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Corporate Social Responsibility and Sustainable Finance: A Review of the Literature

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Abstract:
Corporate Social Responsibility (CSR) refers to the incorporation of Environmental, Social, and Governance (ESG) considerations into corporate management, financial decision making, and investors' portfolio decisions. Socially responsible firms are expected to internalize the externalities (e.g. pollution) they create, and are willing to be accountable to shareholders as well as a broader group of stakeholders (employees, customers, suppliers, local communities,…). Over the past two decades, various rating agencies developed firm-level measures of ESG performance, which are widely used in the literature. A problem for past and a challenge for future research is that these ratings show inconsistencies, which depend on the rating agencies' preferences, weights of the constituting factors, and rating methodology.

CSR also deals with sustainable, responsible, and impact investing (SRI). The return implications of investing in the stocks of socially responsible firms, the search for an EGS factor, as well as the performance of SRI funds are the dominant topics. SR funds apply negative screening (exclusion of 'sin' industries), positive screening, as well as activism through proxy voting or direct engagement. In this context, one wonders whether responsible investors are willing to trade off financial returns with a 'moral' dividend (the return given up in exchange for an increase in utility driven by the knowledge that one invests ethically). A recent literature concentrates on green financing (the financing of environmentally friendly investment projects by means of green bonds) and on how to foster economic de-carbonization as climate change affects financial markets and investor behavior.

Keywords: Environmental, Social, and Governance, CSR, ESG, SRI, Socially Responsible Investments, Impact investing, Externalities, Stakeholders, Stakeholder governance, Climate change, Decarbonization, Global warming, Green bonds

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Corporate Social Responsibility and Sustainable Finance:

1. Corporate Social Responsibility

1.1. CSR and ESG: definitions and scopes

Corporate social responsibility (CSR) has increasingly become a mainstream business activity, ranging from voluntarily engaging in environmental protection to increasing workforce diversity and employee welfare. The term "CSR" is often used interchangeably with "ESG", which is the broad umbrella term that refers to the incorporation of Environmental, Social, and Governance (ESG) considerations into corporate management and investor's portfolio decisions. Specifically, the Environmental (E) dimension measures a company's impact on the natural ecosystem. This comprises for instance its emissions (e.g., greenhouse gases), the efficient use of natural resources in the production process (e.g., in terms of energy, water or materials), pollution and waste (e.g., oil spills), as well as innovation efforts to eco-design its products. The Social (S) dimension covers a company's relation with its workforce, customers and society. As such, it includes for example its efforts to maintain loyal workers (e.g., employment quality, health and safety, training and development), satisfied customers (e.g., producing quality goods and services that keep costumers safe) and being a good citizen within the communities it operates. The Governance (G) dimension is a somewhat ambiguous term in the context of CSR. Governance refers on the one hand to the traditional corporate governance mechanisms that makes management act in the best interest of its long-term shareholders. This includes safeguarding shareholder rights (e.g., limiting anti-takeover devices), a well-functioning board (e.g., with an experienced, diverse and independent composition), well-designed executive compensation policies and avoiding illegal practices such as fraud and bribery. On the other hand, in context of CSR, governance is often defined more narrowly to the diversity and inclusion, and hence the representation of the rights of minorities (based on gender, race, sexual orientation, etc.) on the board of directors and management, and in corporate processes.

Scholars have proposed various definitions of CSR. For example, to distinguish CSR from the traditional corporate compliance to regulations, some consider CSR as a voluntary behavior, i.e., corporate engagement in social issues. That is, CSR is beyond compliance (Vogel, 2005),

beyond those dictated by markets or laws (McWilliams and Siegel, 2001), and is a way of self-regulation (Calveras, Ganuza, Llobet, 2007). Yet, a lot of studies still use cross-country and cross-state variations in regulation to identify the difference in firm-level CSR (e.g., Deng, Kang, Low, 2013; Di Giuli and Kostovetsky, 2014; Liang and Renneboog, 2017a; Flammer, 2019). In addition and with regard to the scope of its definition, some apply a narrower definition of CSR and consider it as "sacrificing profits in the social interest" to satisfy nonpecuniary preferences of investors, employees, and consumers (Benabou and Tirole, 2010). However, most scholars still apply a broader definition of CSR and consider it to be consistent with value maximization (e.g., Edmans, 2011; Flammer, 2015; Ferrell, Liang and Renneboog, 2016; Lins, Servaes, Tamayo, 2017). Overall, scholars' view on what exactly CSR is still remains fuzzy.

To better understand CSR with sufficient theoretical depth, we first revisit the theory of the firm, especially regarding a firm's objective function. Do firms exist to maximize profit or to serve a social purpose? Are firms accountable to shareholders or stakeholders (including employees, customers, community, and other parties)? Is CSR a private provision of public goods, especially when the public sector fails to provide such goods? Does caring about society other than profit reflect non-pecuniary utilities or cognitive biases of shareholders and of managers? These are the fundamental economic questions that we will review in the next sections.

1.2. The objective function of the firm

The neoclassical economic paradigm usually considers CSR as unnecessary and inconsistent with profit maximization (e.g., Friedman (1970)). This discrepancy between the neoclassical theory on the objective function of the firm (which does not include CSR) and real-world observations has attracted much scholarly attention in recent years. Kitzmueller and Shimshack (2012) provide a comprehensive review on the economic perspectives on CSR in the earlier literature, though the real boom of research on this topic, especially those published on top-tier finance, accounting, and economics literature started after 2012. Economics-oriented work addressing CSR acknowledged the well-known incapacity of markets to ensure efficient pricing and provision of non-private goods and services, but emphasized that firms could not and should not be expected to voluntarily act in a socially or environmentally responsible manner. Most notably, Friedman (1970) argued that the only responsibility of firms was profit

maximization and that public preferences combined with democratic empowerment implied that governments, and not firms, should manage externalities and provide public goods. This division of corporate and government responsibility vis-à-vis society became commonly known as the classical dichotomy: the invisible hand of the market harnesses consumers' and corporations' pursuit of self-interest to the pursuit of efficiency, and the state corrects market failures and externalities that harm efficiency (Benabou and Tirole, 2010).

According to Williamson's (1981) theory of the firm, a firm is a nexus of (explicit and implicit) contracts among shareholders and other stakeholders such as creditors, customers, suppliers, employees, and communities ("stakeholders"). In particular, the implicit relationships between shareholders and other stakeholders stand in contrast to the ones between managers and shareholders, in that shareholders have tangible and "hard" claims from explicit contracts. Based on this idea of a nexus of contracts, two distinct models exist with regard to organizing a firm's business activities, namely, a shareholder model and a stakeholder model. According to the shareholder model, corporations should be managed to maximize shareholder interest, i.e., equity market valuation. Fama and Jensen (1983) justify the shareholder supremacy by acknowledging that shareholders are residual claimants of a company's cash flows, thus care most about the company's value. In contrast, other stakeholders are protected by contracts and regulation (thus are "contractual claimants"), and typically have higher liquidation priority than shareholders. This view is also prevalent among legal scholars. For example, Hansmann and Kraakman (2001) advocate shareholder primacy and consider it as the "end of history" for corporate law by recognizing the fact that shareholders cannot be adequately protected by contracts, unlike other stakeholders, and they must be given to right to control to firm to protect their interests. They also debunked alternative models such as the manager-oriented model, the labor-oriented model, the state-oriented model and other stakeholder models, which are too limited in scope and fail to take into account of the interests of other types of stakeholders. More recently, Bebchuk and Tallarita (2020) also argue that corporate leaders do not have sufficient incentives and discretion to protect stakeholders. Embracing "stakeholderism" instead of a shareholder governance model would impose substantial costs on shareholders, stakeholders, and society at large, as it would increase the insulation of corporate leaders from shareholders, reduce their accountability and hurt economic performance.

The alternative – stakeholder – perspective dates back to Edward Freeman's (1984) influential book *Strategic Management: A Stakeholder Approach*. The book describes and recommends

the methods by which management can give due regard to the interests of the stakeholder groups. Tirole (2001) advocates the inclusion of "stakeholders" in corporate governance, and Allen, Carletti, and Marquez (2015) formalize the stakeholder vs. shareholder governance model, and compare how firms with the stakeholder model and those with the shareholder model compete under globalization. However, a common problem that arises with having numerous stakeholders in an enterprise is that their various self-interests are not aligned. That is, caring about one group of stakeholders may not always be in the best interest of another group of stakeholders. Still, Mayer (2020) argues that trade-offs are ubiquitous, not just in stakeholder but also in shareholder governance.

1.3. Three Views of CSR

More recently, research has begun a shift from whether CSR should exist to why it does exist and how it affects the economy, shareholder value, and stakeholder welfare. Broadly, the literature has offered three views on CSR with regard to its motivation and consequence (Benabou and Tirole, 2010).

The first view considers CSR as a "win-win" situation for both the company's shareholders, the other stakeholders and the society at large. This is commonly referred as "doing well by doing good", namely, when a firm acts like a good corporate citizen, it can also become more profitable. In other words, companies can achieve superior financial performance ("doing well") by engaging in CSR ("doing good"). The "doing well by doing good" rationale is that the generated firm value will not only go to the shareholders (the residual claimants and legal owners of the firm) but is also partly distributed to various other stakeholders. The "win-win" view essentially suggests that CSR can be viewed as a long-term investment leading to long-run value maximization, even though it may come at a cost in the short run. For example, a firm can develop costly environmental R&D (sacrificing short-term profit) which can build up its reputation and attract socially conscious consumers, as well as avoid environmental penalties in the future (enhancing long-term firm value). This "win-win" argument can also apply to the inverse, namely "doing good by doing well", i.e., only well-performing firms that can afford to invest in CSR (e.g., Hong, Kubik, and Scheinkman, 2012).

The second view considers CSR as a "delegated philanthropy" (Benabou and Tirole, 2010). That is, CSR emerges as a response to societal demands for corporations to deal with market

and distributive failures, and is a delegated exercise of prosocial behavior on behalf of stakeholders. In other words, corporate policies are channels for the expression of citizen values. Some stakeholders, including investors but also customers and employees, are often willing to sacrifice money (return/yield, purchasing power and wage, respectively), so as to further social goals. In other words, stakeholders demand that corporations engage in philanthropy on their behalf, and this is usually due to the fact that corporations can create positive externalities to an extent that stakeholders cannot achieve on their own as a result of coordination problems (Hart and Zingales, 2017). Magill, Quinzii, Rochet (2015) argue that CSR is motivated by investors' desire to internalize externalities on other stakeholders, which constitute significant risks to shareholders themselves. Therefore, firms should maximize the total welfare of their stakeholders rather than shareholder value alone.

The third view considers CSR as an insider-initiated corporate philanthropy. That is, CSR can be a manifestation of agency problems and raises a corporate governance issue. That is, corporate prosocial behaviour at least in part reflects corporate insiders' own desires to engage in philanthropy rather than stakeholders' demands or willingness to sacrifice money for a good cause. For instance, corporations often give to charities on the boards of which their executives or own board members sit (Cai, Xu, Yang, 2020), or to institutions (e.g., concert halls, opera houses, museums, clubs) and political causes (e.g., political contributions, Hong and Kostovetsky, 2012) which their top management favours. Managers and the board can be entrenched in order to be able to practise corporate philanthropy on a large scale (Cespa and Cestone 2007). Caring about various stakeholders may also weaken managerial accountability by creating multiple objectives and performance criteria.

Based on the three views above, scholars also classify CSR into three types: (1) strategic CSR (i.e., enhancing reputation, advertising, and gaining competitive advantages); (2) not-for-profit CSR (i.e., pure altruistic) behavior; (3) CSR resulting from agency problem. Under the first CSR perspective – the strategic one, the common explanation of why companies engage in CSR is that doing so enhances profitability and firm value (i.e., "doing well by doing good"), which has received most academic attention. Earlier studies mostly concern a firm's "external" stakeholders and focus on only one perspective, such as environmental protection (e.g., Dowell, Hart, and Yeung, 2000; Konar and Cohen, 2001), corporate philanthropy (e.g., Seifert, Morris, and Bartkus, 2004; Liang and Renneboog, 2017b), or consumer satisfaction (e.g., Luo and Bhattacharya, 2006; Servaes and Tamayo, 2013). More recent studies examining the firms'

combined ESG performance and include a firm's "internal" stakeholders (such as employees and creditors) find similar patterns. A meta-analysis of 60 review studies that combine more than 2200 unique primary studies conducted by Friede, Busch and Bassen (2015) documents that 90% of academic studies find a nonnegative relationship between ESG and financial performance (also see e.g., Orlitzky, Schmidt, and Rynes, 2003; Flammer, 2015; Krueger, 2015). Conceptually, CSR engagement can enhance firm value through multiple channels: These include:

- signalling the company's product quality (Calveras and Ganuza, 2018; Cao, Liang, and Zhan, 2019);
- building up social capital and trust (so as to be more resilient to volatile market conditions. e.g. during the global financial crisis) (Lins, Servaes, Tamayo, 2017);
- gaining stakeholder support (Deng, Kang, and Low, 2013);
- insuring the firm against rare environmental disasters or social malfunctioning (Koh, Qian, and Wang, 2014);
- motivating employees leading to employee satisfaction (Edmans, 2011, 2012);
- lowering cost of capital (Goss and Roberts, 2011; El Ghoul, Guedhami, Kwok, and Mishra, 2011; Dhaliwal, Li, Tsang, and Yang, 2011; Albuquerque, Koskinen, and Zhang, 2019; Chava, 2014; Hoepner, Oikonomou, Scholtens and Schroder, 2016);
- lowering idiosyncratic risk and the probability of financial distress (Lee and Faff, 2009);
- attracting more positive sell-side analysts' recommendations (Bushee, 2000; Bushee and Noe, 2001), and
- generating a halo or reputation effect that may have an impact on valuation through e.g. product markets (Hong and Liskovich, 2016).

Compared to the strategic type of CSR, the other two types are relatively less discussed in the literature. According to the second CSR type, the "not-for-profit" (altruism) view, CSR engagement is to satisfy preferences of investors, employees, and consumers, and does not necessarily constitute a governance problem (Benabou and Tirole, 2010). Under the third definition – CSR as an agency problem, CSR investments are made to satisfy management's personal preferences, which do not always align with shareholder value maximization. That is, managers may "do good with other people's money," which has been empirically supported in the case of managerial shareholding and corporate donations (Cheng, Hong, Shue, 2013; Masulis & Reza, 2015; Cai, Xu, Yang, 2020).

In some countries, distributing value to stakeholders besides shareholders may even violate the legal duty embedded in directors' fiduciary duties. For example, in the U.S., directors ought to defend the rights of shareholders although in some states constituency statues give directors discretion to balance the rights of stakeholders rather than uniquely focus on shareholder value maximization. Liang and Renneboog (2017a) document that there are strong differences across countries in terms of CSR performance at the firm level. Firms in common law countries (Anglo-American countries and the Commonwealth) have much lower ESG scores than firms in civil law countries. In the latter countries, Scandinavian firms have the highest ESG scores, firms of the German-type of civil law do better than firms of the French-type of civil law in terms of environmental performance, whereas the latter outperform the former in terms of social engagement. The authors show, by means of micro-level data and quasi-natural experiments, that the country-level legal foundations explain much more of the variance of CSR performance, than other institutional factors such as social preferences.

1.4. The implications of CSR on stakeholders

Besides the implications of CSR on shareholders and firm value as reviewed above, another stream of the literature goes beyond shareholder value and concerns the implications of CSR on stakeholder welfare. Often, CSR concerns or low ESG performance are somehow penalized by stakeholders. For example, with regard to creditors, Chava (2014) and Hoepner, Oikonomou, Scholtens and Schroder (2016) find that firms with high environmental and social concerns face higher interest rates on their bank loans. Customer satisfaction levels are lower in firms with low innovativeness capability, which harms market value (Luo and Bhattacharya, 2006). The management literature has ample evidence on how low CSR performance and especially the lack of employee engagement negatively affects employees' productivity and corporate performance (Greening and Turban, 2000; Edmans, 2012; Korschun, Bhattacharya, and Swain, 2014; Farooq, Farooq, and Jasimuddin, 2014). Such effects take place through employees' affective commitment (Mueller, Hattrup, Spiess, and Lin-Hi, 2012), organizational attractiveness (Albinger and Freeman, 2000; Turban and Greening, 1997; Blackhaus, Dtone, and Heiner, 2002), and employees' emotions, attitudes and behavior (Rupp, Gananpathy, Aguilera, and Williams, 2006). In addition, a growing literature focuses on the relationship between CSR and the community, mostly in the context of corporate philanthropy (Brown, Helland, and Smith, 2006; Masulis and Reza, 2015; Liang and Renneboog, 2017b; Ballesteros, Useem, and Wry, 2017; Cai, Xu, and Yang, 2020).

Several studies investigate how a firm's CSR performance affects other types of stakeholders such as suppliers and competitors. A firm's high CSR performance affects their suppliers' and competitors' financial returns, because there are CSR spillover effects across these corporate networks. As such, suppliers and competitors feel forced to adopt the higher CSR level of their respective client firms and competitors. For example, Dai, Liang, and Ng (2020) and Schiller (2018) find evidence of significant unidirectional spillover effects of CSR from customers to suppliers in global supply chains, even across borders (of developed countries). The supplier's bootstrapping towards the customers CSR performance improves both operational efficiency and firm value for both customer and supplier, and enhance the customer's sales growth. By means of a regression discontinuity design (RDD), Cao, Liang, Zhan (2019) examine the impact of the majority vote on and adoption of a CSR program on a firm on its product market competitors. They document that the passage of close-call CSR proposals on the annual meetings of a sample of firms triggers positive stock returns for these firms but negative ones for these companies' competitors , implying that the latter type faces a competitive threat by lagging in terms of CSR performance. Subsequently, these competitors are forced to catch up in the following years by adopting similar CSR projects.

2. ESG measurement and disclosure

As trillions of dollars are invested based on firms' ESG performance, the reliability of existing ESG measures and the proper disclosure of ESG-related information are of foremost importance to investors, managers, and policymakers. In this section, we review the literature on ESG measurement and on ESG information disclosure.

2.1. ESG measurement: current practices and challenges

Various ESG rating agencies collect and aggregate a range of information on a company's ESG performance – its own disclosures, third-party reports (e.g. from NGOs), news items, and proprietary research through company interviews and questionnaires. This information yields an overall ESG score, as well as scores for the individual components (E, S, and G) separately. ESG ratings are mostly given to publicly listed equities included in major global equity indices and are often industry-adjusted (e.g., the ESG performance of a firm is evaluated relative to all companies within the same business sector across the world). Some widely used ratings are created by KLD (now called MSCI ESG STATS, with 3,000+ US companies), MSCI

Intangible Value Assessment (now MSCI ESG, with 7,500+ global companies), Thomson Reuters ASSET4 ESG (now Refinitiv ESG, with 7,000+ global companies), Sustainalytics Company Ratings (with 11,000+ global companies), Dow Jones Sustainability Index (RobecoSAM), FTSE4Good, ISS ESG (Ethix), Oekom Corporate Ratings, GES International, Vigeo Eiris, S&P ESG Index and Trucost (including data from Carbon Disclosure Project), Bloomberg, Morningstar, FTSE Russell, etc. It should be noted that biases in ESG ratings can be driven by: (1) size (larger companies may receive better ESG reviews because they can dedicate more resources to prepare and publish ESG disclosures, and control reputational risk); (2) geography (higher ESG assessments may be given to companies domiciled in regions with higher reporting requirements); and (3) industry (normalizing ESG ratings by industry can lead to oversimplifications). Another issue is that ESG ratings may be backward-looking and not capture how a company may be making an honest effort to improve its sustainability record.[3]

The providers of ESG scores use different methodologies and input to calculate ESG scores, which entails that the ESG scores of a specific firm can differ significantly across ESG databases. The correlation between ESG ratings across different providers is about 0.3, which casts doubt on the ratings' validity. The low correlation contrasts with that of credit ratings, where the correlation between ratings by the two main providers, S&P and Moody's, is around 0.99.[4] Chatterij, Durand, Levine, Touboul (2016) document the surprising lack of agreement across social ratings from six well-established raters. The authors attribute the disagreement in ESG ratings to a lack of common definition of social responsibility, and of agreement on measuring metrics. Berg, Koelbel and Rigobon (2019) dive deeper into the source of the disagreement by decomposing ESG ratings discrepancy into scope, measurement, and weights. "Measurement" divergence (i.e., raters measure the same ESG attribute with different indicators[5]) explains 53% of the overall divergence. In addition, 44% of the divergence is due to scope, i.e., different raters include different attributes,[6] and 3% of the divergence is due to differing weights, i.e., different raters place different weights on the individual components of the overall score. What may surprise is that there is even disagreement on objective facts

[3] For example, a "controversial stock" today might not be a "controversial stock" tomorrow – incumbent energy firms may be fossil-fuel heavy but best positioned to explore alternative energies in the future.
[4] See blog post by Alex Edmans: https://www.growthepie.net/the-inconsistency-of-esg-ratings/
[5] For example, labor practices could be evaluated on the basis of workforce turnover, or number of labour cases against the firm; Female friendliness could be measured by the gender pay gap, the percentage of women on the board, or the percentage of women in the workforce.
[6] For example, most raters consider a firm's greenhouse gas emissions when evaluating its environmental record, but only some will include electromagnetic radiation; and one rating agency may include lobbying while another might not.

that can be verified from public records. For example, the observations about whether a company is a member of the UN Global Compact have a correlation of merely 0.86 across the rating agencies, while it should equal one. The above ratings discrepancies are also highlighted by Gibson, Krueger, Riand and Schmidt (2019) for S&P500 firms of which they compare the ESG scores from six prominent data providers (Thomson Reuters, MSCI, Sustainalytics, KLD, Bloomberg and Inrate). The average correlation between overall ESG ratings of the six providers amounts to less than 0.5. The authors report that the geographical location of the ESG data providers affects their perspective on ESG: civil-law-based ESG data providers stress the role of labor issues and social protection, while those located in common law countries emphasize the importance of investor protection, of shareholders rights, and of other traditional corporate governance issues. Finally, Kotsantonis and Serafeim (2019) point to inconsistencies in terms of how rating providers report data, how they define peer groups and how they impute ESG ratings.

In general, the existing ESG measurements are largely limited to publically listed large corporations, and potentially biased by country regulations and norms as well as industry characteristics. There is striking inconsistency among ESG scores provided by different rating providers. Consequently, ESG characteristics need to be measured more accurately by focusing on real ESG investments related to the UN's Sustainable Development Goals (SGDs).

2.2. ESG disclosure and sustainability reporting

An emerging literature deals with ESG disclosure and sustainability reporting. Christensen, Hail and Leuz (2019) offer a comprehensive literature review of the accounting and finance research showing that there currently is substantial variation in ESG disclosure across firms, which makes an objective comparison of ESG practices difficult. The idea is that increased quantity and quality of ESG information can generate benefits to capital markets through greater liquidity, lower cost of capital, and better capital allocation. Information related to CSR topics can be useful to investors in estimating future cash flows or when assessing firms' risks (e.g., Dhaliwal, Li, Tsang, and Yang, 2011; Dhaliwal, Radhakrishnan, Tsang, and Yang, 2012; Grewal, Hauptmann, and Serafeim, 2018) and is often closely related to firms' normal business activities.

However, ESG disclosure requirements can bring about proprietary and potential litigation costs. For example, Grewal, Riedl, and Serafeim (2020) document that the equity market reacted negatively to the passage of an EU Directive mandating increased nonfinancial (E&S) disclosure. Still, the negative market reaction is weaker for firms with higher pre-Directive ESG performance and disclosure levels. Likewise, for China, Chen, Hung, and Wang (2017) document that mandatory CSR disclosure alters firm behavior and generates externalities at the expense of shareholders. Mandatory ESG reporting can induce difficulties in terms of the ESG standard setting process, the materiality of ESG disclosures, the use of boilerplate language, and difficulties in enforcement. Regarding the importance of materiality, Khan, Serafeim and Yoon (2016) map CSR-materiality guidance from the Sustainability Accounting Standards Board (SASB) to ESG scores and find that firms with high materiality ESG scores outperform firms with low materiality scores.

Other major impact measurement frameworks include the "Six Capitals" of the International Integrated Reporting Council (IIRC): financial capital, manufacturing capital, intellectual capital, human capital, natural capital, social and relationship capital (which is also the framework that the IIRC adopts in this impact measurement project), the Global Reporting Initiative (GRI), Task Force on Climate-related Financial Disclosures (TCFD), and Sustainability Accounting Standards Board (SASB).

3. Sustainable Finance: The Investor Perspective

Another important literature takes an investor's perspective, and tries to understand how ESG and sustainable finance affect asset prices and portfolio returns. The Global Sustainable Investment Review (2018) reports that over US$ 30 trillion were managed according to responsible investment criteria across the world in 2018. The data show that ESG investing is more pervasive in Europe, but has also seen a rapid growth in the U.S. in recent years. The US SIF Foundation's 2018 biannial Report estimates that the assets under management (AUM) based on ESG strategies amounts to US$ 12 trillion (up 38% from 2016). The Principles of Responsible Investing (PRI), the largest global network of institutional investors committed to considering ESG issues in their investment processes, had more than 2,500 signatories with over US$ 85 trillion in AUM at the end of 2019. The estimates, however, are much more modest if one focuses only on sustainable mutual funds or socially responsible investment funds (SRI funds) and ETFs in US and Europe, with estimates typically lower than US $1

trillion. In this section, we first discuss the general SRI literature by focusing on the strategy, risk, and return of SRI funds that largely focus on public equity investment (mostly managed by institutional investors such as mutual funds). We then review an emerging literature of impact investing, which is mostly done by private equity, and also some current practices of impact measurement, an important pillar of impact investing. Finally, we review the recent work on investor activism, green financial products (such as green bonds), and ESG factor investing in SRI.

3.1. Sustainable, responsible and impact investing

The concept of "SRI" has evolved in its meaning and strategy. First, negative screening is the most basic type of SRI that avoids investing in firms that sell products such as alcohol, tobacco, weaponry, abortion-related drugs, and pornography. The so-called sin stocks are excluded from the portfolio. A second generation SRI fund applies positive screens to select companies that meet above-average standards in areas such as the protection of the environment, the promotion of human rights, or the sustainability of investments. This method of positive screening leads to investing in best-in-class ESG companies or norm-based screening (e.g., following the United Nations Global Compact Principles). A third SRI generation fund combines negative and positive screens, yielding the so-called "transversal" (Capelle-Blancard and Monjon, 2014), "sustainable" or "triple bottom line" ("people, planet and profit") screens (Dyck, Lins, Roth and Wagner, 2019). Gibson, Glossner, Krueger, Matos, and Steffen (2019) study whether institutional investors who are signatories of the Principles of Responsible Investing (PRI) do actually comply with the PRI in their own portfolio investments. They confirm that these institutional investors do indeed "walk the ESG talk" as the ESG performance of their portfolio is better than that of non-signatories.

The academic studies on SRI mostly focus on the performance of SRI/ESG funds. On one hand, if SRI screening creates a binding constraint on portfolio optimization by limiting the investment universe, we will expect that the reduction of optimal diversification induces a cost and hence lower portfolio returns. By the same token, investing in socially irresponsible firms (such as 'sin stocks' – tobacco, alcohol, casinos) may generate higher returns if lower demand initially causes under-pricing. Indeed, Hong and Kacperczyk (2009) show that investing in these stocks yields a higher return. The reason is that investing in such stocks is considered as more risky by investors such that a higher return is required to compensate for the higher risk.

Also, if such stocks are ignored by part of the investor base, these stocks may become more illiquid and may be temporarily under-priced. Bolton and Kacperczyk (2020a, b) revisit this idea for a global sample of firms with high carbon emissions. They find a carbon premium: higher stock returns for companies with higher carbon emissions in the US, Europe and Asia. The premium is not only related to the direct exhaust of carbon but also the carbon emissions that are created in firms' supply chains. Similar results are found for a sample of US firms. One reason for the carbon premium is that institutional investors have been divesting their equity stakes in such environmentally-unfriendly firms.

One the other hand, SRI funds may reach higher returns if the market underestimates the impact of corporate ESG policies such that stocks with high ESG performance may be temporary underprices. In an early survey on the performance of SRI funds, Renneboog, Ter Horst and Zhang (2008a, 2008b) conclude that there is little evidence that the average performance of SRI-focused funds in the U.S. and U.K. differs significantly from that of conventional funds. Moreover, SRI funds do not generate higher than expected returns (the alpha in asset pricing models is not different from zero or even negative – similarly to the alphas of conventional funds) which indicates that higher ESG performance is immediately incorporated in the prices.

While underperforming, SRI funds are still able to attract net money inflows by social conscious investors. Hartzmark and Sussman (2019) find that after the introduction of Morningstar ESG ratings in 2016, US funds with low ESG ratings subsequently observed net outflows while funds with high ESG ratings had net inflows. While past positive (negative) returns trigger money in(out)flows, this is much less the case for SRI funds. Renneboog, Ter Horst and Zhang (2011) and Bollen (2007) respectively show for a global and for a US sample that even in case of disappointing returns, the investors in SRI funds do not withdraw their investments. The authors conclude that in addition to the financial returns, SRI investors also receive a (non-financial) 'moral' or ethical dividend. Using the introduction of eco-labeling of "low carbon designation" funds by Morningstar in the U.S. and Europe, Ceccarelli, Ramelli and Wagner (2019) find that fund managers tend to adjust their holdings towards more climate-friendly stocks in order to retain their investors. Other studies provide unique investor-level evidence. Riedl and Smeets (2017) use administrative and survey data in the Netherlands and find that social preferences rather than financial motives are the most important driver for investors to hold socially responsible mutual funds. Many investors accept lower expected returns on socially responsible investments and are willing to pay higher management fees. In

a field experiment in the Netherlands, Bauer, Ruof, Smeets (2019) find that investors prefer more sustainable investments and are willing to put their pension savings on the table to promote sustainability. All evidence suggests that investors value sustainability criteria and are willing to forgo financial performance in order to invest in accordance with their social preferences.

Several studies investigate the role of institutional investors' ESG preferences and their impact on portfolio companies ESG practice. In a survey of over 400 large institutional investors on matters related to climate change and their view on climate risks in their investment decisions, Krueger, Sautner and Starks (2019) find that 40% of respondents believe climate risks have financial implications for their portfolio firms. These institutional investors consider risk management and engagement, rather than divestment, to be the better approach for addressing climate risks. The impact of institutional investors' ESG preference on portfolio firms' ESG is achieved mostly through behind-the-scenes engagement and proxy voting, of which we will provide a more comprehensive review in Section 3.3.

Why do institutional investors in the different types of SRI funds want to influence their portfolio companies' ESG practice? A popular view is that institutional investors typically have a long-term investment horizon as ESG practices may show financial benefits only in the long term (see e.g. Starks, Venkat, and Zhu (2018) for the US and Dyck, Lins, Roth, and Wagner (2019) for a global sample). Gibson and Krueger (2018) confirm this observation and document that investors with higher ESG portfolio footprints, especially with regard to environmental issues, have higher risk-adjusted returns over longer investment horizon.

3.2. ESG Factor investing

Whereas in the corporate finance literature specific aspects of CSR are shown to generate value (e.g. environmental and employee friendliness), the asset pricing literature has been less convinced about the ability to generating positive returns with ESG investment strategies. The evidence on generating positive alphas over and above the expected returns of the traditional asset pricing models (Fama-French (FF) three-factor model, Fama-French-Carhart (FFC) four-factor model, FF five-factor model, etc.) or outperforming conventional funds is mixed. The early US literature (e.g. Hamilton, Jo and Statman (1993), Statman (2000), and Schroder (2003)) shows that the performance of SRI funds is not significantly different from that of non-

SRI funds. Idem for the evidence on the Europe (and on the rest of world.[7] Geczy, Stambaugh and Levin (2003) show that the financial costs of SRI screens on mean-variance optimizing investors can be substantial. Specifically, the SRI constraints impose a cost of more than 1.5% in return per month on investors believing in asset selection skills, i.e. investors who rely heavily on individual funds' historical risk-adjusted returns to predict future performance.

Renneboog, Ter Horst and Zhang (2008) find that the risk-adjusted returns of the average SRI funds by country amount to –2% and –6% per annum. These results imply that the firms included in SRI funds and hence meeting high ethical/social standards and strict stakeholder governance criteria may be overpriced by the market or that SRI funds are too expensive. They demonstrate that the market-, size-, value-, and momentum-factors are not strongly correlated with the positive and negative screens and with the screening intensity applied by SRI funds, and therefore add a ESG factor (which they call 'ethics' factor) in the FFC asset pricing model. SRI funds have a higher exposure to this ethics factor, however, the difference between five- and four-factor alphas of SRI funds remains economically small. The authors argue that the fact that a higher fraction of the return variation of ethical funds can be replicated by the well-known risk factors may indicate that SRI funds gradually converge to conventional funds by holding similar assets in their portfolios (or that conventional funds become more ethical or socially responsible).

Currently, there is still no consensus about ESG-based investing helps or hurt performance. ESG considerations may *lower* expected returns because high ESG may lower risk which then leads to lower expected returns (e.g., Hong and Kacperczyk, 2009; Albuquerque, Koskinen and Zhang, 2019; Bolton and Kacperczyk, 2020b) while others state that "the outperformance of ESG strategies is beyond doubt" (Financial Times, The ethical investment boom, 3 Sept 2017).

Pedersen, Fitzgibbons, and Pomorski (2020) try to reconcile the opposing views by distinguishing between three types of investors: (i) the ones who are unaware of ESG scores and simply maximize their unconditional or their risk-return utility by considering all assets; (ii) the ones who are aware of ESG scores and have risk-return preferences, but use assets' ESG scores to update their views on risk and expected return, and (iii) the ones who use ESG information in their investment decision and have strong preferences for stocks with high ESG

[7] A review of this SRI literature can be found in Renneboog, Ter Horst and Zhang (2008).

scores. Type (i) investors, who ignore ESG scores, may do better than the other types because, by not restricting the investment universe (by not excluding firms by negative ESG screening), they can reach an optimal portfolio that the other types of investors cannot. Furthermore, type (i) investors' return can even be strengthened by the fact that they can go long on e.g. (sin) stocks that type (iii) investors would exclude from their investment universe. The expected superior return for type (i) investors assumes that ESG information is not related to higher returns or that it is immediately impounded in prices such that an investment strategy based on high ESG scores does not yield higher returns. However, if this assumption is not valid, namely that some ESG information is not impounded in prices and predicts prices, then type (ii) and type (iii) could reach portfolios on the ESG efficient frontier that outperforms the optimal portfolio of type (i) investor. Type (iii) investors hold a portfolio with an optimal tradeoff between a high expected return, low risk, and high average ESG score. In the Pedersen et al. (2020) model, the investor's asset allocation problem is reduced to a tradeoff between ESG and the risk-adjusted return. The authors test their model by means of ESG scores and various proxies of E, S and G. They find that for portfolios that are formed considering (rather rudimentary defined) ESG information, the maximum Sharpe Ratio (SR or excess return by unit of risk) is 12% higher than that of portfolios in which ESG is ignored. The cost of ESG *preferences* in portfolio allocation, e.g. doubling the average ESG score relative to the level that maximizes the SR, reduces the SR by 3%. The net effect return predictability of ESG information and the impact of the reduction of the investment university is positive. To conclude, this analysis show that depending on the relative importance of limitation of the investment universe (which depends on the type and intensity of screening), the return predictability based on ESG information (which may be positive or zero depending on the type of ESG), and the ability to short-sell, different types of investors can obtain a superior risk-return position.

Thus, the above paper reconciles the conclusions of papers arguing that ESG hurts performance and those that conclude the inverse. The former group, based on the segmentation theories, shows that ESG-sensitive investors refuse to hold specific portfolios. In equilibrium, such market segmentation leads to higher expected returns to non-ESG firms (which is confirmed for non-green firms by e.g. Heinkel, Kraus, and Zechner (2001), Bolton and Kacperczyk (2020a), and Zerbib (2020); for non-social firms by e.g. Luo and Balvers (2017); for non-ESG firms or sin stocks by Hong and Kacperczyk, 2009). The opposite strand of the literature shows that positive abnormal returns can be generated by investing in firms with good governance

(Gompers, Ishii, and Metrick, 2003), or firms with high employee engagement and hence satisfaction (Edmans, 2011).

A reason why 'green' (or ESG) firms are expected to have negative alphas and 'brown' (non-ESG) firms positive ones is modelled by Pastor, Stambaugh and Taylor (2020) who also focus on investor tastes as main explicative factor. Agents with strong ESG preferences hold proportionally more firms with high ESG performance in their portfolios, which leads to higher prices for high-ESG firms and a lower required return (and hence lower cost of capital). To compensate for the lower alpha, investors with high-ESG preferences enjoy a moral or ethical benefit. Investors without a taste for ESG invest in the market portfolio. The alpha of the most simple asset pricing model (the CAPM) reflects the exposure to the omitted, priced ESG factor. When including such a factor, Pastor et al. (2020) show that the ESG betas are positive for green assets and negative for brown assets. ESG investors who rebalance their portfolios towards high-ESG assets, will earn lower than expected returns and non-ESG investors will earn higher returns. The size of the return difference depends on the relative wealth share of the ESG investors and the return that these investors are willing to give up in exchange for the intangible ethical dividend. It should also be noted that the ESG investors sacrifice less return than they would be willing to do because the equilibrium asset prices adjust to the ESG tastes such that the market portfolio adjusts towards the portfolio of the ESG investors. The reason is that the high-ESG assets receive higher weights than low-ESG assets because green firms are now more valuable following the increased demand by ESG investors. Pastor et al. (2020) explain expected returns not only by market betas and differences in investor tastes, but add the impact of firm's exposure to climate shocks. The fact that brown assets have a higher climate shock exposure may make them riskier as represented by higher climate betas (Choi, Gao and Jiang, 2020, Engle et al., 2019, Kumar, Xin, and Zhang, 2019; Bolton and Kacperczyk, 2020b) and higher total risk and tail risk (Bansal, Ochoa, and Kiku, 2016; Hoepner et al, 2020; Krueger, Sautner, and Starks (2019); Ilhan, Sautner and Vilkov, 2020). This climate risk exposure induces higher expected returns and generates even higher alphas than one would expect just based on ESG preferences of part of the investors.

A related model is developed by Zerbib (2020) who also considers ESG taste differences between investors and the exclusion of low-ESG firms by part of the investors. By means of the data on green funds, Zerbib shows that the exclusion effect of sin stocks costs ESG investors almost 3% annually, and the integration of environmental criteria by green investors impacts

the different industries with an annual premium ranging from -1.1% to 0.1%. Relative to Pastor et al. (2020), Zerbib shows somewhat lower net benefits of adopting an ESG investment strategy. Both by screening and the integration of ESG criteria, sustainable investors contribute to an increase in the cost of capital of the most environmentally risky firms, which puts effective pressure on those firms to reform.

3.3. ESG Activism

A subset of ESG institutional investors (SRI funds) actively engages with the companies they hold in their portfolios, requesting that these companies improve their environmental, social, and governance (ESG) practices (see, e.g., Dimson, Karakaş and Li, 2015; Doidge, Dyck, Mahmudi and Virani, 2019). These activist funds are so-called fourth generation funds.

While one can regard investors in SRI funds as patient money, impatient investors who believe that they can profit from corporate ESG investment can invest in fourth generation of SRI funds, which combines the sustainable investing approach (third generation) with shareholder activism. Then, portfolio managers attempt to influence their portfolio companies' policies through direct engagement with the management/board of directors (behind the scenes) or through using voting rights at proxy proposals at annual shareholder meetings. These ESG engagements are quite different from the activities by other activist investors such as hedge funds that generally focus on financial value through advocating for asset restructuring and governance improvement (e.g. Becht et al., 2017), but do not consider social and environmental practices as independent objectives. As Peattie and Samuel (2018) argue, ESG-motivated shareholder activism challenges the established societal, ideological and cultural phenomena that still have not moved beyond the paradigm established by Friedman in the 1970s. Arguably, consumers and investors can both shape the landscape of social responsibility, but there is a growing consensus that a quasi-top-down approach is preferable, where investors and asset managers aim to steer corporations towards more ethical business practices (Salzmann, 2013).

Using data from a large SRI funds that engages a portfolio of global companies, Barko, Cremers and Renneboog (2018) study ESG activism in an international context and document that the engaged companies firms typically have lower ex ante ESG ratings, have a high market share and are among the most visible – they are followed by more analysts than their peers. As a consequence of the engagement targets with ex ante low ESG ratings see their ratings improve

during the activism period, but for targets with high ex ante ESG ratings, the engagement process seems to induce a negative correction during the activism period, suggesting that some of the concerns of the activist investor were not previously incorporated in these ratings and are publicly disclosed due to the activism. They do not find an increase in accounting performance or any of its components after the engagement, with exception of an increase in sales growth, which could indicate that the implemented changes appeal to a broader customer clientele. Overall, activism regarding corporate social responsibility generally improves ESG practices and corporate sales, is profitable to the activist, and does not support the argument that the activist fund and the firm engage in CSR efforts only for marketing or reputational purposes (Dupire and M'Zali, 2018).

Similar results are found for proprietary sample of U.S. activist cases by Dimson et al. (2015) who report that engagements in social and environmental topics also induce positive returns and improvements in operating performance and corporate governance. Hoepner et al. (2016) find that ESG activism reduces left tail firm risk, especially when target firms respond with material actions to the activist's requests. Flammer (2015) does not concentrate on behind-the-scenes activism but studies the impact of shareholder close-call proxy proposals. She documents that proposals gain a majority vote at the annual meeting, generate significant short-term stock returns and superior long-term accounting performance.

An important type of investor, which by its size is able to influence the corporate policies of its target firms, are sovereign wealth funds (SWFs), which own equity of over $8 trillion (Bortolotti, Fotak, and Megginson, 2015). Liang and Renneboog (2020) demonstrate that SWF funds consider the level of past ESG performance as well as recent ESG score improvement when taking ownership stakes in listed companies, but the results are driven by the SWF funds that do have an explicit or implicit ESG policy (such as the Norwegian oil fund; see Chambers, Dimson, and Ilmanen (2012)) and are most transparent, that originate from developed countries and countries with civil law origins. Performing two natural experiments with exogenous shocks, the authors show that ESG scores do not change significantly more for firms in which SWFs have ownership stakes. This potentially suggests that SWFs in general do not actively steer their target firms towards higher levels of ESG.

It is not ex ante clear that specific activist tactics are effective across countries. One reason is that legal rules and corporate orientations toward shareholders or stakeholders (and the

resulting regulation regarding ESG issues) as well as the voluntary adoption of CSR policies (e.g., reflecting social preferences or institutional development) differ across countries, inducing varying levels of CSR performance (see among others, see Attig, Boubakri, El Ghoul and Guedhami (2016), or Liang and Renneboog (2017a)).

3.4. Impact investing and impact measurement

A recent phenomenon is impact investing made by private-equity investors who seek both financial returns and a positive social and environmental impact.[8] According to Global Impact Investing Network (GIIN), the global impact investing market has grown to more than US$500 billion by April 2019; it more than doubled from the estimated US$ 228 billion in 2018, and quadrupled from the estimated US$114 billion in 2017. Meanwhile, the global green bond market has also grown to US$521 billion by September 2019, compared to the US$600 million market size in 2007 when the first green bonds were issued. In addition, nearly 200 countries committed to mobilizing green finance under the terms of the 2015 Paris Agreement on climate change.

Using fund-level data, Barber, Morse and Yasuda (2020) examine impact funds around the world and find that venture capital impact funds earn lower returns than traditional funds. The reason that investors are still investing in impact funds is that they derive nonpecuniary utility from such dual-objective funds. This is especially the case in Europe, which dominates the demand for impact funds. Geczy, Jeffers, Musto and Tucker (2019) document that most impact funds tie the compensation of their fund managers to traditional financial incentives and that few relate compensation to impact. Other studies, such as Chowdhry, Davies and Waters (2019), Oehmke and Opp (2019), Landier and Lovo (2020), explore the theoretical underpinnings of how ESG investing can impact firm behavior and partially internalize externalities, but the topic area still remains under-researched.

An important issue within impact investing is the measurement of social and environmental impact. Addy, Chorengel, Collins, Etzel (2019) propose a framework for calculating the value of impact investing and also a new metric of the *impact multiple of money* (IMM), which involves (1) assessing the relevance and scale; (2) identifying target social or environmental outcomes; (3) estimating the economic value of those outcomes to society; (4) adjusting for risks; (5)

[8] For an introduction to impact investing, please see Cole, Gandhi and Brumme (2018).

estimate terminal value; (6) calculating social returns on every dollar spent. Other frameworks are used for impact measurement, such as the Equator Principles (EPs) developed by the World Bank's International Financial Corporation (IFC) to assess social and environmental risks.[9] The IFC has also reviewed several different impact measurement frameworks in its recent report "The Promise of Impact Investing".[10] Notably, a monetization framework is developed by TPG's RISE Fund, which is based on the calculation of an impact money multiple (IMM) in the spirit of Addy et al. (2019) that quantifies and monetizes an investment's net social and environmental impact. Harvard Business School has also been developing the Impact Weighted Accounts Report, which aims to calculate the monetary valuation of the social and environmental consequences of corporate policy and to produce environmental or total profit and loss accounts.[11]

4. Green Financing and the Economic De-carbonization

4.1 The Green Bond Market

A new financial market that has grown fast since 2013 is the market for green bonds and loans. In 2019, this global market reached an issuance of nearly US$ 258b, a 50% increase relative to the previous year. Most of this market (94%) consist of green bonds and the remainder are green loans. Most of the issuance takes place in Europe (45%) where the market also grows fastest; the Asia-Pacific and North American markets account for 25% and 23% of the issuance, respectively (the Climate Bonds Initiative, 2020).[12] In 2019, a total of 1,788 green bonds were issued by 496 issuers. Currently, the cumulative value of green bonds outstanding reaches about US$ 750b. The issuers of green bonds comprise the government including national and supranational agencies (e.g. The European Investment Bank), banks, and corporations (e.g. energy companies who stand for about 20% of green bond issues). Zerbib (2019) reports that about half the bonds of his global sample received a credit rating by S&P, Moody's or Fitch

[9] EPs apply globally, to all industry sectors and to four financial products: (1) project finance advisory services (2) project finance (3) project-related corporate loans and (4) bridge loans. It is primarily intended to provide a minimum standard for due diligence and monitoring to support responsible decision-making in risk management. EPs include ten principles: 1. Review and Categorisation; 2. Environmental and Social Assessment; 3. Applicable Environmental and Social Standards; 4. Environmental and Social Management System and Equator Principles Action Plan; 5. Stakeholder Engagement; 6. Grievance Mechanism; 7. Independent Review; 8. Covenants; 9. Independent Monitoring and Reporting; 10. Reporting and Transparency

[10] https://www.ifc.org/wps/wcm/connect/66e30dce-0cdd-4490-93e4-d5f895c5e3fc/The-Promise-of-Impact-Investing.pdf?MOD=AJPERES

[11] https://www.hbs.edu/impact-weighted-accounts/Pages/default.aspx

[12] https://www.climatebonds.net/resources/reports/2019-green-bond-market-summary

with 90% being investment grade. Most green bonds are issued in US$ and Euro, each type accounting for about one-third of the total outstanding.

The reason of the rapid growth of the green bond market can be found in the many initiatives that been launched to decarbonize portfolios and to redirect assets toward green investments. The OECD (2017a,b) has estimated that a yearly investment in infrastructure of almost US$7 trillion is needed in the next 15 years to keep global warming below the 2 degree Celsius cap as adopted in the Paris Climate Agreement of 2015 (effective as of 2016). To put this staggering number (which accumulates over a 15 years period to US$ 105 trillion) into perspective: the global market capitalization stock of manageable assets amounts to about US$ 90 trillion. The impulse towards green investing is not only generated by governments, but much of the demand for environmentally-friendly assets comes from investors who fear that climate change will lead to long-term wealth erosion. The EUI's (2015) estimate of the value at risk resulting from global warming to the global stock of manageable assets could be up to US$ 43 trillion by the end of the century. Institutional investors responding to the call for an environmentally friendly investment approach, are, for instance, the ones who signed the Montreal Carbon Pledge. These 120 investors with assets under management (AUM) worth more than 10 US$ trillion committed to measure and publicly disclose the carbon footprint of their investment portfolios.[13] In the meantime, more than 32 investors with AUM of more than US$ 800b signed the Portfolio Decarbonization Coalition.[14] Institutional investors expect that the demand for environmentally-friendly assets will continue to rise sharply; Blackrock for instance predicts that passive sustainable (ETF) funds will augment to US$ 400b by 2028.[15]

Green bonds are not issued for general financing purposes of governments or corporations, but are issued for specific projects that are labelled environmentally friendly such as renewable energy, green buildings, or resource conservation. In order to deserve this label, the green bond needs to comply to the Green Bond Principles which are "voluntary process guidelines that recommend transparency and disclosure, and promote integrity in the development of the Green Bond market by clarifying the approach for issuance of a Green Bond."[16] The Green

[13] http://montrealpledge.org/
[14] http://unepfi.org/pdc/
[15] https://www.fnlondon.com/articles/blackrock-predicts-sustainable-etf-assets-will-top-400bn-20181023
[16] The Green Bonds Principles are summarized in: https://www.icmagroup.org/assets/documents/Regulatory/Green-Bonds/GreenBondsBrochure-JUNE2017.pdf. These principles form the basis of international (e.g. Climate Bonds Standard and Certification Scheme) and national certification schemes.

Bond label or certification insures investors that reliable information is provided about the environmental impact of the project finance with green debt. At level or the European Commission, the EU High-Level Group on Sustainable Finance (EU HLEG (2018)) fine-tuned the definition of the green bond label by creating a technical committee responsible for the official European standard for green bonds (EU GBS).

4.2 Green Bond Yields

The rapid growth in the green bond market beckons the question about the pricing efficiency of these bonds. Environmental commitment in the supply (the issuers) and demand (retail and institutional investors) in itself can justify green bond issues, but how is the cost of debt of issuers affected and are investors willing to forgo part of the yield relative to that of conventional bond issues (pay a negative yield premium)?

In addition to a small green bond literature, several studies focus on the impact of a firm's CSR performance on its cost of debt when it issues conventional bonds issues. For instance, Oikonomou, Brooks and Pavelin (2014) demonstrate that good CSR performance is rewarded by lower corporate bond yields and that high CSR scores are negatively correlated with financial risk (which is confirmed by Stellner, Klein and Zwergel., 2015). Likewise, Bauer and Hann (2014) establish that environmental strengths are associated with lower US corporate bond yields.[17] Whereas these papers study the cost of debt based on CSR (including the environmental) performance of firms, Zerbib (2019) studies the yields of green bond (issued by corporations, banks and government agencies) yields directly. He adopts a model-free approach and matches green bonds with conventional bonds with the same properties (similar maturity, currency, credit rating, bond structure, seniority, collateral, and coupon type). The author also controls for differences in liquidity between the green and matched conventional bonds, an important issue often ignored in earlier green yield analyses. As a consequence of this process of matching, all observable factors common to both bond types are controlled for, save the single characteristic under examination: green versus conventional. Zerbib (2019) concludes that green bonds are issued at a small negative yield premium of 2 basis points (relative to conventional bonds). He argues that the high demand for green bonds by investors

[17] In contrast, Magnanelli and Izzo (2017) argue that good CSR performance increases the cost of debt for a sample of worldwide bonds. They assert that CSR is considered as "a waste of resources that can negatively affect firm performance.

willing to fund the environmental transition enables issuers to slightly lower their cost of debt by means of green bonds.

Other studies, some published by banks and also based on a matching methodology (but often without controlling for maturity or liquidity), either report no green bond yield premium (for US$ and Euro denominated: HSBC, 2016 and Climate Bonds Initiative, 2017; for global corporate bonds, Tang and Wang, 2020) or a negative yield of between 8 and 26 basis points (for global green bonds: Barclays, 2015; for supranational banks: Bloomberg 2017; for EIB green bonds: Natixis, 2017; for US$ and Euro denominated bonds: Ehlers and Packer, 2017; for US corporate and municipal bonds: Baker, Bergstresser, Serafeim and Wurgler, 2018).[18]

In addition to reducing the cost of capital, corporations may have other reasons to issue green bonds, which is what Flammer (2019) examines. She studies whether green bonds serve as a signal that a firm is committed to preserving the environment or whether firms commit greenwashing, which comprises unsubstantiated claims that the firm is acting to avoid climate change. Flammer documents that when a firm announces a green bond issue, its stock price reacts positively: by 0.5% (which is close to the 1.5% reaction in the Tang and Wang (2020) study). The stock price reaction is stronger for certified green bonds and for first-time issuers of green bonds, which is in line with the author's signaling argument. Subsequently, Flammer (2019) matches green bond issuers to non-green bond issuers, and demonstrates that the environmental scores as well as the CO_2 emissions of green bond issuers subsequently outperform those of the control firms. The fact that green bond issues obtain tangible environmental results subsequent to the green bond issue refutes the argument that they are undertaken for reasons of greenwashing. Consequently, a green bond issue seems a credible commitment towards the environment. This signal does not go unnoticed as, post-issuance, the percentage of the equity outstanding held by long-term and green investors increases. This finding is in line with recent work by Krueger, Sautner, and Starks (2019) in a broader context of corporate environmental commitment by Tang and Wang (2020). Both studies also show that institutional ownership goes up in firms with lower climate risk.

[18] For US municipal bonds with a green label, bond yield premium is either positive (Karpf and Mancel, 2018) or zero (Larcker and Watts, 2020).

Besides green bonds, some recent studies also investigate how climate change affects financial markets more generally. For example, Hong, Li, and Xu (2019) argue that the trend towards higher global temperatures exacerbates the risks of droughts, and prices of food stocks may discount these risks. Using data from 31 countries with publicly-traded food companies, the authors rank these countries each year based on their long-term trends toward droughts using the Palmer Drought Severity Index, and find a poor trend ranking for a country forecasts: (1) relatively poor profit growth for food companies in that country; (2) relatively poor food stock returns in that country. In addition, the authors find that food stock prices underreact to climate change risks. Using international data, Choi, Gao, and Jiang (2020) find that attention to climate change, as proxied by Google search volume, increases when the local temperature is abnormally high. In financial markets, stocks of carbon-intensive firms underperform firms with low carbon emissions in abnormally warm weather. Retail investors, but not institutional investors sell carbon-intensive firms in such weather.

With regard to the real estate markets, Murfin and Spiegel (2020) compare prices for houses based on their inundation threshold under projections of sea level rise (SLR). They find precisely estimated null results suggesting limited price effects. Baldauf, Garlappi, and Yannelis (2019) also investigate how climate change will have significant impact on coastal regions. They find that real estate valuations reflect the differential beliefs among the general population on its occurrence (risk of future inundation); houses that are projected to be underwater in neighborhoods of people who believe it tend to sell at a discount. This is confirmed by Bernstein, Gustafson and Lewis (2019) who document that homes exposed to SLR sell for 7% less than unexposed houses at equidistance from the beach.

5. Conclusion

Despite extensive attention to CSR and sustainable finance by corporations and the investment industry, these fields are still emerging with respect to academic research. Despite its relatively late advent, the literature has been growing exponentially and evolving towards various topics. The focus of academic research has quickly moved from whether firms and investors should care about sustainability and social responsibility to how CSR and sustainability affects firm performance, investor returns, financial market activities, and the macro-economy. In this article, we aim to provide a comprehensive review of the literature from the perspectives of

corporate finance, asset pricing, investment, and financial markets, and connect finance to broader sustainability issues.

We acknowledge that the academic papers in our review do not constitute an exclusive list of all studies nor even of all topics within this field, and as more studies are cropping up, the list should be updated regularly. There is also a large and growing literature on environmental economics especially on climate finance, which is currently not the focus of our review. Nevertheless, we hope the comprehensiveness of the review in our article provides readers with a more holistic understanding on the topics of CSR and sustainable finance, stimulating more research in this important and exciting field.

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