregate activity level raw data.

In environmental law, for example, such activity-level transparency requirements are fairly common. In the US, for example, toxic emissions of industrial facilities are disclosed annually at the plant level under the Toxics Release Inventory (TRI) Program.[99] In 2010, the Environmental Protection Agency (EPA) created another program mandating the disclosure of GHG emissions at the facility level.[100] Similar plant-level disclosures are due in jurisdictions that have implemented the Protocol on Pollutant Release and Transfer Registers (PRTR) under the Aarhus Convention, which include the EU and its Member States, among others.[101] Externally verified facility-level emissions are also disclosed to the public on an annual basis as part of the EU emissions trading scheme (ETS).[102] While not technically within the jurisdiction of financial regulators, such disclosure requirements are nevertheless important for green finance because they produce raw data that investors can use in capital allocation. This complementarity of disclosure requirements in different areas of law on informationally efficient markets is also illustrated by a number of recent empirical papers that use plant-level data disclosed under environmental regulation to explore ESG-related topics in finance and corporate governance.[103]

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[98] Commission Delegated Regulation (EU) 2020/1818 of 17 July 2020 supplementing Regulation (EU) 2016/1011 of the European Parliament and of the Council as regards minimum standards for EU Climate Transition Benchmarks and EU Paris-aligned Benchmarks, [2020] OJ L 406/17, art. 9, 11.

[99] See Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986, codified at 42 U.S.C. § 11023.

[100] Greenhouse Gas Reporting Program, 40 C.F.R. § 98.

[101] Regulation (EC) No 166/2006 of the European Parliament and of the Council of 18 January 2006 concerning the establishment of a European Pollutant Release and Transfer Register and amending Council Directives 91/689/EC and 96/61/EC, [2006] OJ L33/1.

[102] See the compliance information in the European Union Transaction Log (EUTL) <https://ec.europa.eu/clima/ets/> accessed 29 July 2021; the legal basis is Commission Delegated Regulation (EU) 2019/1122 of 12 March 2019 supplementing Directive 2003/87/EC of the European Parliament and of the Council as regards the functioning of the Union Registry, [2019] OJ 177/3, art. 79 in conjunction with annex XIII section 1.

[103] Sophie A. Shive and Margaret M. Forster, 'Corporate Governance and Pollution Externalities of Public and Private Firms' (2019) 33 RFS 1296; S. Lakshimi Naaraayanan, Kunal Sachdeva, and Varun Sharma, 'The Real Effects

The second level-type calibration that did not feature in our overview of transparency instruments regulators deploy in key jurisdictions is that of issuer-level labels. Looking beyond specific regulatory initiatives, the chief example of such labels are the scores and ratings disseminated by various ESG data providers.[104] These ratings play a considerable role in investment practice as well as in empirical research.[105] Despite there being a vivid debate around the quality and reliability of private ESG ratings, we are not aware of contemporary green finance initiatives in which legislators aimed intentionally at devising or sponsoring labels at the issuer level themselves. Relatedly, regulators have so far been reluctant to mandate the disclosure of such metrics at the portfolio level.[106] There are, however, ongoing discussions in the EU whether the provision and/or use of private ESG ratings should be subjected to some form of regulation (e.g. akin to that of credit rating agencies).[107]

2.3 Synthesis

Our overview of regulatory developments in key jurisdictions illustrates how the distinction between "disclosure" and "labeling" and different layers of the investment chain may help to navigate through the increasingly complex web of regulatory frameworks setting out green disclosure obligations. Table 2 summarizes our results.

of Environmental Activism' (2021) ECGI Finance Working Paper 743/2021 <https://papers.ssrn.com/abstract=3483692> accessed 28 June 2021; Po-Hsuan Hsu, Kai Li, and Chi-Yang Tsou, 'The Pollution Premium' (2020) working paper <https://ssrn.com/abstract=3578215> accessed 18 June 2021; Sorabh Tomar, 'Greenhouse Gas Disclosure and Emissions Benchmarking' (2021) working paper <https://papers.ssrn.com/abstract=3448904> accessed 28 June 2021; Davidson Heath, Daniele Macciocchi, Roni Michaely, and Matthew C. Ringgenberg, 'Does Socially Responsible Investing Change Firm Behavior?' (2021) ECGI Finance Working Paper 762/2021 <https://papers.ssrn.com/abstract=3837706> accessed 14 July 2021; Nicholas Z. Muller, 'Measuring Firm Environmental Performance to Inform Asset Management and Standardized Disclosure' (2021) NBER Working Paper No 29454 <https://www.nber.org/papers/w29454> accessed 24 November 2021.

[104] For a general discussion of the value of such ratings, see Ingo Walter, 'Sense and Nonsense in ESG Scoring', (2020) 5 JLFA 307. On the problem of rating dispersion see below 3.2.2.1.

[105] See e.g. Rui Albuquerque, Yrjö Koskinen, and Chendi Zhang, 'Corporate Social Responsibility and Firm Risk: Theory and Empirical Evidence' (2019) 65 MS 4451; Alexander Dyck, Karl V. Lins, Lukas Roth, and Hannes F. Wagner, 'Do institutional investors drive corporate social responsibility? International evidence' (2019) 131 JFE 693; Karl V. Lins, Henri Servaes, and Ane Tamayo, 'Social Capital, Trust, and Firm Performance: The Value of Corporate Social Responsibility during the Financial Crisis' (2017) 72 JF 1785. See also below 3.2.2.1, 3.2.3.1.

[106] Ratings are not part of the mandatory and voluntary ESG indicators for intermediary-level PAI-reporting under Art. 4 SFDR (the intermediary-level can be viewed as a merged portfolio of all products managed by the relevant intermediary). Under the ESG BMR, disclosure of weighted average ratings is voluntary, see Commission Delegated Regulation (EU) 2020/1816 (n 74) annex II.

[107] See ESMA, Letter to the Commission (29 Jan. 2021), ESMA30-379-423 (calling for legislative action on ESG rating provision); European Commission, Strategy for Financing the Transition to a Sustainable Economy (6 July 2021), COM(2021) 390 final (committing to "take action to improve the reliability and comparability of ESG ratings and further assess certain aspects of ESG research, to decide on whether an intervention is necessary").

	Raw data **unevaluated information to allow informed investment decisions**	**Labels** **evaluation of "green" characteristics based on a fixed set of criteria (seal of quality; scores)**
Economic activity	– US TRI – EPA emissions program – Aarhus Convention PRTR – EU ETS	– EU Taxonomy (also in conjunction with the planned EU Green Bond Standard) – planned UK Taxonomy – Climate Bonds Taxonomy
Firm (Issuer)	– EU NFRD/CSRD (also in conjunction with TR) – UK emission disclosure mandate – SEC request for public input – TCFD (also in conjunction with UK mandates), CDP, GRI, ISSB	– private ESG ratings
Portfolio	– SFDR disclosures (also in conjunction with TR) – French art. 173-VI – TCFD (also in conjunction with UK mandates) – planned UK disclosure framework	– EU Ecolabel for Retail Financial Products – SFDR product categories – EU Climate Benchmarks – planned UK classification scheme

Beyond this mapping function, our two-dimensional distinction also serves as a useful reference point for a more contextualized discussion of the economic rationales behind legislative interventions, and the fundamental question of whether reporting obligations should be mandatory. In all cases, disclosure obligations are aimed at correcting information asymmetries. But the respective "information" differs across categories and levels. Therefore, different agents may be interested in the respective information for different reasons, and the reasons why markets may fail to generate that information may also diverge. All these determinants may strengthen or weaken the case for government interventions. Therefore, our categories and levels serve as bridges connecting our overview of regulatory tools to the functional analysis in the following section.

3 The concept of transparency-invigorated market discipline in light of microeconomic theory, asset pricing, and finance

In this section, we analyze the theoretical consistency of information-centered policy concepts that rely on market discipline when it comes to greening the economy. We examine whether, and under which preconditions, the various legislative interventions will indeed influence the allocation of capital on financial markets in a way that achieves the pursued sustainability objectives. We ask to what extent the envisioned re-routing effect of the new regulation is consistent with economic and finance theory on how financial markets function and look at relevant empirical evidence. By doing so, we also identify potential countervailing forces that may impede a market-induced green transition of the economy. This background allows us to find out if the regulatory interventions do indeed target a sensitive determinant of the pricing mechanism, so that the legal changes can trigger significant shifts in

investment decisions. We do so by looking first at what drives investors' decisions to acquire or shed "green" or "dirty" assets and the equilibrium effect the respective investor preferences may exert on asset prices (infra 3.1). Against this background, we can gauge the need for, and the impact of, mandatory disclosure obligations as a booster of market-based green finance (infra 3.2). We round things off by briefly commenting on some of the complications that arise on financial markets that are fraught with a multitude of agency problems resulting from both the corporate governance of issuers and the structure of contemporary investment processes that typically involve intermediaries (infra 3.3).

3.1 Investor preferences and market equilibria

The fundamental objective of market-centered green finance regulation is to divert capital from "dirty" (negative climate impact) activities to "green" (positive or at least climate-impact neutral) activities without direct regulatory intervention or taxation. One pivotal assumption here is that investors prefer "green" activities – but have trouble identifying them – and that therefore more information on the climate impact of specific investment opportunities stirs productive market forces. Only if investors adjusted their behavior once they had received all necessary information about the "green" properties of an investment opportunity, would shifts in demand and market discipline ensue to unhinge the current equilibrium and induce a transition toward a green economy. Yet, the basis for this assumption is not without some doubt. Put simply, the question is whether, why, and to which extent investors actually care about the environmental-friendliness of the economic activities that they fund. At the outset, such a demand-side appetite for "green" investments can either result from purely financial motives (infra 3.1.1) or non-financial determinants of investment decisions (infra 3.1.2). Both can lead to distinct equilibria that impact on sustainability objectives.

3.1.1 Financial motives: climate risk (and other environmental or social risks)

In this section, we assume that investors value assets solely based on financial considerations, that is, investors seek to maximize risk-adjusted returns. Under this assumption, rational investors may shift capital from "dirty" to "green" investment opportunities if they expect higher future cash-flows from "green" assets or if they apply a higher discount factor compared to "dirty" ones.

3.1.1.1 Asset pricing models

A financially-motivated investor will make an investment if its price is equal to or smaller than its present value. The present value of an investment *i* can be expressed as

$$PV_i = \frac{E(CF_i)}{1 + DF_i}$$

where

$E(CF_i)$=	expected value (i.e. probability-weighted average) of future net cash-flows that the investment will yield
DF_i=	a discount factor that compensates for the time value of money and the risk inherent in the investment

Although climate change is commonly perceived as a risk to economic activities, climate impact (and other ESG) considerations may influence both the numerator and the denominator of the fundamental valuation equation.

Climate change can shape an investor's beliefs about future cash-flows in numerous ways. For analytical purposes, it is useful to distinguish between the direct physical impact of climate change and the more indirect impact of the transition to a low-carbon economy. Physical impact could, for example, stem from increasing average temperatures, rising sea levels, or the higher frequency of extreme weather events.[108] As a result of such impacts, agricultural production in some parts of the world might no longer be feasible, sea-side resorts might become flooded, or production facilities might be destroyed by natural disasters. Transition impacts could take the form of restrictive regulation (e.g. the prohibition of specific activities, or the tightening of maximum-permissible emissions caps) or climate litigation (holding "dirty" firms liable for the environmental harm caused). They could also materialize in less direct forms, such as enhanced climate activism campaigns that engender a more hostile public opinion vis-á-vis specific activities that in turn affects a firm's customer base, its workforce, and its political support. As a result of such interventions, for example, fossil fuel companies might not be able to use up all their reserves, airlines might lose customers to railway companies, or demand for low-carbon technologies – such as electric vehicles or energy-efficient buildings – might increase thereby harming the economic prospects of traditional suppliers while boosting those of innovative businesses. Anticipation of such prospective developments could precipitate adjustments of future revenue and cost expectations. These expectations, in turn, could translate into lower or higher expected cash-flows, and, through a smaller or larger numerator, valuations.

Neo-classical asset pricing theory focuses more on the denominator of the valuation equation. The discount factor represents the actual "consideration" that an investor receives for the provision of capital conditional on her expectations about future payoffs, that is, the return that the investor expects from the investment given their time and, more importantly for our purposes, risk preferences. From the perspective of a firm on the receiving end of a financing transaction, the discount factor corresponds to the cost of capital. The higher the discount factor and thus the cost of capital, the more profitable the firm's activities need to be to receive funding.[109]

Most asset pricing models are representative agent models.[110] They assume that all investors have the same time and risk preferences and agree about the means, variances, and covariances of future expected cash-flows (payoffs). They further assume that all investors optimally diversify. Diversification implies that "winners" and "losers" in a portfolio will, on average, cancel each other out to the extent that future returns are uncorrelated. The so-called idiosyncratic component of expected payoffs therefore has no impact on the discount factor, even if the investor is very risk-averse and the payoff in

[108] See already above 1.

[109] In the models with perfect information, unprofitable firms, i.e. those that cannot generate the required return on capital employed do not receive funding at t_0 and exit the market through bankruptcy. With asymmetric information, these firms may receive funding and engage in a gamble for resurrection, i.e. increase the volatility of their investments.

[110] The most general framework for thinking about discount factors and the workhorse model in modern finance theory is the Consumption-based Capital Asset Pricing Model (CCAPM). It is usually attributed to Robert E. Lucas, 'Assert Prices in an Exchange Economy' (1978) 46 Econometrica 1429 and Douglas T. Breeden, 'An Intertemporal Asset Pricing Model with Stochastic Consumption and Investment Opportunities' (1979) 7 JFE 265. For an introduction, see John H. Cochrane, *Asset Pricing* (Princeton University Press 2005), 3-30. For a model with heterogenous climate beliefs see e.g. Tiziano De Angelis, Peter Tankov, Olivier David Zerbib, 'Climate Impact Investing' (2021) working paper <https://papers.ssrn.com/abstract=3562534> accessed 9 November 2021.

question is highly volatile.[111] What matters is only the so-called systematic component of expected payoffs, which can – according to the investor's beliefs – not be diversified away because the future payoffs of different investments are interdependent. Importantly, from the perspective of a risk-averse investor, an investment that pays off highly when most of their other investments do not is more attractive than an investment that pays off highly when most of their other investments are also performing well. This is because risk aversion implies that the marginal utility which the investor will derive from the high payoff of their investment is higher in the former case than in the latter.[112]

The Capital Asset Pricing Model (CAPM) compresses these intuitions into a digestible formula.[113] In the common notation, the CAPM explains discount factors as

$$DF_i^{CAPM} = R_f + \beta_i\big(E(R_m) - R_f\big)$$

where

R_f=	Risk-free rate, i.e. the rate of return of an investment with zero risk
β_i=	Sensitivity of expected asset returns to expected market returns, i.e. the measure for the additional risk the investment adds relative to a market portfolio
$E(R_m)$=	Expected return rate of the market portfolio, i.e. the rate investors ask for an investment in the market portfolio.

Any factor that increases β_i has a negative impact on the valuation of a given asset. The β_i captures the systematic component of the uncertainty about an asset's future payoffs. It is a function of the correlation of the asset's future payoffs and the payoffs of the market portfolio. Assets with high betas are those that the representative investor expects to perform badly when the market is also doing badly, i.e. asset and market returns have a strong positive correlation. The investor will thus ask for higher risk premiums from issuers of such assets – denoted as $\beta_i\big(E(R_m) - R_f\big)$ –, precipitating a negative cost of capital effect for these issuers.

In the CAPM setting, the desirable wedge between the cost of capital of "green" and "dirty" activities emerges if the β_i are smaller for the former than for the latter, leading ceteris paribus to a higher valuation of "green" assets. This requires that, at least according to the perception of investors, "green" assets promise lower payoffs than "dirty" assets in states of the world in which the payoff of the market portfolio is high, and/or promise higher payoffs in states of the world in which the payoff of the market portfolio is low. Such variations might again arise through the physical and/or adaption

[111] Cochrane (n 110), 15.

[112] This is one of the most fundamental principles of asset pricing theory, *see* Cochrane (n 110), 3 ("Most of the theory of asset pricing is about how to go from marginal utility to observable indicators").

[113] The exposition of the basic model is usually attributed to independent contributions from William F. Sharpe, 'Capital asset prices: A theory of market equilibrium under conditions of risk' (1964) 19 JF 425, John Lintner, 'The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets' (1965) 47 Rev Econ Stat 13, and Jan Mossin, 'Equilibrium in a Capital Asset Market' (1966) 34 Econometrica 768. While the CAPM predates the CCAPM, it is mathematically just a special (and restrictive) case of the latter, see Cochrane (n 110), 152-165. For a review of the (mixed) empirical evidence on the model's validity see Eugene F. Fama, Kenneth R. French, 'The Capital Asset Pricing Model: Theory and Evidence' (2004) 18 JEP 25.

channels sketched above (i.e. "green" assets need to have a lower correlation with the market portfolio than "dirty" ones). For example, to the extent that there is uncertainty about the magnitude to which rising temperatures will cause economic downturn and will thus generally depress market returns, risk premiums could be higher for those assets that are expected to suffer the most under adverse circumstances. To the extent there is uncertainty about future regulatory actions to mitigate climate change, risk premiums could be higher for those assets that would be particularly negatively affected if emitters had to internalize more of the social costs of their carbon emissions.

Already, the simple CAPM perspective highlights an important presumption about climate risk influencing discount factors and, hence, costs of capital, in a way that reinforces the policy objective of transitioning from a "dirty" to a "green" economy. The uncertainties surrounding the impact of climate change need to affect the expected distributions of payoffs which "green" and "dirty" assets will generate asymmetrically. Insofar as realizations of climate risk are simply understood as scenarios in which the entire economy is worse-off, this risk alone does not require relatively higher discount factors for "dirty" assets. If realizations of climate risk affect the whole market uniformly, its existence may lead to an increase of DF_i simply as a function of an increase of $E(R_m)$ that, by definition, occurs independently of the "green" or "dirty" properties of an individual investment.[114] Such an effect of climate change should in and of itself have no allocative effect. From this perspective, the mere notion that climate risks might, to a considerable degree, affect the entire economy – with the consequence that investors cannot easily diversify away from them[115] – does not necessarily imply differential discount factors for "green" and "dirty" assets.[116]

In the CAPM, the only relevant risk factor is market risk, and assets are priced solely based on their exposure to this factor. Most empirical approaches to asset pricing aim to single out more factors capturing specific types of undiversifiable risks relevant for the decisions of risk-averse investors.[117] The

[114] Risk averse investors ask for a higher risk premium for the market portfolio if the variance of this portfolio increases, e.g. because states of the world in which the whole market performs badly become more likely and/or severe and therefore the expected deviation from the portfolio's mean performance increases.

[115] See for instance Robert F. Engle et al., 'Hedging Climate Change News' (2020) 33 RFS 1184, 1185 (proposing a dynamical hedge for climate change risk in light of the "long run and nondiversifiable nature of climate risk").

[116] Our observation is not necessarily a first-order counter-argument against "green" disclosure rules. In practice, $E(R_m)$ is usually estimated from past data. In CAPM theory, for example, $E(R_m)$ depends on the properties of the market portfolio as constructed using the optimization approach originally proposed in Harry Markowitz, 'Portfolio Selection' (1957) 7 JF 77. This diversified market portfolio does not fall from the sky either, but it is also a function of expectations, which need to be formed on some basis. Therefore, disclosure still plays a critical role in the support of efficient capital allocation through the pricing mechanism. However, the disclosure of systematic risks cannot trigger the intended transition effect of "green" financial regulation, which would require a variation in the impact of climate change across issuers, i.e. physical and adaptation risks would need to affect "green" and "dirty" issuers differently in order to trigger a shift in capital allocation.

[117] Classical examples include the three-factor model by Eugene F. Fama and Kenneth R. French, 'Common risk factors in the returns on stocks and bonds' (1993) 33 JFE 3, and the five-factor model by Eugene F. Fama and Kenneth R. French, 'A five-factor asset pricing model' (2015) 116 JFE 1. While multifactor models often have remarkable explanatory power and dominate contemporary asset pricing research, they have also blurred the line between theory and evidence, see e.g. Eugene F. Fama, 'Efficient Capital Markets II' (1991) 46 JF 1575, 1598 ("[T]he multifactor models are licenses to search the data for variables that, *ex post*, describe the cross-section of average returns. It is perhaps no surprise, then, that these variables do well in competitions on the data used to identify them.").

general idea here is that an asset may have high exposure to one aggregate risk factor, but low exposure to another. Multi-factor frameworks allow for the introduction of a special climate risk factor and thus make the notion of climate risk more explicit than the simple CAPM.[118] Beyond the market risk channel, the desired wedge in the cost of capital between "green" and "dirty" firms could then also be driven by different levels of exposure to that factor. The critical presumption, however, is again that assets of different "greenness" indeed differ in their exposure to that climate risk factor (i.e. that climate risk does not uniformly affect the market). For the desired wedge between cost of capital to emerge, "dirty" assets need to be riskier than "green" assets in the sense that they are likely to perform badly in states of the world in which the representative investor's marginal utility is high and vice versa.

Ultimately, the answer to the pivotal question depends on what climate risk realizations one is thinking about and how one assumes that they will affect different firms, and in which state of the world. As far as the physical impacts of climate change are concerned, it does not seem unreasonable to assume that a large fraction of these impacts might indeed spread relatively symmetrically across "green" and "dirty" firms. To be sure, some firms might be expected to be hit harder by certain physical consequences than others. But it is not entirely clear why the former should be predominantly "dirty" firms (e.g. a firm that produces photovoltaic cells on the coastline of the Gulf of Mexico is affected more severely by an increase in the probability of devastating hurricanes than a fracking company in Alaska). More speculatively and pessimistically, one could also imagine states of the world where the economy suffers severe physical impacts from climate change, but "dirty" investments yield relatively high payoffs, precisely because they did not (have to) cut emissions and thus kept the advantage of externalizing much of the social costs that their activities cause indefinitely.[119] Adaption-related risks, in turn, might be more asymmetric and predominantly affect "dirty" firms. For instance, ambitious environmental regulations might target high-impact consumers of fossil fuels more severely than firms that use alternative energy sources and leave a significantly smaller carbon footprint. This observation highlights the interdependence of green finance and regulation,[120] but at least leaves some room for a market-based approach to the transition to a net-zero carbon-emission economy.

Another important qualification to the desirable effect of increased risk premiums for "dirty" assets is that even insofar as providing cheaper capital to "green" sectors makes sense in principle, investors who are motivated by financial gains have no incentives to shed investments in "dirty" activities completely (i.e. to fully defund these activities). For the traditional CAPM investor, a balanced integration of individual assets in a well-diversified, market-wide portfolio remains pivotal to optimize risk-adjusted expected payoffs. As long as "dirty" assets have positive weights in the market portfolio,[121]

[118] From the CCAPM perspective, the factors serve as proxies for marginal utility growth and thus allow to bring the key ideas of the consumption-based model to practical data, see Cochrane (n 110) 149-150.

[119] See e.g. Stefano Giglio, Bryan Kelly, and Johannes Stroebel, 'Climate Finance' Ann Rev Fin Econ (forthcoming) = (2020) NBER working paper No 28226, 4-7 <http://www.nber.org/papers/w28226> accessed 18 June 2021 (discussing, from a macro perspective, the interactions and implications of uncertainty about the path of the climate and the economy). See also below 3.1.2.

[120] See for instance Engle et al. (n 115) 1211 ("good regulation will mean less need for climate hedges [but might itself] create winners and losers from regulatory risk").

[121] Portfolio optimization leads to a combination of risky assets that offers the highest expected return for a defined level of risk – understood as the standard deviation of expected returns – or the lowest risk for a defined

CAPM investors will choose to hold them, albeit at a higher discount, and thus fund environmentally-harmful activities. To be sure, financially motivated investors will shift from "very dirty" to "less dirty" assets within a given class or sector as long as these assets are perfect substitutes for diversification purposes. Yet, even with this optimization at the margin, the diversification rationale attenuates the (full) transition objective, because investors will continue to hold more investments in (less) "dirty" investments than would be desirable from an untampered sustainability perspective.

Macro models that investigate the decision problem of a representative investor who has to allocate capital between a "dirty" and a "green" capital stock also demonstrate the trade-off between climate risk mitigation and diversification efforts.[122] Unless climate impact variables load strongly, that is, very severe climate damages are assumed, the observation that investments in the "dirty" capital stock lead to an increase in global temperature, which eventually reduces overall output and thus affects the investor negatively, may not suffice to terminate the investment in the "dirty" capital stock because of the diversification benefit this investment yields. Along similar lines, other macro models estimate the cost-of-capital wedge required to induce a full transition to a net-zero carbon-emission economy and show that it needs to be very large to achieve the pursued objectives.[123] These findings corroborate that the uninfluenced market mechanism will not necessarily achieve the climate targets, despite plausible incentives to shift investments from "dirty" to "green" assets.

More generally, the macro perspective exposes another important limitation of market-discipline exerting cost-of-capital channels as a means to green the economy. For decades, climate economists have been developing ever-more sophisticated integrated assessment models (IAMs) that aim at quantifying the dynamic feedback loop between climate change and economic activity. These efforts are geared towards supplying evidence-based policy advice to social planners (e.g. by providing estimates for the "social cost of carbon").[124] While this strand of literature has undoubtedly provided an invaluable basis for discussion, it has also shown that such quantification exercises are highly sensitive to assumptions about which reasonable minds may disagree.[125] Uncertainty that can be modelled as risk (i.e. uncertain outcomes with *known* probabilities, as in the decision problem of CAPM investors) is compounded by uncertainty as to which weight should be given to different models with different assumptions and parameters, and as to which extent these models fail to account for the underlying

level of expected return. The optimal (tangency) portfolio has a return-volatility profile that sits on the mean-variance efficient frontier. See generally Markowitz (n 116).

[122] See e.g. Rick Van der Ploeg, Christoph Hambel, and Holger Kraft, 'Asset Pricing and Decarbonization: Diversification versus Climate Action' (2020) Oxford Economics Working Papers No 901 <https://ssrn.com/abstract=3528239> accessed 30 March 2021.

[123] Harrison Hong, Neng Wang, and Jinqiang Yang, 'Welfare Consequences of Sustainable Finance' (2021) NBER Working Paper No 28595 <https://www.nber.org/system/files/working_papers/w28595/w28595.pdf> accessed 17 May 2021 (estimating the necessary risk premium for "dirty" assets in a dynamic stochastic general equilibrium model).

[124] See above n 1 through 6 and accompanying text.

[125] For an instructive review of the methodoligcal challenges of climate-economic scenario anaylsis see e.g. Patrick Bolton et al., *The green swan: Central banking and financial stability in the age of cliamte change* (BIS 2020), 23-46.

complexities of the real world.[126] Climate economists, despite significant efforts, have trouble providing conclusive answers even to such fundamental questions as "how high should a carbon tax be?" Therefore, just like policy makers operate from a shaky basis when making decisions relying on IAM predictions,[127] investors will find it difficult to anticipate correctly (on an expected value basis) not only the macroeconomic consequences of climate change, but also which issuers will be better- or worse-off at the micro level in such already highly uncertain scenarios. Hence, market discipline, which can result from asset prices that impound climate impact, is likely fraught with significant noise and outcomes thereof may deviate far from the social optimum.

3.1.1.2 Empirical evidence

The empirical evidence suggests that markets indeed factor climate change into asset prices. Yet, it provides no conclusive proof that the observable carbon premiums reflect physical and adaptation risks adequately.

Survey data indicate that institutional investors consider climate and environmental risks important, although they neither rank them as the most relevant risks for their investments (they are ranked 5th and 6th, respectively), nor do they exhibit a time horizon that exceeds 10 years from today.[128] The same study found that institutional investors include climate risks not only for financial reasons,[129] follow various approaches to assess climate risk (with estimates of carbon footprints and stranded asset risks being the most frequently-used methodologies), and prefer engagement to reduce climate risk over divestment. From a methodological point of view, the rather granular poll that underlies the survey may trigger self-selection bias simply because less ESG-aware asset managers may have little to say about the issues being polled and may therefore abstain from responding at all.[130]

Quantitative evidence corroborates the basic notion that climate risk indeed is impounded into asset prices at firm level. Studies investigating the effects of carbon emissions in the cross-section of stock returns find a carbon premium charged on US equity markets, which conventional risk factors do not fully explain.[131] The premium has increased in the years after the Paris Agreement, suggesting that investor awareness of climate issues plays a role, a hypothesis that other studies have corroborated.[132]

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[126] These ideas are explored in further detail in Michael Barnett, William Brock, and Lars Peter Hansen, 'Pricing Uncertainty Induced by Climate Change' (2020) 33 RFS 1024 (using concepts from asset pricing theory to model how different dimensions of uncertainty might affect the calculus of a benevolent social planner).

[127] For a bleak account of the explanatory power of IAM see e.g. Robert S. Pindyck, 'Climate Change Policy: What Do the Models Tell Us?' (2013) 51 JEL 860 ("[v]ery little").

[128] Philipp Krueger, Zacharias Sautner, and Laura T. Starks, 'The Importance of Climate Risks for Institutional Investors' (2020) 33 RFS 1067 (surveying 439 global institutional investors, with 48 having more than $100bn assets under management).

[129] See also below 3.1.2.

[130] Krueger, Sautner and Starks (n 128) 1077-1078, 1104 (discussing possible response bias).

[131] Patrick Bolton and Marcin Kacperczyk, 'Do Investors Care about Carbon Risk?' JFE (forthcoming) = (2020) ECGI Finance Working Paper 711/2020 <https://ssrn.com/abstract=3398441> accessed 18 June 2021 (analyzing the effect of corporate emissions on the cross-section of stock returns in the US between 2005 and 2017); applying different methodologies, the same authors find qualitatively similar results in a worldwide analysis, see Patrick Bolton and Marcin Kacperczyk, 'Global Pricing of Carbon-Transition Risk' (2021) NBER Working Paper No 28510 <https://www.nber.org/system/files/working_papers/w28510/w28510.pdf> accessed 18 June 2021.

[132] Darwin Choi, Zhenyu Gao, and Wenxi Jiang, 'Attention to Global Warming' (2020) 33 RFS 1112 (finding that in times of exceptionally warm weather a) high-emitting stocks underperform low-emitting stocks and b) attention

Another contribution finds that the cost of option protection against downside tail risk is higher for carbon-intense firms, indicating that markets view high-emitting firms as particularly exposed to adaptation risk.[133] The evidence linking carbon emissions to market outcomes is consistent with additional research that finds evidence for climate-risk pricing in US municipal bond markets,[134] corporate bond markets,[135]and housing and mortgage markets,[136] although occasional studies proxying climate risk exposure with label-type measures have found no evidence that carbon premiums exist.[137] A study quantifying climate risk exposure via a text-based measure derived from earnings call transcripts[138] found that while investors expect higher returns from firms with higher climate risk exposure *ex ante*, this premium is not realized *ex post*.[139] Another study quantifying aggregate climate risks based on textual analysis of Reuters news coverage on climate change topics also found that market prices impound climate risk, albeit only with respect to transition risks expected from policy changes.[140]

to climate change as proxied by Google search volume increases); Irene Monasterolo and Luca de Angelis, 'Blind to carbon risk? An analysis of stock market reaction to the Paris Agreement', (2020) 170 EE 106571 (showing a decrease in the correlation on indices comprising high carbon emitting issuers on the one hand and low carbon emitting issuers on the other with a significant decrease of systematic risk for low-carbon intensive indices after the conclusion of the Paris Agreement).

[133] Emirhan İlhan, Zacharias Sautner, and Grigory Vilkov, 'Carbon tail risk' (2021) 34 RFS 1540 (showing a positive association between industry-level scope 1 emission intensities – as a measure of exposure to adaption risk – and metrics of downside tail risk derived from option prices).

[134] Marcus Painter, 'An inconvenient cost: The effects of climate change on municipal bonds' (2020) 135 JFE 468 (showing that counties which are more likely to be affected by climate change pay more in underwriting fees and initial yields to issue long-term municipal bonds compared to counties less likely to be affected by climate change).

[135] Lee Seltzer, Laura T. Starks, Qifei Zhu, 'Climate Regulatory Risks and Corporate Bonds' (2021) Nanyang Business School Research Paper 20-05 <https://papers.ssrn.com/abstract=3563271> accessed 15 July 2021 (showing a relationship between indicators derived from CDP data and credit ratings as well as yield spreads); on the reflection of physical risks in corporate borrowing rates see Ricardo Correa et al., 'The rising tide lifts some interest rates: climate changes, natural disasters, and loan pricing' (2021) working paper <https://papers.ssrn.com/abstract=3710451> accessed 8 November 2021.

[136] For a review of this line of research see Giglio, Kelly and Stroebel (n 119) 20-24.

[137] Maximilian Görgen et al.,'Carbon Risks' (2019) working paper <https://ssrn.com/abstract=2930897> (introducing a label-type proprietary measure of carbon risk exposure – based on both raw data and third-party issuer-level labels – and finding no significant return to a "dirty-minus-green" mimicking portfolio constructed using this measure).

[138] The measure is introduced and explored in further detail in Zacharias Sautner, Laurence van Lent, Grigory Vilkov, and Ruishen Zhang, 'Firm-level Climate Change Exposure' (2021) ECGI Finance Working Paper 686/2020, <https://papers.ssrn.com/abstract=3642508> accessed 29 June 2021. Another contribution in similar spirit is Qing Li, Hongyu Shan, Yuehua Tang, and Vincent Yao, 'Corporate Climate Risk: Measurements and Responses' (2020) working paper <https://papers.ssrn.com/abstract=3508497> accessed 28 June 2021.

[139] Zacharias Sautner, Laurence van Lent, Grigory Vilkov, and Ruishen Zhang, 'Pricing Climate Change Exposure', (2021) TRR 266 Accounting for Transparency Working Paper Series No 49 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3792366> accessed 28 June 2021.

[140] Renato Faccini, Rastin Matin, and George Skiadopoulos, 'Dissecting Climate Risks: Are They Reflected in Stock Prices' (2021) working paper <https://papers.ssrn.com/abstract=3792366> accessed 15 July 2021, building on the hedging framework developed in Engle et al. (n 115). A similar effect has been documented for the corporate bond market, see Thanh D. Huynh and Ying Xia, 'Climate Change News Risk and Corporate Bond Returns' JFQA (forthcoming) = (2020) working paper <https://papers.ssrn.com/abstract=3577321> accessed 15 July 2021.

Researchers have also found that carbon emissions drive exit by institutional investors, but this divestment does not translate into significant negative effects on stock returns.[141] The latter is not immediately intuitive and stands in contrast to studies that find positive abnormal returns for portfolios that hold long positions in low-emission-intensity firms and short high-emission intensity issuers.[142] Moreover, it is puzzling that institutional investors seem to rely exclusively on scope 1 carbon emissions intensity[143] for their exclusionary screening that occurs only in high-emitting industries, although the observed carbon premium is linked to total carbon emissions – but not emission intensity – and also includes scope 2 and scope 3 emissions.[144] From an economic perspective, it is difficult to explain why investors do not (also) rely on intensities in their pricing, as high-intensity emitters are more likely to suffer from an increase in carbon prices.[145]

More generally, empirical analyses that seek to estimate price effects of firms' climate related properties may suffer from distortions if the fundamental proposition that underpins transparency centered regulatory interventions holds. Historical asset prices, or other measures of firm value, may be noisy if there was indeed an underproduction of high quality, reliable information in the absence of mandatory disclosure regimes.[146] Regardless of the methodologies and quality of emissions data, finding a statistically significant climate risk premium does not rule out that this premium is (far) too low, especially because it seems to be linked only to the adaption risk in the firm's own supply chains and therefore does not impound physical risks or other adaption risks. In general, adaption risk is inherently difficult

[141] Bolton and Kacperczyk (n 131) 23-25. The authors make the puzzling observation that the effect is almost exclusively driven by investment advisory firms and only to a smaller degree by other institutions including asset managers. However, this effect might stem from the construction of the dataset which the authors use. In their main datasource, FactSet, many if not most asset managers are categorized as investment advisers, including, for example, BlackRock Fund Advisors, which manages most US-based BlackRock funds (including e.g. the "BlackRock U.S. Carbon Transition Readiness ETF"). The management of a mutual fund (an investment company under US law) is usually outsourced to a management company (usually the sponsor that also creates the company); see generally John Morley, 'The Separation of Funds and Managers: A Theory of Investment Fund Structure and Regulation' (2014) 123 YLJ 1228, 1238-1240. The formal legal role of an asset manager is then that of an investment adviser to an investment company. This effect is also evidenced in Table 1 of Bolton and Kacperczyk (n 131) which shows that "advisers" have by far the highest ownership share in their sample. Therefore, the main force behind the observed governance through exit are in fact functional asset managers.

[142] Soh Young In, Ki Young Park, and Ashby H. B. Monk, 'Is 'Being Green' Rewarded in the Market?: An Empirical Investigation of Decarbonization and Stock Returns' (2019) Stanford Global Project Center Working Paper <https://ssrn.com/abstract=3020304> accessed 18 June 2021; Gerald T. Garvey, Mohanaraman Iyer and Joanna Nash, 'Carbon Footprint and productivity: does the "E" in ESG capture efficiency as well as environment?' (2018) 16 Journal of Investment Management 59.

[143] The measure can be understood as carbon emissions per unit of sales and is calculated as the tons of direct carbon emissions from production divided by the firm's revenues in million U.S. dollars.

[144] Bolton and Kacperczyk (n 131) 8 ascribe a "somewhat schizophrenic attitude" to investors in dealing with carbon emissions.

[145] But see Bolton and Kacperczyk (n 131) 5-6 with Table 3 Panel A (showing that emission intensity is a noisy indicator for the likelihood of regulatory interventions and fossil energy replacements which are both rather tied to overall emissions).

[146] See below 3.2.2.1. For the assumption that even pricing on informationally efficient markets benefits from mandatory disclosure requirements (and their enforcement), Ronald J. Gilson and Reinier H. Kraakman, 'The Mechanisms of Market Efficiency' 70 Va. L. Rev. 549 (1984); John C. Coffee, 'The Future as History: The Prospects for Global Convergence in Corporate Governance and its Implications' 93 Nw. U. L. Rev. 641 (1999).

to price because of its political nature and the massive uncertainty that stems from it. Occasional evidence suggests that investors may also underreact to physical risk,[147] although behavioral biases might also lead to overreactions to (perceived) financial risks from environmental factors.[148] Even for ESG factors, the financial impact of which is arguably less difficult to assess (namely because historical data provide a reasonable basis for future expectations), researchers have documented remarkable failures of the stock market to adequately price these factors.[149]

3.1.2 Non-financial motives

Investors may prefer "green" investment opportunities over "dirty" ones not only for climate-risk-related financial reasons, but also because their non-financial preferences motivate their investment decisions. This hypothesis raises the question of how relevant non-financial motives are in investment decisions. Indeed, several indicators corroborate the relevance of non-financial determinants for investor behavior (below 3.1.2.1). Moreover, models that include non-financial tastes as motives for "green" investments indicate that the resulting equilibrium tilts towards "greener" portfolios (below 3.1.2.2).

3.1.2.1 Non-financial motives for investment decisions

At the outset, an inquiry into the relevance and momentum of non-financial preferences for investment decisions varies the fundamental question on the determinants of individual utility that rational agents seek to maximize.[150] For the purposes of our analysis, we need only focus on non-financial determinants of investment behavior. Neo-classical frameworks for the theoretical analysis of asset prices such as the standard CAPM[151] take a narrow view of utility and presume that investors care only about the pecuniary implications of their portfolio choices.

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[147] Harrison Hong, Frank Weikai Li, and Jiangmin Xu, 'Climate risks and market efficiency' (2018) J Econometrics 265 (providing evidence that food stock prices underreact to drought risks).

[148] See Shashwat Alok, Nitin Kumar, and Russ Wermers, 'Do Fund Managers Misestimate Climatic Disaster Risk?' (2020) 33 RFS 1146 (finding that fund managers within major "disaster regions" overreact to disaster risk – e.g., hurricanes – by underweighting companies based in disaster regions to an extent that may not be financially justified).

[149] See e.g. Alex Edmans, 'Does the stock market fully value intangibles? Employee satisfaction and equity prices' (2011) 101 JFE 621 (showing that a value-weighted portfolio based on a publicly available employee satisfaction measure earned substantial excess returns over a 25-year period).

[150] In utilitarian philosophy, utility, by definition, comprises non-financial benefits (happiness) and costs (pain), see Jeremy Bentham, *An Introduction to the Principles and Morals of Legislation* (first published 1789, Athlone Press 1970) 11, 12, 42-44; John Stuart Mill, *On Liberty and Utilitarianism* (Parker, Son and Bourn, 1863) 145-146. Also in welfare economics, non-financial determinants of individual utility are frequently acknowledged, see for instance Gary S. Becker, 'The Theory of the Allocation of Time' (1965) 75 Econ J 493 (devising the concept of "full income" that goes significantly beyond money income); Gary S. Becker, 'Nobel Lecture: The Economic Way of Looking at Behavior' (1993) 101 JPE 385, 386; Louis Kaplow and Steven Shavell, *Fairness versus Welfare* (Harvard University Press 2002) 18-24; but see also the much narrower concept of "wealth maximization" developed in Richard A. Posner, 'Utilitarianism, Economics, and Legal Theory' (1979) 8 J Legal Stud 103, 111-113; Richard A. Posner, 'The Ethical and Political Basis of the Efficiency Norm in Common *Law* Adjudication' (1980) 8 Hofstra L Rev 487; Richard A. Posner, 'The Value of Wealth: A Comment on Dworkin and Kronman' (1980) 9 J Legal Stud 243.

[151] See above n 113.

In principle, however, investors might also derive utility from things other than the amount of cash that they hold now or expect to receive at some point in the future. This insight underpins the proliferating debate on corporate purpose where contributors – almost universally – agree, that (ultimate) investors care about non-financial social goals and only diverge on the normative question of whether these preferences should also be embraced by firms' objective functions (i.e. should they also guide directors' behavior?).[152] Under this presumption, investors might prefer holding (or not holding) specific assets for reasons completely unrelated to their financial risk and return profile. For example, investors with high ethical standards might derive utility simply from the fact that they are holding stock in companies that pursue an environmental-friendly strategy and are treating their workers well, whereas they might derive negative utility from holding companies that generate externalities at the expense of other stakeholders and future generations.

Even for such investors, however, investment decisions will rarely be a function of non-financial considerations alone. Financial factors will at least play a role, and the balance between financial and non-financial motives likely varies across individual investors.[153] Moreover, investors might not explicitly separate financial and non-financial considerations in their calculus, and even if they do, with imperfect information, expectations about future profits of "green" versus "dirty" firms and non-financial preferences might be correlated (i.e. investors who prefer a "green" investment strategy for non-financial reasons may also expect higher payoffs from "green" assets). This commingling of mutually non-exclusive motivations makes investigating the prevalence of non-financial preferences difficult, both theoretically and empirically. Specifically, in a world with imperfect information, observed investor reactions to signals of "greenness" are often ambiguous: they could be a manifestation of non-financial preferences as well as of revised beliefs about a firm's future prospects.[154]

These challenges notwithstanding, the available evidence suggests that non-financial preferences may indeed play a role in practical investment decisions.[155] One study, for example, used the introduction

[152] For an astute discussion of these key differences see Oliver Hart and Luigi Zingales, 'Companies Should Maximize Shareholder Welfare not Market Value', (2017) 2 J L Fin Acc 247 (emphasizing that even Milton Friedman did not dispute that investors have non-financial preferences and discussing the implications for the objective of the firm in light of the effectiveness of alternative mechanisms - government tax and transfers, charitable engagement - that potentially allow satisfying non-financial preferences when firms' have the objective of shareholder wealth maximization only). For broad contemporary, policy-oriented discussions see also below n 264.

[153] See for instance Meir Statman, 'ESG as Waving Banners and as Pulling Plows' (2020) 46 J Portfolio Mgmt 16 (distinguishing between plow-minded ESG investors who are willing to sacrifice returns also for the benefit of others, banner-minded ESG investors, who are interested in their own non-financial benefits but are not willing to sacrifice returns and pseudo-ESG investors who are indifferent to non-financial benefits).

[154] One strategy to address this challenge is to combine the analysis of stock returns with topic modelling of news coverage, see David Ardia, Keven Bluteau, Kris Boudt, and Koen Ingelbrecht, 'Climate change concerns and the performance of green versus brown stocks' (2020) National Bank of Belgium, Working Paper Research 395 <https://papers.ssrn.com/abstract=3717722> accessed 15 July 2021 (arguing that the significant relationship between stock prices and news of certain categories – such as research or societal impact – is easier to reconcile with a taste channel than a cash-flow news expectation channel).

[155] Further examples not mentioned below include Nicolas P. B. Bollen, 'Mutual Fund Attributes and Investor Behavior' (2007) 42 JFQA 683 (finding, among other things, that the sensitivity of fund flows to lagged negative returns is smaller for sustainable funds than for conventional funds); Harrison Hong and Marcin Kacperczyk, 'The price of sin: The effects of social norms on markets' (2009) 93 JFE 15 (finding that institutional investors assumed to be more constrained by social norms – e.g., pension funds, endowments – are less likely to be owners of "sin

of the Morningstar Sustainability Ratings ("Globes" – in our framework, a private portfolio-level label) for mutual funds as a natural experiment, finding that very high and very low ratings resulted in economically meaningful inflows and outflows, although funds with high ratings did not financially outperform the funds with low ratings.[156] Yet, a recent study found that this "Globes"-effect for retail flows disappeared during the stress period caused by the unfolding COVID-19 pandemic in early 2020, suggesting that retail investors' sustainability preferences are sensitive to income shocks and less pronounced during times of high uncertainty.[157] Another study combined administrative data from a Dutch fund provider with an online survey, finding that investors in socially responsible funds hold these products partly because of non-financial preferences, even at the expense of financial returns.[158] Moreover, according to the results of a survey of large institutional investors, moral and ethical considerations are among the chief rationales behind these investors' incorporation of climate risks into the investment process, alongside reputational concerns and financial factors.[159] The widening spread between German green sovereign bonds and their otherwise identical non-green "twin" bonds also speaks to the increasing prevalence of investors holding "green" assets simply because of their greenness,[160] although an earlier study investigating municipal green bonds could find no evidence of such

stocks" than other investors); Harrison Hong and Leonard Kostovetsky, 'Red and blue investing: Values and finance', (2012) 103 JFE 1 (finding that US investment managers making political contributions to Democrats tend to have smaller holdings in "socially irresponsible" firms); Sudheer Chava, 'Environmental Externalities and Cost of Capital' (2014) 60 MS 2223 (providing evidence that exclusionary screening based on environmental ratings has a measurable impact on the cost of both equity and debt); Brad M. Barber, Adair Morse, and Ayako Yasuda, 'Impact Investing' (2021) 139 JFE 162 (analyzing non-financial preferences in the context of dual-objective VC funds).

[156] Samuel M. Hartzmark and Abigail B. Sussman, 'Do Investors Value Sustainability? A Natural Experiment Examining Ranking and Fund Flows' (2019) 74 JF 2789. In a similar vein, another recent study found that funds with a "Low Carbon Designation" (LCD) from Morningstar experience higher inflows upon designation, see Marco Ceccarelli, Stefano Ramelli, and Alexander F. Wagner, 'Low-carbon mutual funds' (2021) ECGI Finance Working Paper 659/2020, 19-27 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3353239> accessed 29 June 2021.

[157] Robin Döttling and Sehoon Kim, 'Sustainability Preferences Under Stress: Evidence from Mutual Fund Flows During COVID-19' (2021) working paper <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3656756> accessed 2 November 2021. However, aggregate flows, i.e. pooled institutional and retail flows, continued to be predictable by funds' 'Globes' ratings during the crisis, also consistent with the findings in Lubos Pastor and M. Blair Vorsatz, ‚Mutual Fund Performance and Flows during the COVID-19 Crisis' (2021) 10 RAPS 791.

[158] Arno Riedl and Paul Smeets, 'Why Do Investors Hold Socially Responsible Mutual Funds?' (2017) 72 JF 2505. See also the field survey evidence in Rob Bauer, Tobias Ruof, and Paul Smeets, 'Get Real! Individuals Prefer More Sustainable Investments' working paper (2021) < https://papers.ssrn.com/abstract=3287430> accessed 29 June 2921, and the experiments reported in Jean-Francois Bonnefon, Augustin Landier, Parinitha Sastry, and David Thesmar, 'Do Investors Care About Corporate Externalities? Experimental Evidence' (2019) HEC Paris Research Paper No. FIN-2019-1350 <https://papers.ssrn.com/abstract=3458447> accessed 29 June 2021, and Jacquelyn Humphrey et al., 'The Asymmetry in Responsible Investing Preferences' (2021) NBER Working Paper 29288 <http://www.nber.org/papers/w29288> accessed 8 November 2021.

[159] Krueger, Sautner, and Starks (n 128) 1085-1086.

[160] See Lubos Pastor, Robert F. Stambaugh, and Lucian A. Taylor, 'Dissecting Green Returns' (2021) NBER Working Paper No 28940 <http://www.nber.org/papers/w28940> accessed 14 July 2021, 6-8 with Figure 1 (highlighting the importance to distinguish between expected and realized returns: shifts in tastes towards more demand for green assets may increase *realized* returns of green over non-green assets, but this "out-performance" comes at the expense of lower *expected* returns). Yield spreads between green and conventional bonds are also documented by Olivier David Zerbib, 'The effect of pro-environmental preferences on bond prices: Evidence from green bonds' (2019) 98 JBF 39, and Malcolm Baker, Daniel Bergstresser, George Serafeim and Jeffrey Wurgler,

so-called "greenium."[161] However, even to the extent that historical data suggest a limited role of non-financial preferences for asset prices in the past, such results do not necessarily rule out these preferences possibly becoming more relevant in the future, particularly in light of the growing awareness of the need for urgent and effective climate change mitigation.[162]

3.1.2.2 Equilibrium outcome

In neo-classical asset pricing theory, the question of whether and how equilibrium asset prices change in the presence of non-financial preferences is again determined by the discount factor in the denominator of the fundamental valuation equation (see above 3.1.1.1). The discount factor DF_i should also compensate an investor whose utility is not only a function of time preference and risk aversion, if they derive (dis)utility from their investment decisions through other channels. However, most equilibrium asset pricing models that consider non-financial preferences do not simply stipulate that the representative investor has such preferences. Instead, these models implicitly or explicitly account for the potential heterogeneity of investors' utility functions.

Consider again a simple CAPM world, where – deviating from the standard assumptions – there are two groups of investors: the traditional CAPM investors who simply combine a risk-free asset with a holding in the mean-variance efficient tangency portfolio; and another group of non-traditional investors who have a "taste" for holding specific assets, irrespective of their financial characteristics.[163] By design, the classical CAPM universe is populated only by traditional investors. In equilibrium, they all invest the risky parts of their portfolio in the tangency portfolio. Therefore, the tangency portfolio is also the market portfolio (i.e. the value-weighted portfolio of all risky assets). Since all investors hold the market portfolio, the difference between the return that their risky assets earn and the market return ("alpha") is zero for all investors. If, however, not all investors choose to hold the tangency portfolio because of their non-financial tastes, the market portfolio no longer equals the tangency portfolio. Instead, it comprises the value-weighted average of the tangency portfolio and the aggregate portfolio held by the taste investors. In this situation, equilibrium asset prices are no longer explained by the CAPM equation. The two investor-groups will over- and under-weight certain assets relative to the market portfolio, respectively, according to their preferences. The magnitude of the price effect of

'Financing the Response to Climate Change: The Pricing and Ownership of U.S. Green Bonds' (2018) NBER Working Paper No 25194 <https://www.nber.org/papers/w25194> accessed 15 July 2021.

[161] David F. Larcker and Edward M. Watts, 'Where's the Greenium?' (2020) 69 JAE 101312 (finding no evidence of a greenium when comparing yields of municipal green bonds with yields of traditional bonds issued by the same issuers at the same day); but see also Shirley Lu, 'The Green Bonding Hypothesis: How do Green Bonds Enhance the Credibility of Environmental Commitments?' (2021) working paper <https://www.dropbox.com/sh/ququo2r718x3fwi/AAAaUAdHV7FmBN-_6Vqg2T1ya?dl=0&preview=Shirley_Lu_Green_Bonding_210509.pdf> accessed 29 July 2021 (arguing that green bonds primarily serve as a commitment device and that hence the benefits of issuing green bonds might be realized at the entity-level rather than the bond-level, and showing that municipal bonds issued at the same day as green bonds also enjoy a premium).

[162] For an account that relates the rise of ESG investment with millennials strong non-financial preferences see Georg Ringe, 'Investor-led Sustainability in Corporate Governance' (2021) ECGI Law Working Paper No. 615/2021, 11-13 <https://ecgi.global/sites/default/files/working_papers/documents/ringefinal.pdf> accessed 26 November 2021.

[163] The seminal contribution on which we base the following discussion is Eugene F. Fama and Kenneth R. French, 'Disagreement, tastes, and asset prices' (2007) 83 JFE 667.

this over- and underweighting depends on the proportional wealth that the respective groups invest in risky assets.

Several contributions in the theoretical asset pricing and finance literature have modeled investors' non-financial "green" preferences and their effects on asset prices more explicitly than through merely applying very broad-brushed extensions of the traditional CAPM framework.[164] Perhaps unsurprisingly in light of the above, they have all yielded in essence the same basic relationship: in the presence of investors whose decisions are motivated by non-financial preferences for holding "green" assets, returns are tilted away from standard predictions of traditional asset pricing models, with assets of "dirty" firms earning higher expected rates of return. From the firm's perspective, these higher return expectations mean a higher cost of capital for "dirty" firms, which is consistent with green finance policy objectives.

Crucially, in the CAPM world there is no mechanism, which guarantees that these price differences will be arbitraged away. As long as the portfolio choices of the non-traditional investors do not change, it is not clear why equilibrium prices should change, because this would require a risk-free arbitrage strategy:[165] any additional investment in the tangency portfolio for arbitrage purposes (e.g. with borrowed money) means taking on additional risk. But investors are risk-averse, and their risk appetite is already satisfied in equilibrium. Therefore, price effects stemming from tastes will only vanish if tastes converge and asset valuation thus goes back in line with the classical CAPM predictions. Only if a "green" and a "dirty" asset were perfectly identical, except for their "green" properties, would a risk-less long-short arbitrage become possible: if the price of the "green" asset was higher, financially-motivated investors could (short-)sell the "green" asset and buy the dirty asset until the prices became identical.[166] Arguments of this kind, however, should not overlook that the wedge between prices of green and dirty companies predicted by theory is an equilibrium outcome that occurs when all investors' preferences are fully satisfied. Under the strong assumption of "green" and "dirty" assets having the same properties apart from their sustainability characteristics, investors with non-financial prefer-

[164] See Robert Heinkel, Alan Kraus, and Josef Zechner, 'The Effect of Green Investment on Corporate Behavior', (2001) 36 JFQA 431 (modelling the effects of exclusionary investment strategies on cost of capital and firm behavior); Lasse H. Pedersen, Shaun Fitzgibbons, and Lukasz Pomorski, 'Responsible investing: The ESG-efficient frontier', 2020 JFE <https://doi.org/10.1016/j.jfineco.2020.11.001> accessed 29 June 2021 (modelling asset prices in a world with three groups of investors: (i) agents not informed about pecuniary benefits from ESG, (ii) agents that are, and (iii) agents that, in addition, have a non-pecuniary preference for high ESG scores); Lubos Pastor, Robert F. Stambaugh, and Lucian A. Taylor, 'Sustainable Investing in Equilibrium' JFE (forthcoming) = (2020) working paper <https://papers.ssrn.com/abstract=3498354> (modelling a capital market in which firms have observable ESG characteristics and investors have varying tastes for holding assets in such issuers); see also Oliver D. Zerbib, 'A Sustainable Capital Asset Pricing Model (S-CAPM)' (2020) working paper <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3455090> accessed 29 June 2021; Martin Oehmke and Marcus M. Opp, 'A Theory of Socially Responsible Investment' (2020) Swedish House of Finance Research Paper No. 20-2 <https://papers.ssrn.com/abstract=3467644> accessed 29 June 2021; Doron Avramov, Si Cheng, Abraham Lioui, and Andrea Tarelli, 'Sustainable Investing with ESG Rating Uncertainty' (2021) working paper <https://papers.ssrn.com/abstract=3711218> accessed 15 July 2021.

[165] Fama and French (n 163) 671.

[166] Paul Brest, Ronald J. Gilson, and Mark A. Wolfson, 'How Investors Can (and Can't) Create Social Value' (2018) 44 JCL 205, 218.

ences also benefit from the riskless arbitrage opportunity, albeit with the opposite effect being imposed on prices. They could short the "dirty" asset and buy the "green" one until prices equal the subjective valuations implied by their tastes, thereby pushing the market back to the original equilibrium with price differences. This outcome therefore represents the only stable steady state.

Investors derive (dis-)utility not only from holding or not holding a specific asset. Another channel through which non-financial preferences may enter an investor's calculus is when the investor has a taste for certain states of the world and asset returns are correlated with that state. The most illustrative example here is that of an investor whose utility is directly determined by the state of the planet's climate. As explained above, under standard assumptions about risk aversion, marginal utility gains from high returns are low in states of the world that the investor likes, and high in states of the world that the investor dislikes. To the extent that asset returns are correlated with state variables for which investors have a taste, such a taste may also have an impact on asset prices.[167] In the climate risk context, this means that if investors' utility depends on the state of the climate, and asset returns are correlated with the climate beyond the market risk channel, investors might demand an extra premium for holding assets that perform badly when the climate is also in a bad state.[168] In turn, assets that promise high payoffs when the climate is bad serve as a hedge against climate risk, because the financial gains potentially offset utility losses due to investors' taste for a good climate. Therefore, investors might be willing to forego returns to hold these assets. Whether the taste-for-climate channel works in the same direction as the taste-for-holdings channel will then depend again on the empirically unanswered question of whether investors expect "green" or "dirty" stocks to perform better in states where the climate is bad. Paradoxically, under the view that the climate could be bad precisely because the "dirty" firms have performed exceptionally well, climate-minded investors might – at least in theoretical models – even rationally prefer to hold "dirty" assets over "green" assets for hedging purposes.[169]

3.1.3 Synthesis

Our survey of theoretical predictions and empirical evidence presented in the finance literature suggests that investment behavior can indeed exert an effect along the lines envisioned by advocates of market-based green finance. However, we also found plausible accounts of countervailing forces that could prevent market discipline from inducing a full transition to a sustainable economy. Moreover, the empirical evidence on price wedges between "green" and "dirty" assets does not allow for any

[167] See Fama and French (n 163) 676-677. While difficult to conceptualize in the simple CAPM framework, the state variable risk perspective features prominently in the Intertemporal Capital Asset Pricing Model (ICAPM) devised in Robert C. Merton, 'An Intertemporal Capital Asset Pricing Model' (1973) 41 Econometrica 867. The starting point of the ICAPM framework is the observation that investors' future utility might not only depend on the returns of the investments expected at t_0, but also on future realizations of stochastic state variables. In the traditional ICAPM, the relevant state variable is the investment opportunity set: In an intertemporal setting, prospects of future investment/consumption trade-offs already affect asset prices in the present. The basic idea, however, extends to other state variable risks. Like the CAPM, the ICAPM can also be motivated as a special case of the more general CCAPM, see Cochrane (n 110) 165-167.

[168] Pastor, Stambaugh and Taylor (n 160) show this in an extension of their formal model.

[169] A formal model of portfolio choices under this consideration (and countervailing incentives) is proposed by Steven D. Baker, Burton Hollifield, and Emilio Osambela, 'Asset Prices with Externalities' (2020) working paper <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3344940> accessed 29 June 2021.

inference that higher costs of capital for less sustainable firms adequately reflect the social costs of their impact on the climate. This mixed evidence does not suggest that regulatory efforts that seek to stimulate market forces for a green transition of the economy are generally futile. Yet, they should be taken with a grain of salt when it comes to boastful promises of achieving climate targets through this channel alone (see also below 4.1).

3.2 The role of disclosure

3.2.1 Why should "green" disclosure be mandatory?

A fundamental precondition for the outlined pricing mechanisms to work is that "green"-minded investors have all the necessary information to evaluate a firm's environmental performance and/or its exposure to climate risk. If such information is simply not available, it is not clear on which basis investors should adjust their asset valuations in line with their financial and non-financial preferences.[170] Disclosure *mandates* rest on the premise that there is an information asymmetry between investors seeking green investment opportunities on the one hand, and firms on the other, and that there is a role for regulation to play in correcting this asymmetry. Under which preconditions informational asymmetries indeed provide a rationale for mandatory disclosure rules is one of the evergreen debates in law and economics in general,[171] and in law and finance in particular.[172]

3.2.1.1 Informational asymmetries and market failure

The debate starts with the observation that in the presence of information asymmetries, markets may fail due to adverse selection.[173] The pivotal assumption in the classical models is that the informed party has no means to credibly signal a certain attribute of the traded good that is of interest to the uninformed party, and that the uninformed party has no means of becoming informed about that attribute anyway. Under these assumptions, mandatory disclosure of the relevant attribute can prevent

[170] A related but distinct question is to which extent disclosure *as such* may impact on an issuers' cost-of-capital, namely by reducing estimation risk or increasing liquidity (and thus decreasing trading costs); for a summary of the relevant literature see e.g. Christian Leuz and Peter D. Wysocki, 'The Economics of Disclosure and Financial Reporting Regulation: Evidence and Suggestions for Future Research' (2016) 54 JAR 548-550. This general benefit of disclosure might also be a by-product of "green" disclosure obligations. Insofar as these obligations reduce the uncertainty of climate risks that affect "green" and "dirty" firms asymmetrically (see also above 3.1.1.1 at n 116 to 120 and accompanying text) the beneficial cost-of-capital effect should be larger for "dirty" firms with higher exposures to the respective risks.

[171] See e.g. Howard Beales, Richard Craswell, and Steven C. Salop, 'The Efficient Regulation of Consumer Information' (1981) 24 JLE 24 491, 501-513; Cass R. Sunstein, 'On Mandatory Labeling' (2017) 165 U Pa L Rev 1043, 1050-1068.

[172] For a succinct summary of the theoretical literature see Christian Leuz and Peter Wysocki, 'Economic Consequences of Financial Reporting and Disclosure Regulation: A review and Suggestions for Future Research' (2008) working paper <https://papers.ssrn.com/abstract=1105398> accessed 1 July 2021, 4-22; seminal (and still topical) contributions of that literature include Joel Seligman, 'The Historical Need for a Mandatory Corporate Disclosure System' (1983) 9 JCL 1; Frank H. Easterbrook and Daniel R. Fischel, 'Mandatory Disclosure and the Protection of Investors' (1984) 70 Va L Rev 669; John C. Coffee, Jr., 'Market Failure and the Economic Case for a Mandatory Disclosure System' (1984) 70 Va L Rev 717; Paul G. Mahoney, 'Mandatory Disclosure as a Solution to Agency Problems' (1995) 62 U Chi L Rev 1047.

[173] See generally George R. Akerlof, 'The Market for "Lemons": Quality Uncertainty and the Market Mechanism', (1970) 84 QJE 488.

a lemon market. Most theoretical critiques of disclosure rules in essence lift one or both of these assumptions and emphasize the incentives of the uninformed party to become informed (to the extent that the value of information exceeds the costs incurred in obtaining it),[174] and, more importantly, the incentives of the informed party to disclose its information voluntarily. Specifically, on perfect neoclassical markets, there should be no information shortage in equilibrium thanks to an "unraveling" mechanism:[175] if product quality is unobservable otherwise, at least the provider of the highest-quality goods will have an incentive to disclose voluntarily, because without such disclosure an uninformed market participant will assume a lower (average) quality. This, in turn, creates an incentive to disclose also for the provider of the second highest-quality good, and so forth. In the end, even providers of low-quality goods are incentivized to disclose, because otherwise the uninformed party might assume that the good is (even) worse than it actually is.

More nuanced justifications of mandatory disclosure add an extra layer of argument in response. They question the existence or optimality of these incentives to gather or disclose quality information voluntarily, based on, for example, the public good characteristics of the information itself,[176] the social wastefulness of duplicative private information gathering efforts,[177] the public good characteristics of standardization,[178] the possibility that the party expected to disclose might not have the desired information either,[179] the positive externalities of disclosures for competing firms,[180] managerial agency problems,[181] the drawbacks of private vis-á-vis public enforcement,[182] or bounded rationality arguments.[183] From this perspective, market outcomes without mandatory disclosure requirements are characterized by information underproduction and the resulting inefficient allocation of resources.[184] Most arguments for or against mandatory "green" disclosures rules are variations of these more general themes.[185]

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[174] See e.g. Steven C. Salop, 'Information and Monopolistic Competition' (1976) 66 AER 240.

[175] See e.g. Paul Milgrom, 'What the Seller Won't Tell You: Persuasion and Disclosure in Markets' (2008) 22 JEP 115, 119-21. Classical contributions developing the "unraveling" argument include Sanford J. Grossman and Oliver Hart, 'Disclosure Laws and Takeover Bids' (1980) 35 JF 323; Sanford J. Grossman, 'The Informational Role of Warranties and Private Disclosure about Product Quality' (1981) 24 JLE 461 and Paul Milgrom and John Roberts, 'Relying on Information of Interested Parties', (1986) 17 RAND J Econ 18. In essence, unraveling is the adverse selection mechanism in reverse, see Beales, Craswell and Salop (n 171) note 45.

[176] See e.g. Beales, Craswell, and Salop (n 171171) 503-505.

[177] See e.g. Easterbrook and Fischel (n 172), 681-682.

[178] See e.g. Luigi Zingales, 'The Future of Securities Regulation' (2009) 47 JAR 391, 395.

[179] See e.g. Milgrom (n 175) 121 (emphasizing that for the unraveling "argument to work, it must be common knowledge that a seller *can* distinguish its product from lower-quality products", emphasis in original).

[180] See e.g. George Foster, 'Externalities and Financial Reporting' (1980) 35 JF 521, 523-525.

[181] See e.g. Coffee (n 172) 737-743.

[182] See e.g. Rafael La Porta, Florencio Lopez-de-Silanes, Andrei Shleifer, 'What Works in Securities Laws?', (2006) 61 JF 1, 2-3.

[183] See e.g. Oliver D. Hart, 'Regulation and Sarbanes-Oxley', (2009) 47 JAR 437, 439-440.

[184] For a review of the literature see Luca Enriques and Sergio Gilotta, 'Disclosure and Financial Market Regulation' in: Niamh Moloney, Eilís Ferran, and Jennifer Payne (eds.), *The Oxford Handbook of Financial Regulation* (OUP 2015) 511.

[185] For a comprehensive discussion see Hans B. Christensen, Luzi Hail, and Christian Leuz, 'Adoption of CSR and Sustainability Reporting Standards: Economic Analysis and Review' (2019) ECGI Finance Working Paper 623/2019 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3427748> accessed 28 July 2021; John Armour, Luca En-

Among the traditional justifications for mandatory disclosure, the most important rationale underpinning recent regulatory initiatives in green finance (above 2.1) appears to be the standardization argument. From an economic perspective, the basic problem of private sector solutions is that any single party who invests in creating a standardized disclosure framework incurs all the costs of undertaking such an effort but typically cannot capture all the benefits that subsequently accrue across all users of the created framework (e.g., the certainty of firms as to what and how to disclose, the clarity of investors as to what information is (not) disclosed, and the comparability of information across disclosing entities). This is true for both demand-side and supply-side efforts to foster standardization, if and insofar as standard-producers cannot restrict access to the frameworks to paying users whose aggregate fees capture the full social benefit of standardization.[186]

With climate-related information, the need for standardization is particularly pronounced because the notion of "green" (and, more generally, "ESG") is sometimes prone to subjective interpretations, resulting in ambiguities not only with regard to standards for labeling, but also with regard to the scope of disclosure of raw data. In theory, there might be mechanisms available for markets to overcome these challenges, coordinating in ways that result in the private formation of widely-accepted standards, at least in narrow markets dominated by a limited number of participants. However, in the absence of specific standards, reports might be flooded with boilerplate language[187] and be biased towards presenting firms in an overly green light.[188] Quite importantly, avoiding vague standards requires more than writing prescriptive disclosure rules. In addition, effective enforcement via fully-fledged audits and government oversight (public enforcement) plays an important role.[189] Like in financial reporting, a division of labor is conceivable, where a private non-profit standard-setter devises

riques and Thom Wetzer, 'Mandatory Corporate Climate Disclosures: Now, but How?' (2021) Col Bus L Rev (forthcoming) = ECGI Law Working Paper 614/2021, 13-23 <https://ssrn.com/abstract=3958819> accessed 26 November 2021.

[186] For a general discussion see Zingales (n 178).

[187] For a discussion of the drivers and problems of such practices see Christensen, Hail, and Leuz (n 185) 84-86.

[188] See Madison Condon, 'Market Myopia's Climate Bubble' Utah L Rev forthc = (2021) working paper, 42 <https://papers.ssrn.com/abstract=3782675> accessed 15 February 2021; Jill E. Fisch, 'Making Sustainability Disclosures Sustainable' (2019) 107 Geo L J 923, 947.

[189] Generally, on the role of audits and enforcement for effective disclosure regimes see e.g. Howell E. Jackson and Mark J. Roe, 'Public and private enforcement of securities laws: Resource-based evidence' (2009) 93 JFE 207 (empirically investigating the relative importance of public and private enforcement); Hans B. Christensen, Luzi Hail, and Christian Leuz, 'Mandatory IFRS reporting and changes in enforcement' (2013) 56 JAE 147 (showing that positive liquidity effects which previous studies attributed to adoption of IFRS were concentrated in a small number of EU countries which made substantial changes to the enforcement framework around the same time); Mark DeFond and Jieying Zhang, 'A review of archival auditing research' (2014) 58 JAE 275 (reviewing the empirical literature on audit quality while highlighting that financial reporting and audit quality are "inextricably intertwined"); Hans B. Christensen, Luzi Hail, and Christian Leuz, 'Capital-Market Effects of Securities Regulation: Prior Conditions, Implementation, and Enforcement' (2016) 29 RFS 2885 (showing differential liquidity effects of the implementation of EU directives in the area of securities regulation depending on measures of enforcement quality in the respective Member States); Brandon Gipper, Christian Leuz, and Mark Maffett, 'Public Oversight and Reporting Credibility: Evidence from the PCAOB Audit Inspection Regime' (2020) 33 RFS 4532 (providing evidence for a positive impact of public audit oversight on financial reporting credibility).

the disclosure rules that are endorsed by the legislator and thus backed with the public enforcement regime.[190]

3.2.1.2 Additional justifications for mandatory disclosure

There are also less traditional and perhaps more controversial rationales behind mandatory "green" disclosure obligations. These rationales go beyond preventing the inefficient allocation of capital due to informational asymmetries and thus express policy choices that seek to promote decarbonization as a social objective beyond market outcomes.

For example, regulators may deliberately prescribe "green" information production as a nudge and reminder appealing to investors' non-financial preferences,[191] although such nudges could have a pernicious indirect effect if they offer the promise of a 'quick fix' and thereby undermine support for policies of greater impact.[192] Moreover, legislators may even stipulate mandatory disclosure obligations with the intention of changing these preferences, thereby further stimulating "green"-regarding incentives in investment choices.[193] Such interference with market participants' investment decisions can be justified on the grounds that tackling climate change through changes in investor behavior potentially addresses real-world externalities.[194]

Another, albeit auxiliary, rationale behind mandatory "green" disclosure obligations might be derived from the positive information externalities that meaningful transparency could create for stakeholders which are neither (current or prospective) investors in, nor competitors of the disclosing issuer.[195] Such beneficiaries might include NGOs, third-party data providers, the media, consumers, environmental regulators, or academic researchers. Pertinently, fears of a backlash from some of these stakeholders, facilitated by insights generated by others (investigative journalists, academics), are one plausible reason why directors of "dirty" companies might be reluctant to publicly disclose information about their firms' greenness on a voluntary basis, even if investors wished that they would do so. Information externalities are, however, notoriously difficult to quantify, rendering comprehensive cost-benefit analyses of "green" disclosure rules a highly speculative undertaking.[196]

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[190] For sustainability reporting, the founders of the ISSB (see above 2.2.1.1) envision the model of the International Accounting Standards Board (IASB) that devises the IFRS which are endorsed in the EU according to the procedure laid down in Regulation (EC) No 1606/2002 of the European Parliament and of the Council of 19 July 2002 on the application of international accounting standards, [2002] OJ L 243/1, which means that the IFRS are supported by the full set of public enforcement institutions.

[191] See also Dirk A. Zetzsche and Linn Anker-Sørensen, 'Regulating Sustainable Finance in the Dark' EBOR (forthcoming) = (2021) University of Luxembourg Law Research Paper No. 2021-007 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3871677> (characterizing the transparency-centered approach that the EU has taken so far as a „nudging approach").

[192] David Hagmann, Emily H Ho and George Loewenstein, 'Nudging out support for a carbon tax' (2019) 9 Nature Climate Change 484.

[193] See Hart (n 183) 442 (discussing influencing taste as a rationale for regulation).

[194] See Sunstein (n 171) 1051-1052, 1054 (discussing rationales with a behavioural touch in the context of food labels).

[195] See generally Ann M. Lipton, 'Not Everything Is About Investors: The Case for Mandatory Stakeholder Disclosure' (2020) 37 Yale J Reg 499 (emphasizing the importance of securities disclosures to non-investor audiences).

[196] See also below section 4.2.

3.2.2 Empirical perspectives

3.2.2.1 Insufficient disclosure on unregulated markets

The empirical evidence so far suggests that markets largely fail to deliver the desired information outcomes, thereby bolstering the case for regulatory intervention.

Qualitative survey results show that the vast majority of the responding institutional investors considers climate risk disclosures to be equally important (51%) or even more important than (28%) traditional financial reporting.[197] Moreover, they also "demonstrate a widespread view that current qualitative and quantitative disclosures are imprecise and not sufficiently informative," and that therefore more mandatory disclosure and more standardization would be desirable.[198] The study also documents a correlation between investors' views on the need for improvements in the disclosure regime, and their evaluation of the financial materiality of climate risks. In this regard, the more investors believe that climate risks matter from a financial perspective, the more critical they are of the current disclosure landscape.[199] This contradicts the widely-held notion that sophisticated and attuned investors will easily find a way to acquire the relevant information themselves. Moreover, investors who are skeptical about the adequacy of current disclosures are more likely to believe that equity market valuations in sectors arguably most affected by climate change do not adequately reflect climate risks.[200]

While various frameworks for voluntary firm-level reporting exist, take-up varies and standardization of climate-related disclosures remains limited. For example, the TCFD reports that in a global sample of more than 1,600 large publicly listed companies, as of 2020, only 32% of those companies disclosed climate-related information in line with TCFD recommendations (on average and across all 11 recommendations).[201] Average TCFD alignment varies significantly across the 11 disclosure categories and across regions; it is particularly low for North American issuers (20% on average across all 11 recommendations).[202] According to the TCFD, there has been a certain upward trend between 2018 and 2020 in most categories.[203] An academic working paper analyzing the financial reports of more than

[197] Emirhan İlhan, Philipp Krueger, Zacharias Sautner, and Laura T. Starks, 'Climate Risk Disclosure and Institutional Investors' (2020) ECGI Finance Working Paper 661/2020, 11 with Figure 1 <https://papers.ssrn.com/abstract=3437178> accessed 1 July 2021.

[198] ibid 17 with Table 3. Recent surveys by private market actors generally paint a similar picture, see e.g. BlackRock, Sustainability goes mainstream (2021), 25 <https://www.blackrock.com/corporate/literature/publication/blackrock-sustainability-survey.pdf> accessed 1 November 2021; Schroders, Institutional Investor Study 2021 – Sustainability, 19 <https://www.schroders.com/en/sysglobalassets/digital/institutional-investor-study-2021/assets/SIIS_2021_Sustainability.pdf> accessed 1 November 2021. These surveys also indicate that concerns about data availability and quality are equally shared among investors from North America, Europe and other regions.

[199] Ilhan et al. (n 197) 20 with Table 4.

[200] ibid 24-25 with Table 7.

[201] TCFD, 2021 Status Report (Oct. 2021), 30 <https://assets.bbhub.io/company/sites/60/2021/07/2021-TCFD-Status_Report.pdf> accessed 2 November 2021.

[202] ibid. 34-35.

[203] ibid. 30 (global cross-section), 34 (by region).

800 firms who publicly support the TCFD comes to (even) more sobering conclusions.[204] The authors estimate that the share of TCFD-related content in those financial reports increased only slightly between 2015 and 2020, from 6.42% to 8.7% on average, raising the question "whether voluntary reporting as propagated by the TCFD has enough bite to initiate a change in climate-risk disclosure effectively."[205]

The high cross-sectional variation in ESG ratings from different providers represents an excellent example of markets' difficulties in generating broadly-accepted label-type definitions and assessments of sustainability. While credit ratings tend to be largely consistent across different providers, ESG ratings from diverse suppliers often correlate only at astonishingly low levels.[206] This is not only true for broad issuer-level labels attempting to measure the overall ESG performance of complex businesses, but also for lower-level ratings that assess specific ESG factors.[207] Diverging rating practices are problematic because following these mixed signals in investment choices may dilute the effect of investors' ESG preferences on asset prices and limit, in turn, firms' incentives to adjust their behavior in response to market discipline.[208]

Moreover, even calculating environmental raw data is often not as straightforward as it may seem at first glance. Scope 3 GHG emissions, which typically account for most of a single issuer's carbon footprint, provide a good illustration of this.[209] The scope classifications are based on the GHG Protocol[210] which is arguably an example of a successful, market-driven development of disclosure standards.[211]

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[204] Julia Anna Bingler, Mathias Kraus, and Markus Leippold, 'Cheap Talk and Cherry-Picking: What ClimateBert has to say on Corporate Climate Risk Disclosures' (2021) working paper <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3796152> accessed 2 November 2021.

[205] ibid. 13.

[206] Florian Berg, Julian F. Koelbel, and Roberto Rigobon, 'Aggregate Confusion: The Divergence of ESG Ratings' (2020) MIT Sloan School Working Paper 5822-19 <https://papers.ssrn.com/abstract=3438533> accessed 1 July 2021 (observing an average correlation of 0.54 in global firm-level ESG ratings across six different providers, which they mainly attribute to divergence in scope and measurement); see also Aaron K. Chatterji, Rodolphe Durand, David I. Levine, Samuel Touboul, 'Do Ratings of Firms Converge? Implications for Managers, Investors and Strategy Researchers' (2016) 37 SMJ 1597, 1604; Dane M. Christensen, George Serafeim, and Anywhere Sikochi, 'Why is Corporate Virtue in the Eye of The Beholder? The Case of ESG Ratings' AR (forthcoming) = (2021) working paper <https://papers.ssrn.com/abstract=3793804> accessed 1 July 2021 (showing that ESG rating disagreement increases with additional disclosure of ESG data); Monica Billio et al., 'Inside the ESG Ratings: (Dis)Agreement and Performance' (2020) SAFE Working Paper 284 <https://papers.ssrn.com/abstract=3659271> accessed 14 July 2021.

[207] Berg, Koelbel, and Rigobon (n 206) 16 with Table 6.

[208] ibid. 2. See also Doron Avramov et al., 'Sustainable Investing with ESG Rating Uncertainty' (2021) working paper <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3711218> (developing an asset pricing model that explicitly takes into account ESG rating uncertainty); Rajna Gibson, Philipp Krueger, and Peter Steffen Schmidt, 'ESG rating disagreement and stock returns' (2021) ECGI Finance Working Paper 712/2020 <https://papers.ssrn.com/abstract=3433728> accessed 1 July 2021 (finding an economically meaningful relationship between rating disagreement and stock returns for S&P 500 firms in the period between 2010 and 2017).

[209] Edgar G. Hertwich and Richard Wood, 'The growing importance of scope 3 greenhouse gas emissions from industry' (2018) 13 Environ Res Lett. 104013, 6.

[210] Above n 28 and accompanying text.

[211] But see below n 213-215 and accompanying text.

Yet, accounting for scope 3 emissions remains anything but an exact science. In practice, scope 3 emissions frequently need to be estimated via crude models of the corporate supply chain.[212] The problem here is not so much the lack of a standard itself, but the leeway that companies enjoy in defining and reporting the breadth and depth of their carbon accounting in the absence of de facto harmonization through effective enforcement mechanisms that could narrow the bandwidth of permissible practices. Varying disclosure practices may limit the comparability of disclosed data and ultimately their usefulness for investors' decision-making. Quality issues aside, due to a lack of mandatory disclosure requirements, even EU issuers often do not disclose scope 3 emissions in the first place.[213] According to the index administrator, data were available for only 18% of the constituents of the MSCI All Country World Index as of March 2020.[214] Without firm-level disclosure, investors and database providers can only estimate firm-level emissions data based on publicly available information. It does not then come as a surprise that these estimated data vary to a great extent across different database providers.[215]

But even for as-reported scope 3 emissions, researchers have documented astonishingly low correlations of entries in different databases.[216] The fact that no such phenomenon can be observed for as-reported scope 1 and scope 2 data speaks to the immense difficulties involved in reporting, interpreting, and compiling scope 3 emissions data,[217] in the absence of meaningful standardization not only of reporting frameworks, but also of actual reporting practices. More generally, even where sustainability disclosure is mandatory, actual accounting practices need not be homogenous if reporting standards are vague and/or enforcement is weak. For example, substantial heterogeneity has been documented in the reporting practices of European issuers under the NFRD framework.[218]

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[212] See GHG Protocol, Corporate Value Chain (Scope 3) Accounting and Reporting Standard, 37-38 <https://ghgprotocol.org/standards/scope-3-standard> accessed 1 July 2021 See also WWF Germany, 'Discussion Paper: Overcoming Barriers for Corporate Scope 3 Action in the Supply Chain' (2019), 10 <https://www.wwf.de/fileadmin/fm-wwf/Publikationen-PDF/WWF-Overcoming-barriers-for-corporate-scope-3.pdf> accessed 1 July 2021.

[213] See Alliance for Corporate Transparency, 2019 Research Report: An analysis of sustainability reports of 1000 companies pursuant to the EU Non-Financial Reporting Directive, 47, 102 <https://corporatejusticecoalition.org/wp-content/uploads/2020/02/2019_Research_Report-_Alliance_for_Corporate_Transparency-7d9802a0c18c9f13017d686481bd2d6c6886fea6d9e9c7a5c3cfafea8a48b1c7.pdf> accessed 1 July 2021 (reporting that of the 1000 companies investigated, 65% provided no information about scope 3 emissions whatsoever). Note that under the NFRD, disclosure of quantitative emissions data is to this date only a non-binding recommendation, see section 3.5 of the Commission's Guidelines on financial reporting: Supplement on reporting climate-related information, [2019] OJ C 2019/1.

[214] See Brendan Baker, 'Scope 3 Carbon Emissions: Seeing the Full Picture', MSCI Blog (17 September 2020), <https://www.msci.com/www/blog-posts/scope-3-carbon-emissions-seeing/02092372761> accessed 1 July 2021.

[215] See Timo Busch, Matthew Johnson, Thomas Pioch, and Matthias Kopp et al., 'Consistency of corporate carbon emission data', (2018) Universität Hamburg/World Wildlife Fund Study, 17-18 <https://ec.europa.eu/jrc/sites/jrcsh/files/paper_timo_busch.pdf> accessed 1 July 2021 (documenting high between-database correlations for scope 1 and 2 emissions, but very low correlations for scope 3 emissions data).

[216] ibid 14-17.

[217] ibid 15-16.

[218] See Alliance for Corporate Transparency (n 213); DRSC, Abschlussbericht CSR Studie [Final Report CSR Study] (Jan. 2021), 12-83 <https://www.drsc.de/app/uploads/2021/06/210128_CSR-Studie_final.pdf> accessed 1 July 2021 (covering NFRD reports of 100 German issuers).

3.2.2.2 Social benefits of mandatory disclosure

There is also empirical support for the hypothesis that mandatory ESG disclosure benefits investors and also invigorates market discipline to spur the decarbonization of the economy.

One study estimating the impact of early ESG-related disclosure requirements in China, Denmark, Malaysia and South Africa found that for firms from these jurisdictions, ESG disclosure scores from Bloomberg significantly increased after the introduction of the disclosure mandates, *relative* to propensity score matched firms from other jurisdictions that were not "treated" with such mandate.[219] While we believe that research designs relying on ratings as their main dependent or independent variable need to be taken with a grain of salt due to the questionable information content of these labels (see above 3.2.2.1), this finding is broadly consistent with the idea that disclosure requirements have a measurable effect in the desired direction because they compel the disclosure of some information that would have remained private otherwise. This effect alone is no proof that the new information equilibrium is socially more desirable, though. The benefits from the additional information might be limited, or the provision of this information might also create costs.[220] Yet, the authors also provide some evidence that market valuations of firms in the four jurisdictions *increased* as a result of disclosure regulations, indicating that the improvement of the information environment did at least not come at the expense of *shareholder* value.

A more recent and hence more comprehensive study used the introduction of ESG-related disclosure requirements in a broader set of 25 different jurisdictions to analyze the informational and real effects of such regulatory interventions in a large global panel of publicly-quoted firms.[221] The authors found that mandatory disclosure requirements increased the number of available standalone or integrated ESG reports in two common databases, suggesting, again, that, without regulatory interventions, not all firms disclosed (sufficient) ESG information on a voluntary basis.[222] This improvement effect was stronger for firms with lower overall ESG performance, proxied by ESG ratings.[223] This is consistent with the idea that firms with questionable ESG performance are least likely to disclose negative information voluntarily.[224]

The authors further documented a positive effect of ESG disclosure mandates on the accuracy and alignment of analysts' earnings-per-share (EPS) forecasts.[225] In a similar vein, earlier studies found lower analyst forecast errors for firms that issue stand-alone CSR reports[226] and for firms that use

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[219] Ioannis Ioannou and George Serafeim, 'The consequences of mandatory corporate sustainability reporting', in: Abgail McWilliams et al. (eds.), *Oxford Handbook of Corporate Responsibility: Psychological and Organizational Perspectives* (OUP 2019), 452.

[220] For further discussion of the cost-benefit trade-off see below 4.2.

[221] Philipp Krueger, Zacharias Sautner, Dragon Yongjun Tang, and Rui Zhong, 'The Effects of Mandatory ESG Disclosure Around the World' (2021) ECGI Finance Working Paper 754/2021 <https://papers.ssrn.com/abstract=3832745> accessed 1 July 2021.

[222] ibid 21-22 with Table 3.

[223] ibid 25-26 with Table 4.

[224] See above 3.2.1.2.

[225] ibid at 27 and Table 5.

[226] Dan S. Dhaliwal, Suresh Radhakrishnan, Albert Tsang, and Yong George Yang, 'Nonfinancial Disclosure and Analyst Forecast Accuracy: International Evidence on Corporate Social Responsibility Disclosure (2012) 87 AR 723.

more specific language in their general risk factor disclosures.[227] All these findings are consistent with the idea that ESG-specific disclosures may improve the overall quality, reliability and usefulness of firm-level disclosures for investment decisions, also for those investors who are solely interested in the pecuniary performance of their investments. Discrete disclosure requirements seem to increase the amount of crucial information, particularly on risks that are relevant for asset valuation and expected cash-flows.[228] This observation holds notwithstanding high-level requirements typically laid down in securities laws[229] or accounting frameworks[230] whereby information that is essential for investors' decision-making should be disclosed even if this is not explicitly required under specific rules or standards.

More direct evidence of the climate impact of mandatory "green" disclosure requirements has been provided in studies investigating the effects of the 2013 legislative change in the UK which required certain listed companies to disclose their GHG emissions in their annual reports. Difference-in-difference estimates indicate that this change in the accounting framework caused listed UK firms to reduce their GHG emissions relative to control-groups of non-listed UK firms and listed firms in other European jurisdictions.[231] One study further documented that those UK firms that disclosed lower emissions relative to their peers experienced positive announcement returns upon the first publication of the new report, whereas there was no corresponding effect detected for other European firms.[232] Another study relying on the same quasi-natural experiment found that over the one-year period after the new rules had entered into force, realized stock returns were higher for firms which did not previously disclose emissions voluntarily but then started to disclose relatively large levels of emissions.[233] These results are consistent with both the idea that disclosing higher emissions imposes a cost on firms as a

[227] Ole-Kristian Hope, Danqi Hu, and Hai Lu, ‚The benefits of specific risk-factor disclosures' (2016) RAS 21, 1005.
[228] For the basic CAPM considerations that bolster this hypothesis see above 3.1.1.1. But see also above n 170: Reducing estimation risk need not necessarily drive the desired wedge between the cost-of-capital of "green" and "dirty" firms.
[229] See e.g. Securities Exchange Act Rule 12b-20 (17 CFR § 240.12b-20) (requiring that "in addition to the information expressly required to be included in a statement or report, there shall be added such further material information, if any, as may be necessary to make the required statements, in the light of the circumstances under which they are made not misleading"). According to Rule 12b-2, "[t]he term material […] limits the information required to those matters to which there is a substantial likelihood that a reasonable investor would attach importance in determining whether to buy or sell the securities registered" (17 CFR § 240.12b-2).
[230] See e.g. International Accounting Standard (IAS) 1.17(c) (requiring reporting entities to "provide additional disclosures when compliance with the specific in IFRSs is insufficient to enable users to understand the impact of particular transactions, other events and conditions on the entity's financial position and financial performance").
[231] See Benedikt Downar et al., 'The Impact of Carbon Disclosure Mandates on Emissions and Financial Operating Performance' (2020) ZEW - Centre for European Economic Research Discussion Paper No. 20-038 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3693670> (focusing on the real effects of the UK disclosure mandate and using emissions data disclosed under the EU ETS); Valentin Jouvenot and Philipp Krueger, 'Mandatory Corporate Carbon Disclosure: Evidence from a Natural Experiment' (2021) working Paper <https://papers.ssrn.com/abstract=3434490> accessed 1 July 2021, 15-19 with Table 2 (relying on issuer-level emissions data from ESG Refinitiv).
[232] ibid 28-32 with Table 6.
[233] Patrick Bolton and Marcin Kacperczyk, 'Signaling through Carbon Disclosure' (2021) working paper <https://papers.ssrn.com/abstract=3755613> accessed 14 July 2021, 17-18 with Table 11.

result of higher adaptation risk,[234] and that standardized mandatory disclosure makes it easier for investors to compare the climate-related characteristics of different firms.[235]

Recent evidence also corroborates the notion that "green" disclosures could induce the desired rebalancing effects via channels other than cost-of-capital-induced market discipline. A study exploiting the introduction of facility-level emission disclosures under US environmental law found that facilities substantially reduced their emissions following the regulatory intervention.[236] While the study found no conclusive evidence that "facilities face pressure from investors with regards to US Program data,"[237] it did suggest that one way by which mandatory disclosure might have helped to reduce emissions was by facilitating "benchmarking."[238] For example, transparency could allow individual firms to assess their own environmental performance against that of their peers, thereby identifying opportunities for efficiency gains and ultimately higher returns. Enhanced transparency might also expose the highest emitters to increased pressure from non-investor stakeholders such as customers, the media, or politicians. The importance of benchmarking was also highlighted by another study that, relying again on the UK natural experiment, showed that even those firms, which were previously disclosing emissions voluntarily, reduced their emissions after disclosure became mandatory for all firms.[239] These findings indicate that "green" disclosure may have socially desirable real effects even without strong investor reactions, bolstering the case for information externalities as an ancillary rationale.

The limited amount of "green" mandatory disclosure regimes around the globe presents empirical researchers with some difficulty in adequately accounting for the heterogeneity of such regimes which vary in terms of design, scope, target audience, and enforcement. Absent adequate raw data for control firms as well as for treated firms in periods before disclosure became mandatory, robust identification of the real effects of disclosure is particularly challenging.[240] Moreover, most existing regulatory

[234] See the discussion above 3.1.1.1. The opposite directions of the announcement and later realized returns are not puzzling, but consistent with the theoretical predictions: New information about emissions may translate to lower discount factors for low-emitting firms (be it for financial or non-financial reasons). Prices of low-emitting stock thus appreciate upon the arrival of the information (because the discount rate enters the valuation equation in the denominator). But after this adjustment, returns will be higher for the high-emitting stocks, corresponding to the increased cost-of-capital of the respective issuers. The superior announcement performance of „green" stocks comes at the expense of lower future returns. See also Pastor, Stambaugh, and Taylor (n 160), 2-3, 6-8 (explaining the interdependence of realized and expected returns in a world with changing attitudes toward „greenness" and discussing the implications for claims about the alleged superior performance of „green" assets: temporary outperformance of „dirty" by „green" assets is not inconsistent with the model).

[235] Jouvenot and Krueger (n 231) 5-6.

[236] Tomar (n 103); see also Lavender Yang, Nicholas Z. Muller, and Pierre Jinghong Liang, 'The Real Effects of Mandatory CSR Disclosure on Emissions: Evidence from the Greenhouse Gas Reporting Program' (2021) NBER Working Paper No 28984 <https://www.nber.org/papers/w28984> accessed 27 July 2021 (focusing on electric power plants).

[237] Tomar (n 103) Online Appendix 22.

[238] ibid 23-31.

[239] Jody Grewal, 'Real Effects of Disclosure Regulation on Voluntary Disclosers' (2021) JAE forthcoming.

[240] Some studies resort to ESG ratings as their main dependent variable for measuring the real effects of disclosure, see e.g. Peter Fiechter, Joerg-Markus Hitz, and Nico Lehmann, 'Real Effects of a Widespread CSR Reporting Mandate: Evidence from the European Union's CSR Directive' (2020) working paper <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3725603> (investigating the real effects of the NFRD on European

frameworks focus on raw-data disclosures at the issuer- and in some cases the activity-level. There is hence limited research available on the effects of raw data disclosure mandates at the portfolio-level and regulatory labeling initiatives at the activity-level (taxonomies) and portfolio level (Ecolabels for investment funds etc.).[241] In addition, the existing issuer-level raw data disclosure frameworks such as the NFRD tend to be limited to high-level reporting requirements, or do not go beyond comply-or-explain mandates.[242] Empirical findings based on relatively narrow disclosure requirements are ambiguous with regard to the much broader obligations which are at the center of the current debate,[243] that is, the far more comprehensive, highly-standardized and quantified disclosure obligations envisioned in many regulators' market-based green finance strategies.[244] Such comprehensive "green" disclosure regimes spanning the entire investment chain could turn out to be less effective relative to their higher costs, but they could nevertheless prove valuable for investors, financial analysts, and the broader public.

3.2.3 Design features of socially-beneficial disclosure obligations

Our discussion of green finance initiatives indicated that regulators deploy different tools to improve the availability of information about the "greenness" of investment opportunities. While the broader objective of all these initiatives is to correct information asymmetries, they should be carefully distinguished when assessing the economic legitimacy of "green" disclosure requirements. For some combinations of information categories and levels, a market failure in information production could be more likely than for others, and the cost-benefit analysis could turn out differently for given instances. Below, we lay out some considerations as to the relative desirability of labels and raw data disclosures.

3.2.3.1 Differing rationales behind information categories and levels

In light of our distinction between information categories (above2.1), standardization has distinct properties for raw data on the one hand and for labels on the other. First, a uniform and comprehensive set of raw data facilitates the fully-informed comparison of investment opportunities by sophisticated traders. Second, the transparency of coherent quality signals (labels) that are based on a trustworthy, methodologically coherent, and widely available assessment of raw data enables less sophisticated investors to acquire a better understanding of key properties of investment opportunities. The degree of investors' sophistication, in turn, might vary not only across investor types, but also across information levels, creating diverging needs for "green" labeling. Professional investors might be able to draw the right conclusions from emission-related raw data at the issuer level, but find it more troubling to assess the environmental sustainability at the activity level – which requires a lot of specific

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firms). However, in light of the severe rating variance (see above 3.2.2.1), one may have doubts whether such strategies will indeed capture the relevant real-world outcomes.

[241] Encouragingly, one recent working paper finds that in response to the French Energy Transition Law, French institutional investors subject to the disclosure mandates under art. 173-VI of that law significantly reduced their holdings in fossil energy companies compared to French banks and other European institutions not subject to the law, see Mésonnier and Ngyuen (n 65).

[242] Ten of the 25 initiatives relied on in Krueger et al. (n 221) were only comply-or-explain mandates, although the analysis is robust to using only the requirements that are mandatory in the narrower sense.

[243] See also Christensen, Hail, and Leuz (n 185) 64-67 (reviewing further studies investigating the real effects of other ESG disclosure mandates, concluding that "most academic studies find that firms subject to CSR disclosure requirements tend to expand and adjust their CSR activities", but cautioning that "[t]he narrow settings limit the generalizability of the results").

[244] For an overview of these initiatives see above 2.1.

and thus costly know-how across economic sectors – and aggregate the respective information to make firm-level evaluations. Retail investors, in turn, may need label-based guidance also at the issuer and portfolio level because they may lack the time, resources, and knowledge to compile and compare raw data from different sources and typically cannot rely on the trustworthiness of information intermediaries.[245]

The available evidence is broadly consistent with the idea that when it comes to "green"-related information, different types of investors may have different information needs. While a lab experiment found that individual investors are willing to bid more for a company when managers disclosed "green" investments (compared to when there is no such disclosure),[246] a recent working paper relying on hourly trading data from the Robinhood platform finds no significant difference between retail investor reactions to ESG-related and non ESG-related press releases.[247] One plausible explanation for these findings is that while retail investors theoretically have some preferences with regard to the content of "green" raw data disclosures, they do not regularly access or adequately process such information in practice, at least not at the issuer-level. In turn, the results of another recent working paper, which also makes use of Robinhood data, suggest that publicly available issuer-level ESG ratings have some measurable impact on retail investors' trading behavior.[248] To be sure, market surveys indicate that the majority of institutional investors also make some use of external ESG ratings in their decision-making processes.[249] However, these surveys also show that those investors tend not to follow such ratings mechanically, but rather use them as only one of several determinants that inform their investment and engagement behavior, along with the raw data underpinning the ratings.[250] The idea that professional investors are the main beneficiaries of detailed ESG-related raw data disclosures is also consistent with the correlation of ESG-disclosure levels and institutional ownership observable in archival data.[251]

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[245] It is well-established in the behavioral finance literature that the investment behavior of the average individual investor systematically deviates from that of the rational agents populating neoclassical models, for a review see e.g. Brad M. Barber and Terrance Odean, 'The Behavior of Individual Investors', in: George M. Constantinides, Milton Harris, and Rene M. Stulz (eds.), *Handbook of the Economics of Finance, Volume II, Part A* (Elsevier 2013), 1533-1570.

[246] Patrick R. Martin and Donald V. Moser, ‚Managers' green investment disclosures and investors' reaction' (2016) 61 JAE 239 (reporting that participants were 55% male and 21 years old).

[247] Austin Moss, James P. Naughton, and Clare Wang, 'The Irrelevance of ESG Disclosure to Retail Investors: Evidence from Robinhood' (2020) working paper <https://papers.ssrn.com/abstract=3604847> accessed 6 November 2021.

[248] Aleksandra Rzeźnik, Kathleen Weiss Hanley, and Loriana Pelizzon, ‚The Salience of ESG Ratings for Stock Pricing: Evidence From (Potentially) Confused Investors' (2021) SAFE Working Paper 310 <https://papers.ssrn.com/abstract=3801703> accessed 6 November 2021.

[249] See e.g. Schroders (n 198), 20 ("62% of investors use third-party ESG ratings such as MSCI and Sustainalytics to inform their sustainable investments, and these services tend to be quite costly").

[250] See e.g. SustainAbility, Rate the Raters 2020: Investor Survey and Interview Results (March 2020), 22-25 <https://www.sustainability.com/globalassets/sustainability.com/thinking/pdfs/sustainability-ratetheraters2020-report.pdf> (discussing how investors use ESG ratings); recall also the institutional investor survey results discussed above 3.2.2.2.

[251] İlhan et al. (n 197), 20-22 with Table 4. While not of concern for the point that we make here, it is useful to note that causality is plausible in either direction: Institutional investors may engage with their portfolio firms to demand more disclosure, or firms supplying more disclosure might attract more institutional investors in the first place. Importantly, these channels are not mutually exclusive. Indeed, in additional analyses, the authors exploit

Insofar as activating and/or reinforcing investors' non-financial preferences for "green" investment opportunities constitutes a legitimate policy rationale for climate-related financial disclosures,[252] the role for government-sponsored labels at the issuer or portfolio level is larger than it would be without such a rationale. In many instances, easily digestible labels might represent a more effective means to appeal to uninformed retail investors' environmental consciousness (i.e. their "tastes") than dense pages of raw data disclosures. Beyond the agency problems that may impede a shift in the demand for "green" investment opportunities from translating into actual adaptations of behavior at the issuer/activity level,[253] sustainability-inducing market discipline requires at least that labels convey accurate information to safeguard capital allocation in line with (retail) investor preferences, bolstering the case for regulatory oversight.

The importance of third-party audits and public enforcement can also vary across information categories and levels. For raw data points that can only be determined with the exercise of some judgement (for instance, the model-based calculation of scope 3 GHG emissions or forward-looking statements as to how climate change mitigation might affect a company's business), one key function of auditors and supervisors is to limit the margin of appreciation enjoyed by those who prepare the relevant reports. For labels based on highly prescriptive criteria, verification is more of a check-the-box exercise. The same is true for portfolio-level raw data to the extent that they are simply computed as weighted averages of lower-level data points. For portfolio-level disclosures, which often face retail and other less sophisticated investors, the role of government supervision and enforcement might hence be greater to ensure that marketing documents and adviser communications adequately reflect the environmental characteristics of a financial product, regardless of whether these characteristics are explicitly disclosed or not.

3.2.3.2 Interaction of raw data and labels

Regulators might also consider that raw data is the essential input for "green" labels. It is conceivable, for example, that the introduction of comprehensive raw data disclosure obligations would eventually also strengthen the market's ability to produce more useful labels that are better tailored to the information needs and tastes of the addressees. Facilitating privately-ordered labeling efforts would then be one of the positive externalities of improved disclosure beyond the improvements in direct investor information supply.

On the other hand, the mere creation of labels will not necessarily improve raw data availability to the same degree, although it might have a pull effect. Yet, if the market for labels fails precisely because raw data are unavailable or unreliable, little value might be created by the mere introduction of additional labels that are not accompanied by auxiliary obligations to produce and disclose the relevant

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the UK carbon disclosures and the French Energy Transition Law as plausibly external shocks to information supply and demand, respectively, to demonstrate that both post-investment influence and pre-investment selection effects play a role in practice, ibid 26-29 with Tables 7-8.

[252] See above 3.1.2.

[253] We discuss these issues briefly in the next section, see below 3.3.

raw data. Green investment funds[254] and green indices (tracked by passive funds)[255] provide a good illustration here: labeled products, in principle, facilitate capital investments of less sophisticated market participants according to their preferences and tastes, and trigger the cost-of-capital-induced market discipline that may incentivize firms to make their business more sustainable. Yet, as long as labeling cannot be based on robust, comprehensive, and comparable raw data, the signals sent by green-labeled funds or indices are noisy at best and may even facilitate greenwashing.

3.2.3.3 Can labels work?

Labeling by its nature entails reducing the complexity of raw data. Therefore, regulators have to select the criteria on which the quality assessment of the respective labels is based as there will hardly ever be a single "right" way to define the relevant determinants. To be sure, some degree of arbitrariness inherent in labelling frameworks is a feature, not a bug: it is simply impossible to reach a consensus on the criteria that support a specific label. Some stakeholders will always deem these criteria too demanding, overly generous, too complex, or not complex enough. Therefore, labels necessarily encode a subjective evaluation of the provider. The alternative of introducing different labels using different criteria to cater to the preferences of diverse stakeholder groups sacrifices most of the benefits of standardization. Moreover, legitimate criticism will be levelled at label heterogeneity, as the revealing case of ESG ratings vividly illustrates. The more dimensions a label is supposed to capture, the more daunting the task of developing and justifying the label criteria becomes. In addition, incorporating more criteria also increases the likelihood that label criteria become outdated in light of new scientific evidence.

The a priori indeterminacy of labels may also influence regulatory and political processes. The wide discretion that regulators enjoy in defining labels might make this type of regulatory intervention more prone to the perils of regulatory capture than a regime of mandatory standards for raw data disclosures.[256] Precisely because defining label criteria is difficult, regulators might also shy away from specifying criteria in the necessary detail in the first place, either because they lack the time and/or expertise to reach an informed decision at the level of granularity required, or because they anticipate public criticisms if they commit themselves to specific criteria. While the EU's taxonomy is without doubt very

[254] Over the last few years, popularity of green fund products has soared. According to fund data provider Morningstar, assets under management in sustainable funds in Europe exceeded one trillion euros at the end of 2020, and products marketed as sustainable accounted for almost half of total net fund inflows. In 2020 alone, more than 500 new sustainable funds were launched, and about 250 existing funds were repurposed to include a sustainability component, Morningstar, 'European Sustainable Funds Landscape' (2021), 4, 6, 10, 13 <https://www.morningstar.com/en-uk/lp/sustainable-funds-landscape> accessed 14 July 2021.

[255] About one fifth of European sustainable fund assets are in index-tracking funds, and this number is a rising, see ibid 4; see also Morningstar, 'Passive Sustainable Funds: The Global Landscape' (2020), 7 <https://www.morningstar.com/lp/passive-esg-landscape> accessed 14 July 2021.

[256] On the interplay between discretion and capture opportunities see e.g. Magdalena Ignatowski, Charlotte Werger, and Josef Korte, 'Between capture and discretion – The determinants of distressed bank treatment and expected government support' (2015) ECB Working Paper No 1835 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2641048> accessed 3 August 2021 (providing evidence that more influential U.S. banks are less likely to be subjected to discretionary measures); see also Arnoud W. A. Boot and Anjan V. Thakor, 'Self-interested Bank Regulation' (1993) 83 AER 206, 211 (arguing that rule-based intervention thresholds might be preferable to discretionary requirements if bank regulators are self-interested).

elaborate, there remain various open ends.[257] The SFDR introduces the shiny categories of "light green" and "dark green" products, but when scrutinized more thoroughly, the definitions of these product categories turn out to be borderline tautological.[258] Another unique trade-off that regulators face is that labels which are so demanding that only very few activities, issuers, or portfolios would benefit from the signals they send, will conjure up fierce opposition from the vast majority of the assessed actors and their lobbyists, whereas labels with observably lax criteria might be rejected even by an unsophisticated audience. This dilemma turned out to be one of main challenges in designing the criteria for the EU Ecolabel for retail financial products[259] and the preliminary outcome has not been too encouraging: the label criteria have good optics but arguably little substance, giving rise to concerns that an unnecessary amount of transaction and opportunity costs will be incurred by asset managers in wasteful attempts to "optimize" portfolios in order to reach label-relevant thresholds.[260]

3.2.3.4 Synthesis

Overall, from the foregoing we can assert that it may be easier to justify raw data disclosure obligations than regulatory labeling, especially at the issuer and portfolio level, and that it might be advisable to prioritize raw data disclosure initiatives over labeling projects, although meaningful labels could be valuable for retail investors with bounded rationality.[261] The key problem is that we believe such labels are difficult to achieve in practice and suboptimal labels might do more harm than good. In any case, our discussion shows that broad claims á la "green finance is important and we need more transparency" are a poor justification for coherent policy initiatives. Our framework helps policy makers to disentangle the pivotal aspects and to clarify why exactly they choose disclosure obligations of which

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[257] See e.g. the very lofty and unspecific requirement for the minimum human rights safeguards in TR, art. 18. Moreover, also the technical screening criteria rely to a considerable degree on standard-type language, see Commission Delegated Regulation (EU) __/__ (n 80), annex I and II.

[258] The "light green" product "promotes, among other characteristics, environmental or social characteristics" (SFDR, art. 8(1)), whereas the "dark green" product "has sustainable investment as its objective" (SFDR, art. 9). The definition of "sustainable investment" (SFDR, art. 2(17)) adds little clarity. In particular, it is not entirely clear whether the sustainability of investment is a characteristic of an activity, an issuer, or a portfolio.

[259] See JRC (n90), 40 (noting that some stakeholders were concerned that the low implicit greenness threshold under the initial proposal – 18% weighted average taxonomy-based turnover for equity funds – "could compromise the credibility of the EU Ecolabel" while others were of the opinion that "it should be ensured that a significant number of investment funds would be eligible").

[260] The latest proposal combines a relatively high threshold (Ecolabel qualifying equity funds need to have a 50% weighted average of company-level greenness) with a peculiar company-level greenness metric: the sum of taxonomy-aligned turnover and capital expenditures, divided by total turnover, whereby for taxonomy-aligned capital expenditures, the highest value of the last three years is to be used; see JRC (n 94), annex section 1.1 A. From an accounting point of view, this company level metric has no meaningful interpretation. Theoretically, a single portfolio company's greenness quota can also be greater than one.

[261] For avoidance of doubt, the policy question that we analyzed here is whether *regulators* should strive to provide their *own* labels (as a public good). We used the case of ESG ratings mostly to *illustrate* potential problems of market-based labeling approaches. Whether ESG rating dispersion is a problem that should (or even can) be addressed by regulating the provision and/or use of such ratings is a related, but ultimately a different policy question (see also above n 107), on which we do not take a position in this paper. For a brief discussion see e.g. Quinn Curtis, Jill E. Fisch, and Adriana Robertson, 'Do ESG Mutual Funds Deliver on Their Promises?' Mich L. Rev. (forthcoming) = (2021) ECGI Law Working Paper No 586/2021, 57-58 <https://papers.ssrn.com/abstract=3839785> accessed 29 October 2021 (cautioning that diverging rating practices may simply reflect different interpretations of what the inherently indeterminate concept of ESG means, and that issuer-level rating dispersion might not be a first-order concern from the perspective of end investors in portfolio products).

particular category and at which particular level. The distinctions provided in this paper can also guide comparative empirical research seeking to investigate the relative effectiveness of policy alternatives.

3.3 Challenges beyond the model world

The previous sections provided theoretical and empirical arguments which, in part corroborate the key assumptions that underpin the regulatory concept of a market-based approach to green finance, but also identified significant obstacles such a concept faces. Mandatory disclosure obligations can indeed enhance the available information needed by market participants to identify "green" investment opportunities, which they may seek due to their financial and/or non-financial motivation. The predicted and observable negative cost-of-capital effect for "dirty" issuers is, in principle, apt to influence firm behavior and push for more environmentally-sustainable activities in equilibrium, although the steady state may still deviate from the social optimum.

However, even those who share our assessment of the existing evidence in principle, may rightfully hesitate to jump to the conclusion that a disclosure-centered approach to green finance will actually work and achieve the ambitious goal of spurring market discipline to induce the transition to a net-zero carbon-emission economy. Capital allocation is in practice significantly more complex than most asset pricing and finance models suggest. These models often disregard the various agency conflicts that may arise in real-world investment relationships. Enhanced transparency can in itself help mitigate the adverse consequences of such conflicts. But in many cases, transparency will at best partly resolve these conflicts, especially where principals lack the resources or incentives to monitor their agents' behavior.

The firms issuing the financial instruments supposed to fund "green" or "dirty" economic activities are typically complex organizations. Their response to more favorable refinancing conditions for sustainable activities is critically influenced by controlling insiders' (i.e. management and dominant blockholders) own interests. Indeed, the gist of corporate governance research suggests that more favorable financing conditions for green activities do not translate into incentives for firms to reorganize their businesses without some frictions. In traditional models, in which shareholders as principals are motivated solely by financial considerations and agree that the objective of the firm is to maximize value/profits, managers might not do what is financially best for the firm, because they would prefer a quiet life. Alternatively, executives may undertake/forgo "green" projects, even if the respective choice does not benefit the financial interests of shareholders, but rather suits the executives' own preferences regarding the balance between "green" and "dirty" activities (for instance, the pursuit of non-financial private benefits incurred from acting in accordance with their own political beliefs). All of these agency conflicts are mitigated, but not necessarily resolved, by the institutions of corporate governance like various forms of shareholder voice (e.g., voting, informal engagement, and "green" activist campaigns), the (threat of) exit working through the decline of stock prices, or fiduciary duties enforced in shareholder litigation.[262] Moreover, many further complexities arise if one accepts that

[262] For an overview see Mark J. Roe, 'The Institutions of Corporate Governance' in: Claude Ménard and Mary M. Shirley (eds.), *Handbook of New Institutional Economics* (Springer 2008) 371; for a recent contribution highlighting the relative effectiveness of corporate governance mechanisms on U.S. markets see Holger Spamann, 'Indirect Investor Protection: The Investment Ecosystem and Its Legal Underpinnings' (2021) LawFin Working Paper No 18 <https://ssrn.com/abstract=3707249> accessed 13 July 2021.

firms may have comparative advantages in fulfilling shareholders' non-financial preferences,[263] may have a stakeholder-oriented objective function,[264] or that diversified shareholders may pursue engagement strategies that seek to maximize returns at the portfolio level. These engagement strategies may have both a bright and a dark side, because diversified shareholders internalize not only socially wasteful externalities such as carbon emissions[265] but also socially desirable externalities such as the effects of competitive product market behavior[266] with the resulting incentives potentially inducing welfare enhancing as well as welfare decreasing behavior.

The omnipresence of institutional investors is another feature of real-world markets that traditional models of financial markets tend to abstract away from. Investment intermediation, in particular by asset managers and pension funds, introduces another set of agency conflicts on the supply side of capital, which may further impede translating shifts in demand for "green" assets into changes in firm behavior. Institutional investors' "green"-oriented trading strategies could deviate from their ultimate beneficiaries' preferences in either direction: Intermediaries might exploit informational asymmetries to pursue "green" strategies in accordance with their own non-financial preferences where clients would rather want intermediaries to maximize their risk-adjusted financial returns. Conversely, intermediaries might also fail to take sufficient measures to protect their clients' investments from climate-related financial risk or to consider their clients' non-financial preferences where the principals (ultimate investors) cannot observe such deviating agent behavior. To be sure, under the applicable investment laws institutional investors are typically subject to fiduciary duties that require them to manage assets solely in the interest of the ultimate beneficiaries, and regulators increasingly emphasize that the discharge of these fiduciary duties also requires considering climate and other sustainability risks.[267] The effectiveness of such high-level fiduciary duties and risk management obligations will depend on the quality of enforcement and will rarely lead to perfectly aligned incentives of intermediaries and ultimate beneficiaries.

The impact of institutional investors' agency problems is not limited to asset trading and portfolio construction, but also extends to corporate governance: institutional investors typically have little "skin in

[263] See Hart and Zingales (n 152).

[264] The potential societal benefits of a stakeholder-oriented approach are highlighted in recent monographs by Colin Mayer, *Prosperity: better business makes the greater good (*OUP 2018) and Alex Edmans, *Grow the pie: how great companies deliver both purpose and profit* (CUP 2020). More sceptical contributors to the corporate purpose debate emphasize the increased leeway for managerial rent seeking under a stakeholder oriented objective function of firms, see e.g. Lucian A. Bebchuk and Roberto Tallarita, 'The Illusory Promise of Stakeholder Governance', (2020) 106 Cornell L Rev 91.

[265] See e.g. Madison Condon, 'Externalities and the Common Owner' (2020) 95 Wash L Rev 1; Jeffrey N. Gordon, 'Systematic Stewardship' (2021) ECGI Law Working Paper 566/2021 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3782814> accessed 14 July 2021.

[266] For a review of the recent literature investigating the anticompetitive effects of common ownership see Martin Schmalz, 'Recent Studies on Common Ownership, Firm Behavior, and Market Outcomes' (2021) 66 Antitrust Bulletin 12.

[267] See e.g. Commission Delegated Directive (EU) 2021/1270 of 21 April 2021 amending Directive 2010/43/EU as regards the sustainability risks and sustainability factors to be taken into account for Undertakings for Collective Investment in Transferable Securities (UCITS), [2021] OJ L 277/141, art. 1(4) (introducing a requirement that "Member States shall ensure that investment companies integrate sustainability risks in the management of" mutual funds).

the game" when they vote in the general meetings of portfolio companies or otherwise engage with their management, which again might distort their incentives in either direction. The intermediary role in which institutional investors exercise shareholder rights has led to vivid debates about these institutions' "stewardship" responsibilities vis-á-vis end investors, firms, and other stakeholders. Akin to "green" raw data disclosure obligations at the portfolio level, regulators use transparency of engagement behavior as a tool to allow end investors to select their intermediaries in accordance with their stewardship-related (financial or non-financial) preferences. At the European level, for example, the revised Shareholder Rights Directive (SRD II) of 2017 requires asset managers and other institutional investors to publish, on a comply-and-explain basis, annual reports detailing their voting and other engagement behavior, including with respect to environmental and social issues.[268] As long as free rider problems prevail, however, it is not clear whether market forces alone will cause institutional investors to engage in corporate governance as if their exposure was proprietary.[269] Moreover, the European legislator's ambitions to strengthen institutional investor engagement have arguably met limited interest by the Member States, who have mostly opted for a "minimalistic" transposition of the relevant SRD II provisions.[270]

These examples highlight that principals' interests do not automatically motivate agents' behavior and therefore need (institutional) safeguards, which may in turn prove imperfect. However, we believe that these potential impediments do not create categorically different, and by their nature insurmountable, challenges for a disclosure-based regulatory approach to green finance. Our claim is not that frictions such as those canvassed above will only have negligible implications for the impact of a disclosure-centered approach to green finance. Our view is, however, that the complications that arise in a real-world investment ecosystem are ultimately slowdowns or accelerants for the general transformative trend precipitated by disclosure-centered regulatory interventions. This is not to say that scrutinizing the implications of frictions is unimportant. Quite the contrary, understanding agents' incentives is a key component in designing an efficient regime. Yet, with regard to this paper's objective to verify the viability of a market-oriented regulatory strategy to induce the decarbonization of the economy, these design questions are secondary.

4 Conclusion

Our analysis has shown that a disclosure-centered regulatory intervention can indeed lead to a shift in the demand for "green" assets that is, in principle, apt to activate market discipline to induce the decarbonization of economic activities, although significant countervailing forces may prevent reaching the social optimum in the steady state. However, even such a cautiously favorable assessment of disclosure-centered regulatory approaches to green finance is in and of itself an insufficient justification

[268] Directive 2007/36/EC of the European Parliament and of the Council of 11 July 2007 on the exercise of certain rights of shareholders in listed companies, art. 3g, [2007] OJ L 184/17 as amended.

[269] See e.g. Lucian A. Bebchuk, Alma Cohen, and Scott Hirst, 'The Agency Problems of Institutional Investors', (2017) 31 JEP 89, 97-100.

[270] Dionysia Katelouzou and Konstantinos Sergakis, 'When Harmonization is Not Enough: Shareholder Stewardship in the European Union' (2021) 22 EBOR 203; see also Georg Ringe, 'Stewardship and Shareholder Engagement in Germany' (2021) EBOR 87 (discussing German lawmakers' reluctance to improve shareholder engagement).

for legislative interventions. The main arguments against a regime that relies on comprehensive mandatory green disclosure obligations are that social planners have more direct means at hand to tackle climate change and that the costs of an information-centered green financial regulation simply exceed the benefits of such an intervention. Yet still, in our view, the available evidence, political realism and the magnitude of the challenge posed by climate change justify pursuing disclosure centered green finance interventions as second-best regulatory strategies.

4.1 What works in climate impact mitigation?

Ideally, governments should address externalities directly by forcing prices to fully reflect the social costs of harmful activities or limiting activity levels to the social optimum. In the context of climate change and impact mitigation, a global emission-trading scheme, carbon tax, or quick phase-outs of high-emitting technologies through outright regulatory prohibitions all represent options that dominate in an institutional comparison. But, as a matter of practical policy, governments have arguably failed so far to adopt effective direct measures.[271]

Is green finance, then, the solution? Our analysis shows that financial and non-financial preferences might, at least at the margins, play a role in shifting capital from "dirty" to "green" activities and arriving at a more sustainable equilibrium. However, we have also identified many caveats. These range from the difficulties in assessing how climate risk will impact – in a manner relevant for asset pricing – both individual firms and the economy in general, to the countervailing benefits that risk-averse investors aspire to reap from diversification, to the various agency conflicts along the supply side of the investment chain. While a cautiously optimistic picture emerges from our review of theory and evidence, there is no guarantee that green finance will also work on a large scale. The impact of economic activity on the global climate poses a gargantuan externality problem. Activating market discipline to induce the full alignment of economic activity with sustainability objectives thus requires that asset prices reflect the social costs of climate-relevant economic activity completely (i.e. the cost-of-capital effect that underpins market-oriented concepts of green finance needs to compel the full internalization of these costs). These highly demanding preconditions make it almost illusory to expect that changing financing conditions by increasing transparency requirements might eventually serve as a meaningful substitute for environmental regulation or taxation. Yet, to the extent that first-best solutions are not politically feasible, second-best alternatives that are within reach in the political process may have value for society.[272]

Political realism aside, disclosure-centered financial and securities regulation may play a role even if direct interventions in the real economy were to become a viable option in the future. Even the most effective environmental policy will not solve information asymmetries in financial markets, creating

[271] See e.g. Jan Christoph Steckel, Ottmar Edenhofer, and Michael Jakob, 'Drivers for the Renaissance of Coal' (2015) 112 PNAS E3775 (showing how restricting the use of coal in developed economies increased the carbon intensity of global energy production as the decline of the price of coal allowed developing countries to satisfy their energy needs cheaply by increasing coal-fired production).

[272] We acknowledge that in some jurisdictions, particularly where "green" transparency requirements involve a contested extension of the mandate of regulatory rulemaking, even the second-best solution might not be available for political reasons. But see also the strong push of the SEC for green disclosure in the US above 2.2.1.1 and 2.2.1.2.

the potential for an inefficient capital allocation that attenuates the beneficial impact of direct regulatory interventions. The shifts in production and technology that would become necessary to respond efficiently once regulation compels emitters to internalize the social costs of carbon are unlikely to occur without market discipline. Even if the reorientation of activities in a market-oriented economy was jolted by direct carbon pricing, it would still require a reallocation of capital. A well-developed information infrastructure would certainly help to bring about such a reallocation faster and in a more efficient manner. In this scenario, the specific justifications of "green" finance disclosures based on their potential to contribute to climate change mitigation will become void, but the more traditional rationales for mandatory disclosure will continue to apply.

In light of the tremendous uncertainties surrounding climate predictions, IAMs, and estimates of the social costs of carbon, it would also be naïve to believe that environmental regulation will necessarily and instantaneously achieve socially optimal outcomes, once sufficient political support emerges to implement more stringent climate policies. In lockstep with advances in climate (impact) science, the path to net-zero carbon emissions will likely entail a constant updating of priors and a re-evaluation of fundamental policy parameters like, for instance, the size of emission caps or carbon import taxes. Under these circumstances, the price mechanism of green finance might serve as a welcome additional device to achieve adjustments faster and more granularly. Informationally efficient capital markets should be able to incorporate new available information at a swifter speed than that at which updates could be achieved in the political or regulatory processes. Moreover, the transnational nature of market pricing removes the need for cumbersome international coordination and compromise when it comes to green regulation. These advantages will become all the more important, the more our knowledge on the interrelation of climate and biodiversity objectives grows, i.e. "green" finance transcends decarbonisation targets.

Moreover, should stringent environmental policy measures be adopted one day, they might also have a dramatic one-time impact on firm valuations. In our framework, pricing of this prospective impact, despite its inherent uncertainty, would be more adequate if markets received more information allowing for the estimation of firms' likely exposure to adaptation risks. If markets "get it right" faster, the threat of a more subtle externalities problem that could arise from the interplay between environmental policy and market expectations seems less severe. In principle, governments could be forced to not enact or at least delay the climate policies that are necessary based on scientific evidence, because the ensuing devaluations of assets would result in severe economic distortions. These devaluations are particularly harmful from the perspective of public policy if they spill-over to the banking system, for instance via a depreciation of collateral leading to downwardly-spiraling liquidity crises or a general decline in creditworthiness, triggering more traditional forms of bank runs. In fact, the expected "tactfulness" of environmental regulators is one of the reasons why some sustainable finance critics argue that prudential regulators should, as of today, not care about climate risks.[273] At least at the margins, comprehensive transparency of issuers' climate-risk exposures should tweak prices to reflect impending devaluations more adequately, and thereby facilitate a more credible commitment of non-financial

[273] See, e.g., John C. Cochrane, 'Testimony on financial regulation and climate change to the US Senate Committee on Banking, Housing, and Urban Affairs' (*The Grumpy Economist*, 18 March 2021) <https://johnhcochrane.blogspot.com/2021/03/testimony-on-financial-regulation-and.html> accessed 12 July 2021.

regulators to do "whatever it takes." To be sure, adaptation risk is inherently political and therefore the comprehensive disclosure of climate-risk exposures does not prevent markets from rationally operating on the expectation that governments will, in one form or another, compensate for extreme losses from environmental policy interventions. However, even if comprehensive mandatory disclosure cannot remove all of the uncertainty surrounding adaptation risks and thereby extinguish the impediments that could thwart governments' abilities to enact adequate climate policies, it contributes at least to some degree to more accurate predictions of future developments today, by making sensitive intervention points at activity and firm level more transparent.

4.2 Costs and benefits of green finance

At the outset, it is hard to dispute that regulators should not pursue policies if the costs of those policies exceed the social benefit they create. In complex settings such as financial markets, however, attempts at meaningful ex ante cost-benefit analyses of specific disclosure rules are often futile, which is all the more true if a wide set of disclosure obligations potentially entails a host of positive externalities. Experience shows that even ex post, it is often very difficult to assess the welfare effects of disclosure rules empirically.[274] Realistically, any "formal" cost-benefit analysis of green finance policies that aims at adequately capturing all benefits at the macro level is akin to mere speculation and crystal ball gazing. In the absence of adequate data and in the presence of enormous uncertainties about future states of the world, there is, unfortunately, only very little that formal quantitative impact assessments, beyond partial analysis of specific regulatory interventions, can contribute to practical policy decisions.[275] Recognizing these difficulties, political decision-makers, for a lack of alternatives, have to rely on plausible qualitative considerations, even though these may lack scientific rigor, in order to rely to the largest degree possible on verifiable normative guidance. One qualitative consideration deserving particular attention in the green finance context is the precautionary principle,[276] which is also reflected in the European Treaties' provisions on environmental policy.[277] Under this principle, regulators are advised to risk sinking too many (direct and opportunity) costs in dealing with environmental challenges, rather than to err on the side of doing too little.

The precautionary principle is, of course, not a blank cheque to justify any policy measure regardless of its costs or the plausibility of its contribution to social welfare. But in the present case, it is not evident why there should be an obvious and severe mismatch between costs and benefits. From a macro perspective, one may plausibly argue that the costs of mandatory "green" transparency rules in financial markets should be relatively low compared to the potential benefits.

To be sure, for many issuers and financial intermediaries, complying with comprehensive "green" disclosure mandates might entail some non-trivial direct costs, from setting up the reporting infrastructure to legal and accounting fees paid to advisors who explain how to apply the relevant regulatory frameworks. Since many disclosure frameworks are adopted by regulators at a rapid speed and often lack precedent, their practical application – from monitoring raw data, to its verification, to the application of label criteria, to reporting – might be particularly difficult and costly in the earlier periods of

[274] For an instructive discussion of data and identification challenges, see Leuz and Wysocki(n 170) 531-542.
[275] On the similar challenges for macro modelling, see above 3.1.1.1.
[276] See Hugues Chenet, Josh Ryan-Collins, and Frank van Lerven, 'Finance, climate-change and radical uncertainty: Towards a precautionary approach to financial policy' (2021) 183 EE 106957.
[277] Treaty on the Functioning of the European Union (TFEU), [2012] OJ C 326/47, art. 191(2).

implementation. Finally, due to scale effects, compliance costs might affect smaller and larger players to a different degree. Therefore, the social costs of mandatory disclosure include heightened barriers to market entrance and the resulting decrease in competition with all the associate negative welfare consequences. Finally, undesirable real effects of increased transparency requirements can stem from imposing proprietary costs on those firms that are particularly innovative in developing more sustainable business models, because highly granular disclosures allow competitors to copy the best strategies without investing in R&D themselves. These costs diminish firms' incentives to innovate in the first place and are not offset by information spillovers that benefit society.[278] Compelling firms to disclose granular forward-looking information on how they intend to achieve carbon emission reduction targets is particularly vulnerable to these negative latent effects, although such a step may be needed to facilitate adequate asset pricing, leaving regulators with a true dilemma.

We caution, however, that the appropriate comparison is not between the costs of complying with complex disclosure regulations and no costs at all, but between costs of complying with disclosure *mandates* and the costs of *voluntary* disclosure under a hypothetical market solution. In light of our review of finance and microeconomic theory and the empirical evidence on disclosure, a counterfactual scenario in which there would be no market-driven increase in "green" information production seems highly unlikely. The policy choice is therefore not between mandatory disclosure or no disclosure, but between government-regulated and market-regulated disclosure. Moreover, under the precautionary principle, some overproduction of information and some wasteful disclosure costs are preferable outcomes compared to a scenario in which costs have been saved excessively and the information available to market participants is insufficient to stimulate financial market mechanisms in the desired manner. The regulatory process arguably leaves more room for an explicit consideration of this fundamental trade-off, which also enhances the legitimacy of the outcomes.

Another non-negligible cost factor of green finance disclosure mandates might be political opportunity costs. Putting bets on a disclosure-centered green finance strategy might exhaust social planners' ambition to do better, i.e. inducing them to refrain from fighting for a global carbon tax or emissions trading scheme because they have already shown sufficient problem-solving capacity to their constituents. Such a crowding-out effect would, of course, be highly undesirable. Due to the magnitude of the threats that climate change poses and the growing attention that it receives in the public debate, however, fears that politicians and regulators might be able to enjoy a "quiet life" after having adopted a set of green finance policies appear unwarranted at this stage. Financial as well as environmental regulators seem generally aware of the fact that green finance policies can only (but still do) play an ancillary role in strategies pursuant to reaching climate targets. On balance, our analysis bolsters the case that activated investor preferences will indeed contribute to greening the economy and thereby create very large social benefits overall. Even though the mechanisms we outlined are subject to significant limitations and caveats, policies aimed at enabling them could have considerable option value.

[278] For this general incentive effect of disclosure requirements see Matthias Breuer, Christian Leuz, and Steven Vanhaverbeke, 'Reporting Regulation and Corporate Innovation' (2020) LawFin Working Paper No. 8 <https://ssrn.com/abstract=3449813> accessed 3 August 2021.

In particular, increased disclosure combined with morphing investor preferences could serve as a tipping point that, in the medium term, substantially changes the trajectory of capital flows towards environmentally-sustainable activities.[279]

[279] Farmer et al. (n 11) (highlighting financial disclosure as one example of a "sensitive tipping point" that regulators should look out for in the search of non-conventional policies to address climate change).

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