

The Role of Disclosure in Green Finance

Law Working Paper N° 604/2021

August 2021

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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 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.

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. However, the market discipline that this negative cost of capital effect exerts on “dirty” issuers is potentially attenuated by countervailing investor interests and does not automatically lead to socially optimal outcomes.

Mandatory disclosure obligations and their (public) enforcement can play an important role in green finance strategies. They prevent an underproduction of the standardized high-quality information that investors need in order to allocate capital according to their preferences. However, the rationale behind regulatory intervention is not equally strong for all categories and all levels of “green” disclosure obligations.

Corporate governance problems and other agency conflicts in intermediated investment chains do not represent a categorical impediment for green finance strategies.

However, the many forces that may prevent markets from achieving socially optimal equilibria render disclosure-centered green finance legislation a second best to more direct forms of regulatory intervention like global carbon taxation and emissions trading schemes. Inherently transnational market-based green finance concepts can play a supporting role in 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

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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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Corporate governance problems and other agency conflicts in intermediated investment chains do not represent a categorical impediment for green finance strategies.

However, the many forces that may prevent markets from achieving socially optimal equilibria render disclosure-centered green finance legislation a second best to more direct forms of regulatory intervention like global carbon taxation and emissions trading schemes. Inherently transnational market-based green finance concepts can play a supporting role in sustainable transition, which is particularly important as long as first-best solutions remain politically unavailable.

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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

Sebastian Steuer[†] and Tobias H. Tröger^{††}*

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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. Nordhaus² 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

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.

stock,⁴ that is the inventory of assets that facilitate production. Finally, it augments the stochastic risk⁵ 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 Paris Agreement⁸ that entered into force in 2016, and the preceding UN 2030 Agenda for Sustainable Development.⁹ These documents constitute points of reference for many policy initiatives that have been deliberately aimed at influencing the market mechanism to achieve climate protection goals without directly intervening in market outcomes through activity-restricting regulation or Pigouvian taxation.¹⁰ The posterchild in this regards is the European sustainable finance workstream under the so-called 'Green Deal' initiative.¹¹ The European Commission's ultimate objective here is nothing less

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 [2016] OJ L 282/4.

⁹ G.A. Res. 70 (25 Sep. 2015) <http://www.un.org/ga/search/view_doc.asp?symbol=A/RES/70/1&Lang=E>.

¹⁰ 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).

¹¹ 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.

than tweaking the whole financial system in a new direction by stimulating market participants' assumed appetite for "green" financial instruments.¹² 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.¹³

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 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 financial models.

This paper primarily analyzes the theoretical preconditions under which such a disclosure-centered approach to green finance could prove successful. The paper is divided into three parts.

In the first part, we illustrate the regulatory model (see section 2 below). We start by surveying recent regulatory initiatives that aim to improve transparency in the area of green finance. In doing so, we draw heavily on the legislative package that implements the European policy approach. The European

¹² 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).

¹³ 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.

co-legislators have promulgated the most ambitious and comprehensive regulatory package world-wide, seeking to influence almost every link in the investment chain.¹⁴ Quite importantly, however, other regulators around the world are pursuing or considering similar approaches. Based on our survey of regulatory initiatives, we propose a two-dimensional framework to categorize different transparency measures according to the type of information (raw data or label) and the level of 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.

In the second part, we examine the theoretical consistency of the prevailing 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, in principle, apt to induce at least some decarbonization of economic activities. 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 the fundamental question of whether climate-related disclosures should be mandatory is largely a matter of “old wine in new casks.” Drawing again on recent findings in the literature, we explain why we are skeptical about market forces sufficing to solve the fundamental information asymmetry problems, in particular in the area of green finance. Building on our review of regulatory initiatives, we also emphasize how arguments for and against transparency rules deserve different weight for different types and levels of information. We look at all of these issues primarily through an asset pricing lens. Yet, to round off the discussion, we also briefly sketch how the various agency relationships in real-world investment chains may complicate, but should not completely invalidate, our analysis.¹⁵

In the third part, we conclude by briefly commenting on the policy implications of our analysis (see section 4 below). While we are generally optimistic as to the merits of an information-centered approach to green finance, we 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

¹⁴ We do not analyze all intricacies of the European green finance framework here. The highest and most laudable ambitions notwithstanding, successful regulatory frameworks need to intervene in a way that could – at least in principle – achieve the critical policy objectives, because they conform with a theoretically plausible – albeit contestable – concept of financial markets’ allocative function and adhere to this understanding without major inconsistencies. In this paper, our main interest is whether regulatory interventions can rely on theoretically sound underpinnings at all. Even if such theoretical foundations exist, it is a different question to which extent the EU framework will actually live up to its promise of improving “green” transparency and combating “greenwashing”. For a critical account, see Sebastian Steuer and Tobias H. Tröger, ‘Inconsistencies in the implementation of the EU green finance strategy’ (2021) SAFE Working Paper No. ■■■ <■■■> accessed ■■■.

¹⁵ We explore the role of these agency relationships in greater detail in Sebastian Steuer and Tobias H. Tröger, ‘The Agency Costs of Green Capitalism’ (2021) SAFE Working Paper No. ■■■ <■■■> accessed ■■■

is to achieve superior solutions such as a comprehensive global carbon emissions trading scheme 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

This section describes 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 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 distinguish between the disclosure of climate impact raw data on the one hand and the evaluative categorization of economic activity through transparent climate impact labels on the other. Our review of regulatory tools also shows that both transparency strategies occur at different levels of aggregation (activity, issuer, and portfolio). We illustrate our functional mapping of the regulatory tools deployed in this market-based approach to green finance by classifying real-world examples of such strategies along the lines of our analysis. Our insights into the institutional set-up are not specific to any existing regulatory framework. Instead, they can serve as the background for our functional analysis that transcends existing legal systems and can thus claim universal relevance (*infra* 2.1). Finally, we demonstrate that our distinctions between different categories of information and the varying levels at which they have to be disclosed is important not only when it comes to establishing the normative rationale behind the various regulatory interventions, but also with respect to understanding the specific design of the respective transparency requirements (*infra* 2.2).

2.1 Main building blocks

The first pillar of a transparency-centered regulatory approach to greening market-based finance compels the disclosure of high-quality, standardized, and granular information not only at the issuer level, but also at the level of investment intermediaries and index administrators who provide portfolio-based financial products or benchmarks that inform investment decisions (*infra* 2.1.1). In the second pillar, legislators provide rigidly-regulated green quality labels (*infra* 2.1.2).

2.1.1 Disclosure of climate impact data

Consistent with an information model that assumes rational investors are able to choose and price financial instruments according to their preferences providing they possess sufficient and accurate information on these instruments' relevant properties, regulatory frameworks require various agents to

disclose data on the climate impact of their economic activities that influence the characteristics of investment products.

2.1.1.1 Sustainability reporting at the issuer level

Decentralized decisions on markets lead to an optimal allocation of resources if market participants are also adequately informed about the relevant qualitative features of goods.¹⁶ More specifically, investors who want to allocate capital according to their preferences need to be able to assess and compare the “green” properties of different investment products. Disclosure of standardized high-quality information facilitates critical comparison, which underpins, for instance, financial reporting standards in general.¹⁷ Consistent with this rationale, climate-impact-related disclosure obligations at the level of individual issuers can be thought of as an extension of more traditional corporate disclosure and reporting duties, serving the information needs of current and prospective investors.

At the international level, an array of voluntary reporting frameworks for climate impact and other environmental, social or governance (ESG¹⁸) 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 (GRI).¹⁹ 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 Greenhouse Gas (GHG) Protocol.²⁰ The business press have characterized the informal sustainability reporting frameworks as an “alphabet soup,”²¹ 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

¹⁶ The literature starts with Phillip Nelson, ‘Information and Consumer Behavior’ (1970) 78 JPE 311.

¹⁷ 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.

¹⁸ While our main interest in this article is climate-related transparency, we recognize that the line between climate-related and “other” ESG 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.

¹⁹ 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.

²⁰ 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. The most relevant GHG Protocol standards are 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).

²¹ 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.

(IFRS) Foundation recently proposed establishing a new International Sustainability Standards Board (ISSB) which would develop sustainability reporting standards akin to the widely-used financial reporting standards under the IFRS umbrella.²²

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.²³ However, the amendments of the Non-Financial Reporting Directive (NFRD)²⁴ largely proved to be a toothless tiger in practice.²⁵ The NFRD did not mandate any quantitative, standardized disclosures of specific ESG indicators (such as ex post emissions data or relevant targets),²⁶ and left the imposition of audit requirements to the discretion of the Member States.²⁷ 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.²⁸ 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 (CSRD).²⁹ 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.³⁰ It would introduce a more comprehensive assurance requirement³¹ and task the Commission with developing detailed, technical sustainability reporting standards building on the advice of the European Financial Reporting Advisory Group (EFRAG).³² Sustainability reporting under the CSRD framework would expressly have qualitative *and* quantitative components.³³ 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

²² See IFRS Foundation, ‘Proposed Targeted Amendments to the IFRS Foundation *Constitution* to Accommodate an Internal Sustainability Standards Board to Set IFRS Sustainability Standards (Exposure Draft)’ (April 2021) <<https://www.ifrs.org/content/dam/ifrs/project/sustainability-reporting/ed-2021-5-proposed-constitution-amendments-to-accommodate-sustainability-board.pdf>> accessed 31 May 2021.

²³ 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.

²⁴ 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.

²⁵ See also below 3.2.2.1.

²⁶ 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).

²⁷ Accounting Directive, art. 19a(6), 29a(6).

²⁸ Accounting Directive, art. 2(1), 3(4), 19a(1), 29a(1).

²⁹ European Commission, Proposal for a Directive ... as regards corporate sustainability reporting, COM(2021) 189 final.

³⁰ *ibid.* 42, 49 (proposal for revised Accounting Directive, art. 19a(1), 29a(1)).

³¹ *ibid.* 52 (proposal for revised Accounting Directive, art. 34(1)[2](aa)).

³² *ibid.* 45-47 (proposal for revised Accounting Directive, art. 19b)).

³³ *ibid.* 43, 50 (proposals for revised Accounting Directive, art. 19a(3)[1], 29a(3)[1]).

take into account the work of global standard-setting initiatives such as the TCFD or the standards to be developed by a prospective ISSB under the umbrella of the IFRS Foundation.³⁴

Furthermore, many jurisdictions are going beyond mere encouragement of voluntary reporting and are moving to introduce mandatory climate-related disclosure requirements for certain companies.³⁵ For example, already in 2013 the UK introduced a quantitative emissions reporting requirement for listed companies.³⁶ Moreover, in pursuit of the UK's Green Finance Strategy,³⁷ 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.³⁸ In early 2021, the UK Department for Business, Energy & Industrial Strategy (BEIS) further consulted on a proposal that would 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).³⁹ Plans to require listed companies to report in line with TCFD recommendations are also afoot in New Zealand.⁴⁰

In the US, the SEC recently requested public input on a revision of its approach to climate disclosures.⁴¹ The questions posed indicate that the SEC under the Biden administration is open to mandate the disclosure of standardized data, such as GHG emissions.⁴² Moreover, the SEC instated 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."⁴³ In June 2021, the House of

³⁴ *ibid.* 46 (proposal for revised Accounting Directive, art. 19b(3)).

³⁵ A helpful interactive resource to research voluntary and mandatory reporting requirements around the globe is provided by the Carrots & Sticks Project, available at <https://www.carrotsandsticks.net/> accessed 28 June 2021.

³⁶ 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.

³⁷ 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.

³⁸ 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.

³⁹ 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.

⁴⁰ See Ministry of Business, Innovation & Employment, Mandatory climate-related disclosures (2021), <<https://www.mbie.govt.nz/business-and-employment/business/regulating-entities/mandatory-climate-related-disclosures/>> accessed 1 June 2021.

⁴¹ SEC, Public Statement by Acting Chair Allison 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.

⁴² *Id.*

⁴³ 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.

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.⁴⁴ Whether the bill will also pass the (split) Senate remains unclear at this point.

2.1.1.2 Disclosure obligations for investment intermediaries

In contemporary investor capitalism, capital does not flow directly from investors to issuers. Instead, investment relationships typically involve specialized institutions that collect and invest capital on behalf of the ultimate beneficiaries.⁴⁵ A regulatory concept that wants to spur a transformation into a net-zero carbon economy through market discipline needs to make sure that investment intermediaries reflect investors' preferences in their critical decision-making processes and in portfolio selection (i.e. adapt their behavior and (re-)balance their portfolios to reflect ultimate beneficiaries' appetite for "green" investment strategies). In line with the information-centered approach to green finance, the primary tool to induce the desired behavior is, again, enhanced disclosure. High-quality information on the sustainability properties of institutional investors' activities and of the products they offer should allow investors to choose intermediaries and investment products which are more closely aligned with their own preferences. The informed choices of ultimate beneficiaries should, in turn, incentivize institutional investors who compete for market shares to design investment products and behave generally in ways that conform with their clients' appetite for pursuing sustainability goals as part of their investment strategy. If these clients were to exhibit strong preferences for "green" investments, market discipline would precipitate a "green" modification of institutional investor behavior, channeling intermediated capital incrementally to "green" economic activities and therefore ultimately contributing to a transition to a more sustainable economy.

In line with these propositions on institutional investors' role in capital allocation, the TCFD recommends that sustainability considerations should also be reflected in the disclosures that asset managers and asset owners (namely, life insurers and pension funds) make vis-à-vis their clients and beneficiaries.⁴⁶ 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.⁴⁷ 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 metrics that might be useful for their clients' investment decisions.⁴⁸

⁴⁴ Corporate Governance Improvement and Investor Protection Act, H.R. 1187, 117th Cong. (2021).

⁴⁵ For a general description and an analysis of the corporate governance implications see Ronald J. Gilson and Jeffrey N. Gordon, 'The Agency Costs of Agency capitalism: Activist Investors and the Revaluation of Governance Rights' (2013) 113 Colum L Rev 863, 874-888; Ronald J. Gilson and Jeffrey N. Gordon, 'Agency capitalism: further implications of equity intermediation' in Jennifer G. Hill and Randall S. Thomas, *Research Handbook on Shareholder Power* (EE 2015) 32-52.

⁴⁶ TCFD (n 20) 33, 38.

⁴⁷ *ibid.* 33-44.

⁴⁸ *ibid.* 37, 42.

At the European level, the functional hard law equivalent to these initiatives which build on voluntary adaption is the Sustainable Finance Disclosure Regulation (SFDR)⁴⁹, 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 level, the SFDR requires these ‘financial market participants’ (FMPs)⁵⁰ to report how they integrate sustainability risks⁵¹ and sustainability impacts in their risk management and remuneration processes.⁵² Under the prospective RTS, 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).⁵³ At the level of ‘financial products’⁵⁴ – 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.⁵⁵ For products with a sustainability dimension, additional pre-contractual and periodic disclosure requirements apply.⁵⁶

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

⁴⁹ 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.

⁵⁰ SFDR, art. 2(1).

⁵¹ The integration of these risks in management decisions in the financial sector is arguably a matter of directors’ fiduciary duties (of care): the Global Risk Report 2020 of the World Economic Forum (WEF) lists five perils related to climate change among the ten most severe long-term threats to financial stability, WEF, Global Risk Report 2020 (2020) 12 <http://www3.weforum.org/docs/WEF_Global_Risk_Report_2020.pdf> accessed 25 May 2021. Accordingly, sustainability risks also play an increasingly important role in the regulation and supervision of the banking sector, see e.g. European Banking Authority, Discussion paper on management and supervision of ESG risks for credit institutions and investment firms, EBA/DP/2020/03 (2020) (discussing the implications of sustainability risks for supervisory and review process). For avoidance of doubt, note, however, that commercial and investment banks do generally not qualify as FMP under the SFDR.

⁵² 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.

⁵³ Joint Committee of the European Supervisory Authorities (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 recently 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.

⁵⁴ SFDR, art. 2(12).

⁵⁵ SFDR, art. 6(1).

⁵⁶ SFDR, art. 8-11, specified in Draft RTS (n 53), art. 13-73 and annexes II-V.

comply-or-explain basis.⁵⁷ In both the UK and New Zealand, regulators' plans to mandate TCFD disclosures extend to product-level disclosures for asset managers and asset owners.⁵⁸ 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.⁵⁹ 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."⁶⁰ In two hastily-reached rulemakings, purporting to protect the financial interests of American pension savers, the Department of Labor (DOL) under the past Trump administration tried to limit the extent to which private pension fund managers could incorporate ESG aspects into their investment decisions and proxy voting practices.⁶¹ The DOL under the Biden administration has meanwhile announced that it will revise this controversial course of action, and will not enforce said rules until further notice.⁶²

2.1.1.3 Disclosure obligations of index providers and other benchmark administrators

Indices, reference rates, and other benchmarks represent an important determinant for investment decisions as they allow for the tracing of 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

⁵⁷ 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.

⁵⁸ See FCA, Enhancing climate-related disclosures by asset managers, life insurers and FCA-regulated pension providers (June 2021), CP 21/17; Department for Work & Pensions, Taking action on climate risk: improving governance and reporting by occupational pension schemes (Jan. 2021) <https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/955950/taking-action-on-climate-risk-pensions-consultation.pdf> accessed 1 June 2021.

⁵⁹ 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.

⁶⁰ 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.

⁶¹ DOL, Financial Factors in Selecting Plan Investments, 85 Fed. Reg. 72846 (13 November 2020); DOL, Fiduciary Duties Regarding Proxy Voting and Shareholder Rights, 85 Fed. Reg. 81658 (16 December 2020).

⁶² DOL, Statement regarding enforcement of its final rules on ESG investments and proxy voting by employee benefit plans (10 March 2021) <<https://www.dol.gov/sites/dolgov/files/ebsa/laws-and-regulations/laws/erisa/statement-on-enforcement-of-final-rules-on-esg-investments-and-proxy-voting.pdf>> accessed 31 May 2021. See also The White House, Executive Order on Climate Related Financial Risk (20 May 2021) <<https://www.whitehouse.gov/briefing-room/presidential-actions/2021/05/20/executive-order-on-climate-related-financial-risk/>> accessed 16 July 2021 (directing the DOL to consider suspending, revising or rescinding the rules).

can then be tracked by ETFs and other low-cost index-based products.⁶³ 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.⁶⁴

In the EU, however, benchmark administrators are regulated under the separate legal framework of the Benchmarks Regulation (BMR),⁶⁵ which was adopted as a response to the 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 explain *ex ante* how the methodology of the benchmark considers ESG factors.⁶⁶ 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.⁶⁷ The second pillar consists of two special types of climate-related benchmarks and is further discussed *infra* 2.1.2.2.

2.1.2 Quality signals (“green labels”) for economic activities

Obligations to disclose climate-related raw data build on the fundamental assumption of the efficient capital market hypothesis (ECMH)⁶⁸ that (fully) rational investors can process available information adequately and thus reflect disclosed data in their pricing of financial instruments. Quality labels respond to investors’ bounded rationality which prevents them from translating publicly-available information into prices and ultimately investment decisions aligned with their preferences. Under these preconditions, “green” labels that certify favorable climate impact properties of investment opportunities may add value in inducing a “green” (re-)allocation of capital.

2.1.2.1 A standardized sustainability metric and label at the activity level

Quality signals collateralized with ambitious regulation that enhances credibility can be sent at the level of economic activity. In line with this approach, taxonomies of economic activities provide the

⁶³ On the growing role of index administrators in capital allocation see 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.

⁶⁴ 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.

⁶⁵ 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.

⁶⁶ 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.

⁶⁷ 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.

⁶⁸ 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.

backbone for the information-centered green finance strategies that seek to propel the transformation of the economy through market discipline. 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. 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.⁶⁹

In recent years, there has also been an increasing interest among regulators to use formal rulemaking processes to draw up taxonomies,⁷⁰ 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.

The most developed taxonomy project is the EU’s Taxonomy Regulation (TR).⁷¹ The TR stipulates “criteria for determining whether an economic activity qualifies as environmentally sustainable for the purposes of establishing the degree to which an investment is environmentally sustainable.”⁷² While the TR itself sketches the sustainability definition only with a relatively broad brush, the actual technical criteria are spelled out over several hundred dense pages of a Delegated Regulation that the Commission adopted based on the recommendations of a Technical Expert Group.⁷³ 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

⁶⁹ Climate Bonds Initiative, Climate Bonds Taxonomy (Jan. 2021) <https://www.climatebonds.net/files/files/CBI_Taxonomy_Jan2021.pdf> accessed 2 June 2021.

⁷⁰ 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).

⁷¹ 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.

⁷² 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.

⁷³ 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.

many different activities, the activity-level measures can be aggregated to determine the *degree* to which the investment is environmentally sustainable.⁷⁴

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.⁷⁵ 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.⁷⁶ 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.⁷⁷

2.1.2.2 Investment intermediaries and benchmark providers

Labeling as a device to facilitate green investments also occurs at the portfolio level for investment intermediaries. The Commission is currently developing a seal-type ecolabel for financial products under the umbrella of the EU Ecolabel Regulation.⁷⁸ 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.⁷⁹ 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 also serve as high-level labels that distinguish financial products according to their relative "greenness."⁸⁰

⁷⁴ TR, art. 1(1).

⁷⁵ 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.

⁷⁶ TR, art. 5,6. The relevant RTS provisions were recently under consultation, see ESAs, Taxonomy-related sustainability disclosures (Joint Consultation Paper), 15 March 2021, JC 2021/22.

⁷⁷ See European Commission, Proposal for a Regulation ... on European green bonds, COM(2021) 391 final, art. 6.

⁷⁸ 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.

⁷⁹ 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.

⁸⁰ Somewhat paradoxically, the Commission recently stated that the SFDR was "not a labelling regime", yet used the SFDR product categorization as a reference point for the definition of "sustainability references" in the context of investment advice regulation, see 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, 9-10. In line with a labeling objective, however, "one of the main ways to differentiate the two categories of products" under the relevant RTS (draft) provisions is that the pre-contractual documents carry different disclaimers, see ESAs (n 53) 142.

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).⁸¹ Functionally, these categories serve as a seal of quality for 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.⁸²

2.2 Relevance of different categories and levels of obligations

Our discussion shows that regulatory interventions driven by a market-centered concept of green finance seek to improve the information supply of market participants in two important dimensions. Regulators aspire to first supply labels, that is, quality signals that imply a normative assessment, and, second, raw data, that are unevaluated (quantitative and qualitative) information (below 2.2.1). The respective disclosure requirements for each category can pertain to three different levels: economic activities, issuers of financial instruments, and portfolios of such instruments (below 2.2.2). This two-dimensional distinction of categories and levels, summarized in Table 1 and further explained below, provides a useful framework for characterizing individual legislative interventions and for analyzing the functional rationale of green finance disclosures in general.

| | Disclosure Transparency of raw data to allow informed investment decisions | Labeling Certification of alignment with discrete sustainability objectives (“seal of quality”) |
|--------------------------|--|--|
| Economic activity | Emissions etc. | Taxonomies: <ul style="list-style-type: none"> • 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. |

2.2.1 Information categories

Labels 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,⁸³ a rating, or a ranking. These

⁸¹ BMR, art. 19a-19d and annex III.
⁸² 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.
⁸³ The latter represents a binary qualification where objects either receive the quality seal or not.

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 therefore 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 such 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. We understand the “raw data” to include the entirety of information that might be relevant for an economic actor’s own assessment. 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.

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-financial products and services.⁸⁴ 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)⁸⁵, 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).⁸⁶

2.2.2 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 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.” The

⁸⁴ See e.g. Nikolay Minkov, Annkatrin 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).

⁸⁵ ISO, Environmental labels and declarations: Type I environmental labelling, Principles and Procedures, ISO 14024:2018, para. 3.1.

⁸⁶ ISO, Environmental labels and declarations: Type III environmental declarations, Principles and procedures, ISO 14025:2006, introduction and para. 3.2.

EU taxonomy definition of environmentally-sustainable production of transport technologies, for example, is mainly a function of the given vehicle's tailpipe emissions.⁸⁷

While labeling in the form of taxonomies is becoming more and more popular, our review indicated little to no interest among financial regulators in also requiring the disclosure of climate-related raw data at the activity level. Activity-level transparency requirements are more common, however, in environmental law. In the US, for example, toxic emissions of industrial facilities are disclosed annually at the plant level under the Toxics Release Inventory (TRI) Program.⁸⁸ In 2010, the Environmental Protection Agency (EPA) created another program mandating the disclosure of GHG emissions at the facility level.⁸⁹ 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.⁹⁰ Externally verified facility-level emissions are also disclosed to the public on an annual basis as part of the EU emissions trading scheme (ETS).⁹¹ These disclosure requirements are also 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.⁹²

Companies typically engage in a variety of different activities and/or outsource certain activities at various stages of production, for instance with a just-in-time organization in our car-manufacturing example. This leads to an aggregation problem if market participants want to assess the "greenness" of an investment in a specific company's capital. One way to deal with this problem is to simply look at aggregate raw data indicators, such as the tons of carbon dioxide equivalents emitted in that company's various business activities. This is, by and large, the approach followed by most investor-facing issuer-level disclosure frameworks such as the TCFD or the NFRD. Activity-level labeling, however, al-

⁸⁷ Commission Delegated Regulation (EU) ___/___ (n 73) annex I section 3.3.

⁸⁸ See Section 313 of the Emergency Planning and Community Right-to-Know Act (EPCRA) of 1986, codified at 42 U.S.C. § 11023.

⁸⁹ Greenhouse Gas Reporting Program, 40 C.F.R. § 98.

⁹⁰ 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.

⁹¹ 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 L77/3, art. 79 in conjunction with annex XIII section 1.

⁹² Sophie A. Shive and Margaret M. Forster, 'Corporate Governance and Pollution Externalities of Public and Private Firms' (2019) 33 RFS 1296; S. Lakshmi Naaraayanan, Kunal Sachdeva, and Varun Sharma, 'The Real Effects 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.

allows for the breakdown of conventional financial metrics (such as revenues, capex, and opex) according to the labeling of the underlying firm activities. This combination of labeling and disclosure obligations yields additional data points at the issuer level, for example the percentage of revenues and operational or capital expenditures attributable to EU taxonomy-compliant activities, thereby feeding activity-level assessments into issuer-level disclosure obligations.

Of course, issuers can also be labeled directly (i.e. they receive their label based on issuer-level raw data or an aggregation of activity-level data following a specific methodology). The chief examples of such issuer-level labeling are the scores and ratings disseminated by various ESG data providers.⁹³ In practice, investors⁹⁴ – and empirical researchers⁹⁵ – rely on such ratings to a considerable degree. Our review of the main building blocks of contemporary green finance initiatives indicated, however, that regulators so far seem less interested in introducing their own labels at the issuer level.⁹⁶

As mentioned before, asset managers and index providers dominate today's financial markets and many investors do not invest directly in the financial instruments of a single issuer, but rather acquire portfolios of such instruments prepackaged by investment intermediaries. For green finance, portfolio-level investing adds another layer of complexity and aggregation problems similar to those at the issuer level. To the extent that comparable raw data are available at the issuer level, this information can be aggregated at the portfolio level easily by taking a weighted average. The advantage of activity labels is that they allow for a look-through from portfolios to activities if relevant data on label alignment are available for all portfolio positions.

In the same way that activity-level labels can be used to compute additional issuer-level data points, issuer-level labels can be employed to derive aggregate information at the portfolio level. While the aggregation of third-party issuer-level ratings plays a significant role in practice as part of investment

⁹³ For a general discussion of the value of such ratings, see Ingo Walter, 'Sense and Nonsense in ESG Scoring', (2020) 5 *JLFA* 307. For a comprehensive overview of the market environment for ESG ratings and its interwovenness with the general ESG data market, see ERM, *Study on Sustainability-Related Ratings, Data and Research* (Nov. 2020) <<https://op.europa.eu/en/publication-detail/-/publication/d7d85036-509c-11eb-b59f-01aa75ed71a1/>> accessed 3 June 2021. On the problem of rating dispersion see below 3.2.2.1 .

⁹⁴ See e.g. SustainAbility, *Rate the Raters 2020: Investor Survey and Interview Results* (March 2020), 17-18 <<https://www.sustainability.com/globalassets/sustainability.com/thinking/pdfs/sustainability-ratetheraters2020-report.pdf>>.

⁹⁵ Recent examples include 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.

⁹⁶ This observation begs the question whether private providers of ESG ratings should be subject to government regulation and supervision akin to that of credit rating agencies, see e.g. 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").

strategies, regulators have so far been reluctant to mandate the disclosure of such metrics at the portfolio level.⁹⁷ On the other hand, as our survey shows, at least in the EU, significant work has gone 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.

2.2.3 The essential interconnection of labeled activities, issuers etc. and funding: the example of green bonds

Labeling approaches will only lead to the desired redirection of capital if the funds that investors were prompted to provide by the labels are indeed bound to the labeled activities, issuers, or portfolios. Where this essential interconnection of labels and deployment of invested funds is cut off, a misallocation of capital and a severe loss of investor trust are inevitable. Our two-dimensional framework allows us to illustrate this insight by commenting briefly on so-called green bonds. These bonds collect capital at the issuer level, but through their – heavily marketed – use-of-proceeds clauses,⁹⁸ 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 activity-level label in our framework.⁹⁹ However, through the lens of two core principles in corporate finance theory – the Fisher separation theorem¹⁰⁰ and the Modigliani-Miller theorem¹⁰¹ – 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,¹⁰² 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

⁹⁷ 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 67) annex II.

⁹⁸ 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 June 2021.

⁹⁹ 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.

¹⁰⁰ Irving Fisher, *The Theory of Interest* (MacMillan 1930) 269-275.

¹⁰¹ Franco Modigliani and Merton H. Miller, ‘The Cost of Capital, Corporation Finance and the Theory of Investment’ (1958) 48 AER 261.

¹⁰² 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.

when issuer-level quotas of label-aligned activities are computed for the purpose of evaluating the “greenness” of general-purpose financings. This logic, however, is frequently ignored in practice, including in the draft-delegated requirements for the FMP’s taxonomy-related reporting obligations.¹⁰³

2.2.4 Synthesis

The distinction between “disclosure” and “labeling” and the allocation of obligations at different levels are important not only because they help to navigate through the increasingly complex web of regulatory frameworks setting out green disclosure obligations,¹⁰⁴ but also because the economic rationales behind legislative interventions and the answer to the fundamental question of whether reporting obligations should be mandatory, are not uniform across all instances. 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 either strengthen or weaken the case for mandatory disclosure. Therefore, our categories and levels serve as bridges connecting our survey 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 also 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. This allows us to find out if the regulatory intervention does 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).

¹⁰³ Under the latest SFDR RTS Draft, 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 ESAs, Taxonomy-related sustainability disclosures (Joint Consultation Paper), JC 2021/22 (15 March 2021), proposed art. 16b. When computed with such methodology, portfolio-level quotas suggest higher funding of taxonomy-aligned activities than are actually pursued. The same “greenwashing per methodology” occurs in the calculation of the Green Asset Ratio (GAR) as the key metric that banks will have to use in their issuer-level disclosures under TR, art. 8, see Commission Delegated Regulation (EU) ___/___ (n 75) annex V formula 1(c).

¹⁰⁴ In separate work, we rely heavily on these distinctions to explore inconsistencies in the EU’s regulatory framework and to point to possible solutions, see Steuer and Tröger (n 14) ■■■.

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 equals 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.¹⁰⁵ As a result of such impacts, agricultural production in some parts of the world might

¹⁰⁵ See already above 1. On the WEF assessment of climate related risks as major perils for financial stability see already n 51.

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-à-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 cost of capital, the more profitable the firm’s activities need to be to receive funding.¹⁰⁶

Most asset pricing models are representative agent models.¹⁰⁷ 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 question is highly volatile.¹⁰⁸ 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 at-

¹⁰⁶ 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.

¹⁰⁷ 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, ‘Asset 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.

¹⁰⁸ Cochrane (n 107), 15.

tractive 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.¹⁰⁹

The Capital Asset Pricing Model (CAPM) compresses these intuitions into a digestible formula.¹¹⁰ In the common notation, the CAPM explains discount factors as

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

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 of the market portfolio, i.e. the rate of return 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. The investor will thus ask for higher risk premiums from issuers of such assets – denoted as $\beta_i(E(R_m) - R_f)$ –, 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 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

¹⁰⁹ This is one of the most fundamental principles of asset pricing theory, see Cochrane (n 107), 3 (“Most of the theory of asset pricing is about how to go from marginal utility to observable indicators”).

¹¹⁰ 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 107), 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.

climate change, risk premiums could be higher for those assets that would be particularly negatively affected if emitters had to internalize more of the full social cost 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 independent of the “green” or “dirty” properties of an individual investment.¹¹¹ 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 them¹¹² – does not necessarily imply differential discount factors for “green” and “dirty” assets.¹¹³

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.¹¹⁴ The 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.¹¹⁵ Beyond the market risk

¹¹¹ 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.

¹¹² 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”).

¹¹³ 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. On the consequences for portfolio investor engagement to mitigate climate risk see Steuer and Tröger, (n 15) ■■■.

¹¹⁴ 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.”).

¹¹⁵ 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 107) 149-150.

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.

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 pay-offs, 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.¹¹⁶ 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,¹¹⁷ 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,¹¹⁸ CAPM investors will choose to hold them, albeit at a higher discount, and thus fund environmentally-harmful activities.

¹¹⁶ 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.

¹¹⁷ See for instance Engle et al. (n 112) 1211 (“good regulation will mean less need for climate hedges [but might itself] create winners and losers from regulatory risk, and one might therefore want to construct regulatory hedge portfolios”).

¹¹⁸ 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 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 113).

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.¹¹⁹ 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.¹²⁰ 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) 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”).¹²¹ 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. 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 complexities of the real world.¹²² 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,¹²³ 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.

¹¹⁹ 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.

¹²⁰ 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).

¹²¹ See above n 1 through 6 and accompanying text.

¹²² 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).

¹²³ 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”).

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.¹²⁴ The same study found that institutional investors include climate risks not only for financial reasons¹²⁵ 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.¹²⁶

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.¹²⁷ 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.¹²⁸ Another contribution finds that the cost of option protection against downside tail risk is higher for carbon-intensive firms, indicating that markets view high-emitting firms as particularly exposed to adaptation risk.¹²⁹ 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,¹³⁰ corporate

¹²⁴ 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).

¹²⁵ See also below 3.1.2.

¹²⁶ Krueger, Sautner and Starks (n 124) 1077-1078, 1104 (discussing possible response bias).

¹²⁷ 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.

¹²⁸ 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 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).

¹²⁹ 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 adaptation risk – and metrics of downside tail risk derived from option prices).

¹³⁰ 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

bond markets,¹³¹ and housing and mortgage markets,¹³² although occasional studies proxying climate risk exposure with label-type measures have found no evidence that carbon premiums exist.¹³³ A study quantifying climate risk exposure via a text-based measure derived from earnings call transcripts¹³⁴ found that while investors expect higher returns from firms with higher climate risk exposure *ex ante*, this premium is not realized *ex post*.¹³⁵ 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.¹³⁶

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.¹³⁷ The latter is not immediately intuitive and stands in contrast to studies that find abnormal returns for portfolios that hold long positions in low-emission-intensity firms and short high-emission intensity issuers.¹³⁸ Moreover, it is

initial yields to issue long-term municipal bonds compared to counties less likely to be affected by climate change).

¹³¹ 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).

¹³² For a review of this line of research see Giglio, Kelly and Stroebel (n 116) 20-24.

¹³³ Maximilian Grger 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).

¹³⁴ 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.

¹³⁵ 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.

¹³⁶ 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 112). 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.

¹³⁷ Bolton and Kacperczyk (n 127) 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 127) 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.

¹³⁸ 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

puzzling that institutional investors seem to rely exclusively on scope 1 carbon emissions intensity¹³⁹ 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 2¹⁴⁰ and scope 3¹⁴¹ emissions.¹⁴² 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.¹⁴³

Regardless of the methodologies and quality of emissions data,¹⁴⁴ 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 to price because of its political nature and the massive uncertainty that stems from it. Occasional evidence suggests that investors also underreact to physical risk,¹⁴⁵ although behavioral biases might also lead to overreactions to (perceived) financial risks from environmental factors.¹⁴⁶ 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.¹⁴⁷

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

Nash, ‘Carbon Footprint and productivity: does the “E” in ESG capture efficiency as well as environment?’ (2018) 16 *Journal of Investment Management* 59.

¹³⁹ 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.

¹⁴⁰ Scope 2 emissions originate from the consumption of purchased energy (electricity, heat, steam) during production.

¹⁴¹ Scope 3 emissions are indirect emissions from the production of materials, the use of the product, the waste disposal created, outsourced activities, and all other sources not owned or immediately controlled by the firm.

¹⁴² Bolton and Kacperczyk (n 127) 8 ascribe a “somewhat schizophrenic attitude” to investors in dealing with carbon emissions.

¹⁴³ Bolton and Kacperczyk (n 127) 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).

¹⁴⁴ See below 3.2.2.1.

¹⁴⁵ 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).

¹⁴⁶ 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).

¹⁴⁷ 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).

“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.¹⁴⁸ 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 CAPM¹⁴⁹ take a narrow view of utility and presume that investors care only about the pecuniary implications of their portfolio choices.

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?).¹⁵⁰ 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 environmentally-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. 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

¹⁴⁸ 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 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.

¹⁴⁹ See above n 110.

¹⁵⁰ 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 236.

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.¹⁵¹

These challenges notwithstanding, the available evidence suggests that non-financial preferences may indeed play a role in practical investment decisions.¹⁵² One study, for example, used the introduction of the Morningstar Sustainability Ratings (“Globes”) 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.¹⁵³ 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.¹⁵⁴ Moreover, according to the results of a survey of large institutional investors, moral and ethical considerations are among the chief rationales behind these investors incorporating climate risks into the investment process, alongside reputational concerns and financial factors.¹⁵⁵ 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

¹⁵¹ 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).

¹⁵² 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 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).

¹⁵³ 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 Caccarelli, 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.

¹⁵⁴ 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, 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.

¹⁵⁵ Krueger, Sautner, and Starks (n 124) 1085-1086.

simply because of their greenness,¹⁵⁶ although an earlier study investigating municipal green bonds could find no evidence of such so-called “greenium.”¹⁵⁷ However, even to the extent that historical data suggest a limited role being played by non-financial preferences with respect to 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.

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_t 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.¹⁵⁸ 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

¹⁵⁶ 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, ‘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.

¹⁵⁷ 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).

¹⁵⁸ 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.

portfolio held by the other 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 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.¹⁵⁹ 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 rates. 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 arbitrated away. So 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:¹⁶⁰ 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 riskless 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.¹⁶¹ Arguments of this kind, however, should not overlook that the wedge between prices of

¹⁵⁹ 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.

¹⁶⁰ Fama and French (n 158) 671.

¹⁶¹ Paul Brest, Ronald J. Gilson, and Mark A. Wolfson, 'How Investors Can (and Can't) Create Social Value' (2018) 44 JCL 205, 218.

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 preferences 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.¹⁶² 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.¹⁶³ 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.¹⁶⁴

3.1.3 Summary

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

¹⁶² See Fama and French (n 158) 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 107) 165-167.

¹⁶³ Pastor, Stambaugh and Taylor (n Fehler! Textmarke nicht definiert.) show this in an extension of their formal model.

¹⁶⁴ 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.

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 inference that higher costs of capital for less sustainable firms adequately reflect the social costs of their impact on the climate.

3.2 The role of disclosure

3.2.1 A variation of an old theoretical debate: 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.¹⁶⁵ 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 most evergreen debates in law and economics in general,¹⁶⁶ and in law and finance in particular.¹⁶⁷

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.¹⁶⁸ 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

¹⁶⁵ 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 113 to 117 and accompanying text) the beneficial cost-of-capital effect should be larger for “dirty” firms with higher exposures to the respective risks.

¹⁶⁶ 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.

¹⁶⁷ 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 Chic L Rev 1047.

¹⁶⁸ 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),¹⁶⁹ and, more importantly, the incentives of the informed party that offers a high-quality good to disclose its information voluntarily, because otherwise the uninformed party will assume the worst (i.e. that the traded good is of the lowest conceivable quality).¹⁷⁰ Accordingly, more nuanced justifications of mandatory disclosure add an extra layer of argument in response. They question the existence or optimality of these incentives to disclose quality information voluntarily, based on, for example, the public good characteristics of the information itself,¹⁷¹ the public good characteristics of standardization,¹⁷² positive externalities of disclosures for competing firms,¹⁷³ managerial agency problems,¹⁷⁴ the drawbacks of private vis-à-vis public enforcement,¹⁷⁵ or bounded rationality arguments.¹⁷⁶ From this perspective, market outcomes without mandatory disclosure requirements are characterized by information underproduction and the inefficient allocation of resources.¹⁷⁷ Most arguments for or against mandatory “green” disclosures rules are variations of these more general themes.¹⁷⁸

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

¹⁶⁹ See e.g. Steven C. Salop, ‘Information and Monopolistic Competition’ (1976) 66 AER 240.

¹⁷⁰ This is often referred to as the “unravelling argument”, 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 this 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, unravelling is the adverse selection mechanism in reverse, see Beales, Craswell and Salop (n 166) note 45.

¹⁷¹ See e.g. Beales, Craswell, and Salop (n 166) 503-505.

¹⁷² See e.g. Luigi Zingales, ‘The Future of Securities Regulation’ (2009) 47 JAR 391, 395.

¹⁷³ See e.g. George Foster, ‘Externalities and Financial Reporting’ (1980) 35 JF 521, 523-525.

¹⁷⁴ See e.g. Coffee (n 167) 737-743.

¹⁷⁵ See e.g. Rafael La Porta, Florencio Lopez-de-Silanes, Andrei Shleifer, ‘What Works in Securities Laws?’, (2006) 61 JF 1, 2-3.

¹⁷⁶ See e.g. Oliver D. Hart, ‘Regulation and Sarbanes-Oxley’, (2009) 47 JAR 437, 439-440.

¹⁷⁷ 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.

¹⁷⁸ For a comprehensive discussion see Hans B. Christensen, Luzi Hail, and Christian Leuz, ‘Adoption of CSR and Sustainability Reporting Standards: Economic Analysis and Review’ (2021) ECGI Finance Working Paper 623/2019 <https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3427748> accessed 28 July 2021.

insofar as standard-producers cannot restrict access to the frameworks to paying users whose aggregate fees capture the full social benefit of standardization.¹⁷⁹

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 language¹⁸⁰ and be biased towards presenting firms in an overly green light.¹⁸¹ 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.¹⁸²

3.2.1.2 Additional justifications for mandatory disclosure

There are also less traditional and perhaps more controversial rationales behind mandatory “green” disclosure obligations. For example, regulators may deliberately prescribe “green” information production as a nudge and reminder appealing to investors’ non-financial preferences. Moreover, legislators may even stipulate mandatory disclosure obligations with the intention of changing these preferences, thereby further stimulating “green”-regarding incentives in investment choices.¹⁸³ 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.¹⁸⁴

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. Such

¹⁷⁹ For a general discussion see Zingales (n 172).

¹⁸⁰ For a discussion of the drivers and problems of such practices see Christensen, Hail, and Leuz (n 178) 84-86.

¹⁸¹ See Madison Condon, ‘Market Myopia’s Climate Bubble’ Utah L Rev forthcoming (2021) working paper, 42 <<https://papers.ssrn.com/abstract=3782675>> accessed 15 February 2021; Jill E. Fisch, ‘Making Sustainability Disclosures Sustainable’ Geo L J 107 (2019), 923, 947.

¹⁸² 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).

¹⁸³ See Hart (n 176) 442 (discussing influencing taste as a rationale for regulation).

¹⁸⁴ See Sunstein (n 166) 1051-1052, 1054 (discussing rationales with a behavioural touch in the context of food labels).

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 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.¹⁸⁵

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.

The 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.¹⁸⁶ 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.¹⁸⁷ 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.¹⁸⁸ 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.¹⁸⁹

While various frameworks for voluntary firm-level reporting do exist, take-up varies, and even among issuers who submit to such frameworks, accounting practices are often very heterogeneous.¹⁹⁰ The high cross-sectional variation in ESG ratings from different providers represents an excellent example of markets’ difficulties in generating a broadly-accepted definition and assessment of sustainability. While credit ratings tend to be largely consistent across different providers, ESG ratings from diverse

¹⁸⁵ See also below section 4.2.

¹⁸⁶ 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.

¹⁸⁷ *ibid* 17 with Table 3.

¹⁸⁸ *ibid* 20 with Table 4.

¹⁸⁹ *ibid* 24-25 with Table 7.

¹⁹⁰ See e.g. TCFD, Status Report (Oct. 2020), 8-25 <<https://www.fsb.org/wp-content/uploads/P291020-1.pdf>> accessed 1 July 2021; see also 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 (documenting substantial heterogeneity in the mandatory NFRD reports of 100 German issuers in the period between 2017 and 2019); Alliance for Corporate Transparency, 2019 Research Report: An analysis of sustainability reports of 1000 companies pursuant to the EU Non-Financial Reporting Directive, <https://corporatejusticecoalition.org/wp-content/uploads/2020/02/2019_Research_Report-_Alliance_for_Corporate_Transparency-7d9802a0c18c9f13017d686481bd2d6c6886fea6d9e9c7a5c3cfafea8a48b1c7.pdf> accessed 1 July 2021 (documenting substantial heterogeneity in NFRD reports within and across EU Member States).

suppliers often correlate only at astonishingly low levels.¹⁹¹ 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.¹⁹² 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.¹⁹³

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.¹⁹⁴ Scope 3 emissions are those emissions that occur along the corporate value chain but are not directly controlled by the company or its subsidiaries (scope 1 emissions) and are not emissions from the production of energy (electricity, steam, heat, or cooling) that the organization purchases and consumes (scope 2 emissions). The scope classifications are based on the GHG Protocol¹⁹⁵ which is sometimes seen as an example of a successful, market-driven development of disclosure standards.¹⁹⁶ However, 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.¹⁹⁷ 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

¹⁹¹ 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; 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.

¹⁹²Berg, Koelbel, and Rigobon (n 191) 16 with Table 6.

¹⁹³ *ibid.* 2. See also 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).

¹⁹⁴ Edgar G. Hertwich and Richard Wood, 'The growing importance of scope 3 greenhouse gas emissions from industry' (2018) 13 Environ Res Lett. 104013, 6.

¹⁹⁵ Above n 20 and accompanying text.

¹⁹⁶ But see below n 198-200 and accompanying text.

¹⁹⁷ 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.

to a lack of mandatory disclosure requirements, even EU issuers often do not disclose scope 3 emissions in the first place.¹⁹⁸ According to the index administrator, data were available for only 18% of the constituents of the MSCI All Country World Index as of March 2020.¹⁹⁹ 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.²⁰⁰ But even for as-reported scope 3 emissions, researchers have documented astonishingly low correlations of entries in different databases.²⁰¹ 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,²⁰² in the absence of meaningful standardization not only of reporting frameworks, but also of actual reporting practices.

3.2.2.2 Social benefits of mandatory disclosure

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

One study used the introduction of ESG-related disclosure requirements in 25 different jurisdictions to analyze the informational and real effects of such regulatory interventions in a large global panel of publicly-quoted firms.²⁰³ The authors found that mandatory disclosure requirements increased the number of available standalone or integrated ESG reports in two common databases, suggesting that, without regulatory interventions, not all firms disclosed (sufficient) ESG information on a voluntary basis.²⁰⁴ This improvement effect was stronger for firms with lower overall ESG performance, proxied by ESG ratings.²⁰⁵ This is consistent with the theoretical consideration that firms with questionable ESG performance are least likely to disclose negative information voluntarily, largely because the neo-classical unravelling hypothesis²⁰⁶ does not hold with regard to adverse ESG information. The authors fur-

¹⁹⁸ See Alliance for Corporate Transparency (n 190) 47, 102 (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.

¹⁹⁹ 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.

²⁰⁰ See Timo Busch, Matthew Johnson, Thomas Pioch, and Matthias Kopp et al., 'Consistency of corporate carbon emission data', (2018) Universität Hamburg/WWF (2018), 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).

²⁰¹ *ibid* 14-17.

²⁰² *ibid* 15-16.

²⁰³ 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.

²⁰⁴ *ibid* 21-22 with Table 3.

²⁰⁵ *ibid* 25-26 with Table 4.

²⁰⁶ See above n 170 and accompanying text.

ther documented a positive effect of ESG disclosure mandates on the accuracy and alignment of analysts' earnings-per-share (EPS) forecasts.²⁰⁷ This effect is consistent with the idea that ESG-specific disclosures may provide useful additional information for those investors who are solely interested in the pecuniary performance of their investments. The discrete disclosure requirements seem to increase the amount of available information, particularly on risks that are relevant for asset valuation and expected cash-flows,²⁰⁸ notwithstanding the overarching financial reporting requirement typically laid down in securities laws and accounting standards whereby all information that could reasonably be expected to influence the decision-making of users of financial statements needs to be disclosed anyway.²⁰⁹

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.²¹⁰ 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.²¹¹ 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.²¹² These results are consistent with both the idea that disclosing higher emissions imposes a cost on firms as a

²⁰⁷ *ibid* at 27 and Table 5; see also 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 (finding lower analyst forecast errors for firms that issue stand-alone CSR reports).

²⁰⁸ For the basic CAPM considerations that bolster this hypothesis see above 3.1.1.1. But see also above n 165: Reducing estimation risk need not necessarily drive the desired wedge between the cost-of-capital of "green" and "dirty" firms.

²⁰⁹ See for instance International Accounting Standard (IAS) 1.7.

²¹⁰ 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).

²¹¹ *ibid* 28-32 with Table 6.

²¹² 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,²¹³ and that standardized mandatory disclosure makes it easier for investors to compare the climate-related characteristics of different firms.²¹⁴

Recent evidence also corroborates the notion that “green” disclosures could induce the desired re-balancing 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.²¹⁵ While the study found no conclusive evidence that “facilities face pressure from investors with regards to US Program data,”²¹⁶ it did suggest that one way by which mandatory disclosure might have helped to reduce emissions was by facilitating “benchmarking.”²¹⁷ 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.²¹⁸ 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, 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.²¹⁹ Moreover, existing frameworks such as the NFRD

²¹³ 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 156), 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).

²¹⁴ Jouvenot and Krueger (n 210) 5-6.

²¹⁵ Tomar (n 92); 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).

²¹⁶ Tomar (n 92) Online Appendix 22.

²¹⁷ *ibid* 23-31.

²¹⁸ Jody Grewal, ‘Real Effects of Disclosure Regulation on Voluntary Disclosers’ (2021) JAE forthcoming.

²¹⁹ 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 firms). However, in light of the severe rating dispersion (see above 3.2.2.1. Insufficient disclosure on unregulated markets), one may have doubts whether such strategies will indeed capture the relevant real-world outcomes.

tend to be limited to high-level reporting requirements, or do not go beyond comply-or-explain mandates.²²⁰ 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,²²¹ that is, the far more comprehensive, highly-standardized and quantified disclosure obligations envisioned in many regulators' market-based green finance strategies.²²² Such comprehensive "green" disclosure regimes 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 review 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.

3.2.3.1 Differing rationales behind information categories and levels

In light of our distinction between information categories (above 2.2), 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 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 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.

Insofar as activating and/or reinforcing investors' non-financial preferences for "green" investment opportunities constitutes a legitimate policy rationale for climate-related financial disclosures,²²³ 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

²²⁰ Ten of the 25 initiatives relied on in Krueger et al. (n 203) were only comply-or-explain mandates, although the analysis is robust to using only the requirements that are mandatory in the narrower sense.

²²¹ See also Christensen, Hail, and Leuz (n 178) 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").

²²² For an overview of these initiatives see above 2.1.

²²³ See above 3.1.2.

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,²²⁴ 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 raw data. Green investment funds²²⁵ and green indices (tracked by passive funds)²²⁶ provide a good illustration here: labeled products, in principle, facilitate capital investments of less sophisticated mar-

²²⁴ We discuss these issues briefly in the next section, see below 3.3.

²²⁵ 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.

²²⁶ 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.

ket 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.²²⁷

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.²²⁸ 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 elaborate, there remain various open ends.²²⁹ 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.²³⁰ Another unique trade-off that regulators face is

²²⁷ We discuss the issue in more detail in Steuer and Tröger (n 15) ■■■.

²²⁸ On the interplay between discretion and capture opportunities see e.g. Magdalena Ignatowski, Charlotte Wergler, 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).

²²⁹ 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 73), annex I and II.

²³⁰ 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. See Steuer and Tröger (n 14) ■■■.

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 products²³¹ 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.²³²

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. 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 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, by and large, corroborate the key assumptions that underpin the regulatory concept of a market-based approach to green finance. 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. Financial markets are significantly more complex than most asset pricing and finance models suggest. Therefore, the overall impact of shifts in demand from “dirty” to

²³¹ See JRC (n 102), 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”).

²³² 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 77), 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.

“green” assets and the ensuing new equilibrium hinges on the response of a multitude of agents whose incentives are determined by their own interest. Real-world outcomes may thus be distorted as a result of opportunistic rent-seeking in agency relationships. Principal-agent conflicts are pivotal for predicting firm behavior (i.e. the supply-side response to shifts in demand for “green” assets induced by regulation). Financial instruments supposed to fund “green” or “dirty” economic activities are typically issued by 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. Moreover, even the demand-side reaction to ultimate investors’ “green” preferences is not as straightforward as it would seem at first glance, because capital allocation on contemporary financial markets occurs through investment intermediaries such as pension and mutual funds, asset managers, or insurance companies. All of these institutional investors may pursue their own objectives that do not always align with those of their beneficiaries, thereby introducing another set of principal-agent relationships.

We do not address these issues in this paper however.²³³ In our view, 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, which is not to say that scrutinizing the regulatory implications is unimportant. 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 by the institutions of corporate governance like various forms of shareholder voice (e.g., voting, informal engagements, and “green” activist campaigns), the (threat of) exit working through the decline of stock prices, or fiduciary duties enforced in shareholder litigation.²³⁴ To be sure, many further complexities arise if one accepts that firms may have comparative advantages in fulfilling shareholders’ non-financial preferences,²³⁵ may have a stakeholder-oriented objective function,²³⁶ or that diversified shareholders may pursue engagement strat-

²³³ For an in-depth discussion see Steuer and Tröger (n15).

²³⁴ 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.

²³⁵ See Hart and Zingales (n 150).

²³⁶ 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 skeptical contributors to the corporate purpose debate emphasize the increased leeway for managerial rent seeking under a stakeholder oriented objective

egies that seek to maximize returns at the portfolio level, internalizing both socially wasteful externalities such as carbon emissions²³⁷ and socially desirable externalities such as the effects of competitive product market behavior.²³⁸ Finally, in the age of institutional investor capitalism,²³⁹ the “shareholders” who wield the actual influence of residual claimants in the governance of firms are typically not the ultimate beneficiaries in the investment chain, but it tends to instead be the investment intermediaries who also pursue their own interests.²⁴⁰ This situation introduces another set of agency conflicts on the supply side of capital, which may further complicate translating shifts in demand for “green” assets into changes in firm behavior.²⁴¹ 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, because they only vary the general theme that principals’ interests do not automatically motivate agents’ behavior and therefore need (institutional) safeguards. Just like more traditional shareholder wealth maximization preferences have to be enforced in corporate governance, investors’ “green” interests – which can be partially constructed in accordance with traditional, shareholder-wealth-maximization-oriented models of corporate governance and finance (see above 3.1.1) – need to be accomplished through the institutions of corporate governance.

Our claim is not that the specific corporate governance implications of a disclosure-centered approach to green finance are negligible. On 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.

function of firms, see e.g. Lucian A. Bebchuk and Roberto Tallarita, ‘The Illusory Promise of Stakeholder Governance’, (2020) 106 Cornell L Rev 91.

²³⁷ 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.

²³⁸ For a review of the recent literature investigating the hence potentially anticompetitive effects of common ownership see Martin Schmalz, ‘Recent Studies on Common Ownership, Firm Behavior, and Market Outcomes’ (2021) 66 Antitrust Bulletin 12.

²³⁹ 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).

²⁴⁰ For empirical data see above n 225 and n 226.

²⁴¹ For an optimistic account of the corporate governance implications of asset managers and other investment intermediaries, see e.g. Bernard S. Black, ‘Agents Watching Agents: The Promise of Institutional Investor Voice’ (1992) 39 UCLA L Rev 811; for a more pessimistic perspective, see e.g. Lucian A. Bebchuk, Alma Cohen, and Scott Hirst, ‘The Agency Problems of Institutional Investors’ (2017) 31 JEP 89. In light of the growing importance of passive investment strategies, a more recent strand of the literature specifically addresses the incentives of large index fund and ETF managers, see e.g. Lucian A. Bebchuk and Scott Hirst, ‘Index Funds and the Future of Corporate Governance: Theory, Evidence, and Policy’ (2019) 119 Colum L Rev 2029; Jill E. Fisch, Asaf Hamdani, and Steven D. Solomon, ‘The New Titans of Wall Street: A Theoretical Framework for Passive Investors’ (2019) 168 U Pa L Rev 17.

4 Conclusion

Our analysis has by and large confirmed 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 the social optimum being reached 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 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.

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.²⁴²

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. 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.

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

²⁴² 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).

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.

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.²⁴³ 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 regulators to do “whatever it takes.” To be sure, adaptation risk is inherently political and therefore

²⁴³ 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.

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.²⁴⁴ 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.²⁴⁵ 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,²⁴⁶ which is also reflected in the European Treaties' provisions on environmental policy.²⁴⁷ 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 implementation. Finally, due to scale effects, compliance costs might affect smaller and larger players

²⁴⁴ For an instructive discussion of data and identification challenges, see Leuz and Wysocki (n 165) 531-542.

²⁴⁵ On the similar challenges for macro modelling, see above 3.1.1.1.

²⁴⁶ 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.

²⁴⁷ Treaty on the Functioning of the European Union (TFEU), [2012] OJ C 326/47, art. 191(2).

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 associated 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.²⁴⁸ 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.

²⁴⁸ 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.²⁴⁹

²⁴⁹ Farmer et al. (n 10) (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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