Review of World Economics (2026) 162:87–119
https://doi.org/10.1007/s10290-024-00541-9

ORIGINAL PAPER

How sustainable finance creates impact: transmission mechanisms to the real economy

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Accepted: 10 April 2024 / Published online: 23 May 2024

Abstract

When and how does sustainable finance tangibly contribute to creating a better world? In this paper, we outline mechanisms through which impact on sustainability outcomes is transmitted from financial systems to the real economy. We argue that, to have a positive impact on sustainability outcomes, financial institutions must make a clear contribution to: (1) reducing (increasing) the cost of capital for firms' (un)sustainable activities; (2) increasing (reducing) their access to liquidity; and (3) encouraging or enabling sustainable corporate practices. We assess the potential for impact in each category across several asset classes. We analyse how financial institutions can integrate the development of "impact budgets" into strategic asset allocation. Finally, we consider ways in which future research could consider the implications for impact-oriented portfolio construction in more detail and develop empirical methods for further testing and quantifying the impact of the different transmission mechanisms we discuss.

Keywords Sustainable finance · Impact investing · Greenwashing · Transmission mechanisms

JEL Classification G11 · G23 · G24 · G28 · Q01 · Q54 · Q57

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1 Introduction

Financial institutions are increasingly making commitments to "align" the activities they finance with sustainability goals[1] both broad (e.g. net zero emissions) and specific (e.g. reduced water footprints). In doing so, they are pursuing at least two main objectives (Caldecott, 2020). The first is risk management, reflecting growing recognition that unpriced sustainability risks, such as climate change and water stress, can affect financial returns, the creditworthiness of firms, and in some circumstances, financial stability (see OECD, 2020; European Systemic Risk Board, 2020). The second, and the focus of this paper, is to respond to growing investor demand for "impact", in the form of real economy outcomes that are aligned with a given set of non-financial standards or targets. Stakeholders ranging from retail investors to large institutional asset owners are looking for ways to generate impact by driving progress towards sustainability goals through their investment decisions. The proliferation of objectives and strategies in sustainable finance seeking to demonstrate such impact is increasingly well-documented (Busch et al., 2021; OECD, 2020; Popescu et al., 2021; Schoenmaker, 2017).

The "alignment" of financial portfolios with given sustainable targets—buying and holding green assets, and selling brown assets—is often equated with impact. Indeed, this logic is fundamental to the European Union (EU) Sustainable Finance Taxonomy and Sustainable Finance Action Plan (see Kahlenborn et al., 2017), and implicit in regulatory and voluntary frameworks including the Science-based Targets Initiative (SBTi), UK Roadmap to Sustainable Investing (2021), and Task Force on Climate-Related Financial Disclosures (TCFD), as well as recent guidance from the UK Financial Conduct Authority (2021). It is not yet clear whether, how, and to what extent, this assumption is justified. At the very least, there is insufficient evidence to support the claim that a portfolio alignment approach to sustainability necessarily generates any real economy impact, and the two should not be conflated. Similarly, not all alignment strategies are equal. They may range from aspirational objectives that do not substantively influence firms' decision-making to "impact-oriented climate alignment" approaches that commit investee firms to "facilitating rapid, real economy decarbonization" in line with time-bound targets (RMI, 2022).

In general, the lack of clarity over the nature of the link between portfolio alignment and real-world outcomes has given rise to concerns that financial institutions are engaging in "impact-washing"—using impact-labelling as a marketing tool to attract capital or provide reputational benefits, without necessarily providing any real solutions to environmental and/or societal challenges (Busch et al., 2021). Left unchallenged, this permissive approach to defining impact could dilute the contribution of finance to meeting sustainability challenges and undermine investor confidence in the ability of impact-labelled products to deliver the outcomes they nominally seek (Findlay & Moran, 2019; Harji & Jackson, 2012).

[1] This paper focuses on "green" sustainable finance with goals relating to climate change and the environment, although the analysis presented here is also applicable to other areas of sustainability.

This paper sets out to answer Busch et al.'s (2021) call for a "re-orientation" of what impact in investing means. In this paper, we define the minimum threshold for "impact-generating" activities as those that encourage sustainable real economy activity, and/or discourage unsustainable activity. We investigate the mechanisms through which decisions in the financial sector can drive progress towards an environmentally sustainable economy generally and climate change specifically. Rather than focusing on a single asset class, as most studies have done to date, we take a comparative perspective across multiple asset classes, aiming to initiate the development of a framework for strategic asset allocation across multi-asset portfolios.

The typology put forward in this paper is based on a survey of the existing literature across several asset classes. We identify transmission channels through which financial institutions can achieve sustainability outcomes in the real economy. Outlined in more detail in Sect. 2, we begin with existing literature in order to establish a clear theoretical basis from which to consider the differential routes to impact by asset class. With the knowledge that the available research varies widely across asset class (with public equities and better studied than, for instance, private equity and real estate funds), the authors conducted eight expert interviews with practitioners to test and validate the theoretical conjectures we developed. Two of the interviewees had expertise across multiple asset classes, and the remaining six specialised in fixed income, real assets, and public and private equity. Those interviewed represented pension funds, hedge funds, investment banks, index providers, and research institutes.

Our starting point, grounded in the literature, is that having a positive impact on sustainability outcomes in the real economy requires financial institutions' actions, directly or indirectly, to: reduce (increase) the cost of capital for firms' (un)sustainable activities; increase (reduce) their access to liquidity; and/or encourage or enable sustainable corporate practices in other ways beyond the cost of capital and liquidity. We assess the potential for financial decisions to drive real impact in each of these categories, across several asset classes. We then analyse how, based on this framework and findings in the wider literature, financial institutions can integrate "impact budgets" into strategic asset allocation. Finally, we consider ways in which future research could consider the implications for impact-oriented portfolio construction in more detail and develop empirical methods for further testing and quantifying the impact of the different transmission mechanisms we discuss.

Our findings reaffirm that holding green assets is not necessarily sufficient for real economy impact. By looking at the differential potential for impact across asset classes, our typology suggests that fixed income and particularly sustainability-linked products (under the right conditions and subject to appropriate penalty design) have the greatest overall potential to generate impact. In most circumstances, passively-managed public equities have the least potential for impact, while impact potential in private equity, infrastructure and hedge funds can vary widely depending on the strategy adopted. We explore the implications for strategic asset allocation across multi-asset portfolios. In addition to optimising the impact within an existing asset class allocation, we also suggest, consistent with the literature, that

using an "impact budget" as part of strategic asset allocation could allow financial institutions to further optimise their impact across a multi-asset portfolio for a given targeted financial return.

Our first novel contribution is to propose an asset class-specific typology through which finance can exert clear and measurable influence on real economy sustainability outcomes. Our second contribution is to tentatively benchmark the relative potential impact of each transmission mechanism across asset classes, with implications for practice within each asset class as well as for strategic asset allocation. From this theoretical grounding, we hope to spur further empirical work to assess impact claims against evidence, and further theoretical work to more robustly define how impact transmission channels function with a view to maximising their potential to effect real economy change.

The paper begins by summarising current debates in the relevant literature and identifying transmission mechanisms linking financial investments to the real economy and their application to sustainable finance (Sect. 2). This forms the basis for assessing the theoretical impact of sustainable investing by asset class (Sect. 3). Section 4 explores the implications for portfolios and strategic asset allocation, and Sect. 5 concludes.

2 Literature review

2.1 Defining real economy impact

In the literature linking sustainable finance to real economy impact, "impact" itself is not yet a universally well-defined concept (Busch et al., 2021; Nicholls & Daggers, 2016). Actors in academia, policy, advocacy, and the financial industry have various different interpretations of what impact means, whether and why investments should seek to generate it, and the modalities for doing so. This lack of coherence is a key contributor to the absence of agreement over measuring impact.

This definitional challenge has been exacerbated by the blurry distinctions between the "impact investment" community, which is explicitly willing to trade off financial returns for social impact, and the much broader family of "sustainable finance", which looks to integrate sustainability into the wider investment universe—whether at a firm or system level. Several typologies define impact investment as a distinct sustainable investment approach (O'Donohoe et al., 2010). The Global Sustainable Investment Alliance (2019, p. 3) describes impact investing as "a small but vibrant segment of the broader sustainable and responsible investing universe". But the boundary conditions separating it from the broader categories of socially responsible investment and/or Environmental, Social and Governance (ESG)[2] approaches remain unclear. To illustrate, the impact investment market is estimated at US$502 billion (Global Impact Investing Network, 2020), while the

[2] ESG refers to the integration of environmental, social and/or governance factors in investment decision making and is often used synonymously with the term "responsible investment". See Principles for Responsible Investment. (2016), Integrating ESG issues into Executive Pay.

amount of assets ostensibly managed in an ESG context stood at US$30.7 trillion at the start of 2018 (Global Sustainable Investment Alliance, 2019). This disparity raises the question of what really counts as impact investment, and whether the overwhelming majority of sustainable financial assets sitting outside the impact investment community can really live up to their labels.

Recent literature broadly agrees that impact investment requires a clearly articulated intention to create positive social and/or environmental outcomes, rather than simply managing sustainability-related risks that affect financial performance (Brest & Born, 2013; Findlay & Moran, 2019; Freireich & Fulton, 2009; Jackson, 2013). In their account of the evolution of sustainable finance, Busch et al. (2021) provide a useful way of distinguishing impact investment from other sustainable investing strategies. They argue that the shift towards consideration of investment outcomes and portfolio alignment with sustainability goals can be viewed as hallmarks of "Sustainable Finance 3.0" (marking a gradual evolution from "1.0" centred around value-driven socially responsible investment, and "2.0", which saw mainstreaming into financial markets through ESG-based approaches to sustainable value creation). To identify where investment products sit along this continuum, they differentiate between "impact-aligned" and more stringent "impact-generating" investments. Environmental and/or social outcomes can be claimed post hoc for the former, where already-realized outputs are measured against sector benchmarks or internal impact targets. The latter requires that an outcome be achieved *as a result of* the investment.

For the purposes of this paper, "impact" refers to the stricter "impact-generating" criterion, whereby a causal link must be established between financial decision(s) and real economy outcomes. This approach is not dissimilar from Brest and Born's (2013) proposed "additionality" criterion, which requires that the impact would not have been generated, or would have been less viable, without the sustainable investment. Since the existing theoretical and methodological challenges of defining the baselines required to reliably prove additionality are fraught with difficulty and controversy, in this study we concentrate on identifying theoretical pathways for generating impact, rather than engaging in detailed discussion of how to measure the additionality of this impact.

2.2 Identifying transmission mechanisms

While the literature offers no shortage of debates surrounding the definitions of impact investment, the discourse surrounding *how* real economy change occurs under different definitions is only beginning to emerge.

For instance, Green and Roth (2021) argue that if impact is defined as global social value created by an investor, rather than the social value of the firms in its portfolio, impact-seeking investors act inefficiently by focusing only on their portfolio holdings. Where companies are both socially valuable and financially sound investments, impact-seeking investors willing to pay higher prices for them risk displacing non-impact seeking investors into less socially valuable investments. They conclude that impact-seeking investors truly seeking social value should target

less profitable projects, and not simply compete for investment in socially valuable, profitable firms. Other similar studies argue that marginal social impact (i.e., additionality in reducing externalities) requires investors to trade off fiduciary duties for social benefits, a mandate that most funds do not have (Oehmke & Opp, 2023) echoing Pástor et al. (2021). In a subtly different approach focused on carbon emissions, Lander and Lovo (2020) distinguish between "value-alignment" by investors with green preferences, and "impact", defined as an improvement in social welfare. Echoing Edmans et al. (2023), their modelled results show value-aligned investors targeting the clean sector, with impact investors holding higher-emissions firms but imposing emissions reductions on them directly—although this result depends on their ability to credibly impose these restrictions on firms.

If we define impact as "the change that investor activities achieve in company impact" (Kölbel et al., 2020), simply buying and holding green assets, or not holding brown assets, does not automatically imply any influence over the underlying companies' activities. Kölbel et al. (2020) identify three mechanisms that investors can theoretically use to generate sustainability outcomes: by affecting capital allocation, which decides what firms and projects receive funding at what cost (i.e. the cost of capital channel); indirect impact on firm activities; and shareholder engagement. In their own review of channels for investors to deliver impact, Busch et al. (2021) suggest three broadly similar mechanisms through which, in theory, sustainable finance can generate real economy impact: by providing additional capital to firms or projects generating positive social/environmental impact (corresponding to "capital allocation" in Kölbel et al., 2020); by investing in companies with forward-looking targets for impact generation ("indirect impact"); and by prompting firms to change by leveraging voting rights ("shareholder engagement"). In their review of the evidence to support the existence and effectiveness of these channels, Kölbel et al. (2020) find that empirical support for the capital allocation mechanism has only been proven partially, as the literature tends to study components of it separately; and evidence supporting indirect impact is very limited. They do find shareholder engagement to be the most empirically reliable mechanism for delivering impact, although it does not follow from this that it is necessarily the most effective. Overall, the existing literature suggests firstly that there is a need for greater specificity in theorising and testing the capital allocation mechanism and its relationship to sustainable outcomes, and that there is an even more significant gap in understanding how investment decisions affect firm behaviours beyond the shareholder engagement modality.

Our definition of impact requires only that sustainable investments affect real economy activity[3] since in this paper, we are more interested in "how" impact is achieved than "what" it is defined as. Based on a review of applicable theory and literature, we posit a framework composed of three possible transmission mechanisms by which sustainability-conscious financial decisions can affect real economy activity: (1) the cost of capital faced by firms when accessing finance; (2) firms' access to liquidity, which affects corporate operations, investment planning and refinancing,

[3] Although we focus on firms as a proxy for the real economy, the same logics could also apply to households, governments etc.

Table 1 Transmission mechanisms linking sustainable finance with the real economy

Mechanism	Definition	Links to the real economy
Cost of capital	Opportunity cost of similar possible uses for capital resources, represented by the cost of accessing these resources. In theory, firms invest in projects where returns exceed this opportunity cost	The cost of capital affects firms' ability to finance capital expenditure. Sustainability performance can affect the cost of capital where investors seeking impact and/or perceiving lower risks in sustainable firms offer cheaper financing (i.e. lower return requirements or interest rates) to more sustainable firms or projects. This influences how capital expenditure is allocated. These preferences can be expressed in traditional bond, loan, and equity markets, and in dedicated markets for sustainable products such as sustainable bonds and loans (which price debt differently for sustainable versus unsustainable firms or projects) and sustainability-linked bonds and loans (with interest rates tied to the achievement of sustainability targets)
Access to liquidity	The ease with which firms can access funding and working capital	Restricting/expanding the supply of funds to unsustainable projects can constrain firms' ability to engage in unsustainable/sustainable activities and drive a wedge between the cost of capital for sustainable and unsustainable projects and firms. This includes both short-term supply of liquidity from banks and liquidity in financial markets from which longer-term capital is raised. Firms may also be able to access a broader investor base by participating in sustainable debt markets. Relative to traditional debt markets, wider pools of investors may be willing to offer firms funding for impact-aligned or -generating activities. This can be particularly relevant for smaller firms, and/or those with a limited track record in capital markets
Changing corporate practices	Influence over corporate governance and operations. Application of tools, including but not limited to shareholder engagement and voting rights, to persuade a firm to behave differently than it otherwise would have	Shareholders and creditors can use their status to influence corporate strategy, governance, and organizational management. Shareholders can pressure firms to adopt more sustainable policies and practices, including through (1) collaborative engagement with management; (2) shareholder resolutions and proxy voting; (3) signalling effects of public engagement with, and/or divestment from, companies that do not respond adequately. Creditors can influence corporate practices by conditioning their lending on the adoption of sustainable practices. They can also engage with company management as future funding agreements are negotiated

particularly when under pressure to realise returns; and (3) investors' influence over corporate management and practices. Since they can be affected by some of the same underlying drivers and in turn influence each other, the total real impact resulting from a given investment would depend on both external conditions and feedback dynamics between each mechanism. Further, in addition to the direct effects they might generate on firms' real-world activities, these transmission mechanisms can also improve or inhibit firms' ability to manage and mitigate risk; and generate broader spill-over effects beyond a given financial portfolio which in turn can trigger wider systemic feedbacks. The three proposed transmission mechanisms and their possible applications to sustainable investment are summarised in Table 1.

2.3 Mechanism 1: the cost of capital

A firm's cost of capital is the average rate of interest/return that it pays on debt and equity capital. Firm-level cost of capital is often, but not exclusively, measured by the capital asset pricing model (Brotherson et al., 2013; Brounen et al., 2004; Graham & Harvey, 2001) and can be affected by a variety of macro variables (such as central bank interest rates, inflation, and the business cycle) and firm-level variables (such as a firm's creditworthiness and the quality of its senior management team) (Elton, 1994). Financial market characteristics, such as secondary market liquidity, have been shown to affect the yield spread of new bond issuance (Chen et al., 2007; Goldstein et al., 2019) and the fees associated with new equity issuance (Butler et al., 2005). The cost of capital is one determinant of firms' decisions to invest in real economy assets. There is clear evidence that corporate investment is negatively correlated with the cost of debt capital (Gilchrist & Zakrajšek, 2007, 2012; Frank & Shen, 2016; Lin et al., 2018). Research also suggests a negative relationship between corporate investment and the cost of equity capital, although this is stronger when it is derived directly from stock prices than when calculated using the risk-based capital asset pricing model (Frank & Shen, 2016; Byoun et al., 2015). Perhaps unsurprisingly, this suggests short-term market fluctuations have a role in investment decisions, even when the risk profile of a firm's assets remains unchanged relative to the market. This may be less true for large, listed firms with a much greater ability to finance projects through retained earnings and little or no exposure to external capital costs (Allen & Gale, 2000; Blanchard et al., 1993; Kay, 2015).

Several studies have sought to model the conditions under which impact can be achieved through the cost of capital channel. Some suggest that excluding high-emitting or otherwise misaligned companies from a portfolio has limited impact on real economy emissions due to emissions "leakage" as alternative capital sources step in (Ansar et al., 2013). Theoretical results from Lander and Lovo (2020) show that exclusion does not raise unsustainable firms' cost of capital enough to affect real investment. However, if investors derive utility just from holding sustainable assets, Pástor et al. (2021) show this allows them to accept lower returns by lowering the cost of capital offered to green firms, thereby increasing their market value. De Angelis et al. (2022) find that where green investors exclude the most carbon-intensive companies from their investable universe, their cost of capital rises as the pool

of capital available to them shrinks. This effect is more pronounced where green investors are more sensitive to climate impact, represent a higher share of wealth, where regulation is expected to tighten faster, and technological innovation is expected to proceed more quickly. It is less pronounced when there is greater uncertainty over climate risks, as this prompts investors to diversify once more. They also find impact to be compatible with profit maximisation in circumstances where investors favour companies already on transition pathways. Edmans et al. (2023) find that major shareholders can affect the cost of (primary market) capital by excluding some externality-generating firms, but that exclusion strategies do not necessarily incentivise excluded firms to change their behaviours (since there is no direct reward for doing so). Tilting strategies allow investors to hold shares in firms conditional on their behaviour, while financing firm transition and green expansion. For investors seeking impact, they conclude, impact strategies based on tilting are more effective where corrective actions by firms reduce externalities, corrective actions are less costly, and firms are more sensitive to stock prices. Absent these conditions, only a large shareholder willing to pay a premium for firms' shares condition on corrective action would have sufficient influence.

There are early empirical indications that firms' cost of capital is affected by their sustainability performance, although this varies across asset classes. Both Berk and van Binsgergen (2021) and Hunt and Weber (2019) find that the cost of capital effect, while present, is insufficiently large to meaningfully affect real investment decisions. Zhou et al. (2021) show divergence in the cost of capital between renewable and fossil fuel-based energy companies. ESG and corporate social responsibility (CSR) ratings incorporating environmental performance measures are associated with lower costs of equity and debt (Drobetz et al., 2018; Ge & Liu, 2015), and lower credit default risk (Kiesel and Lücke, 2019). Higher costs of capital have also been linked to higher carbon emissions, for firms in similar sectors (Chen & Silva Gao, 2012; Kleimeier and Viehs, 2018). These trends may become more widespread and pronounced as government and investor climate policies tighten. For instance, some financial institutions now set hurdle rates for new coal projects of 40%, up from 16% for recently completed coal projects, and compared to 10% for wind or solar projects (Fattouh, 2019).

Initial survey evidence (Alessi, 2019) finds that at least some investors meet Oehmke and Opp's (2023) and Pastor et al.'s (2021) criterion of being explicitly willing to accept lower returns on investments linked to more sustainable economic activities, thereby creating an incentive for firms to adapt their investment plans accordingly. The advent and growth of green and sustainability-linked loans (SLLs) and bonds (SLBs), in which interest rates are tied to the achievement of sustainability targets, are clear manifestations of these preferences. While the market for these instruments remains small relative to overall debt markets, it is growing rapidly (Linklaters, 2019; Environmental Finance, 2022, p.28). Green and sustainable bond issuance represented $992 billion (11% of total bond issuance) in 2021, a 64% increase from 2020. Issuance is expected to reach $1.35 trillion (15% of total issuance) in 2022 (Moody's, 2022).

Green and sustainable bonds provide financing in exchange for guaranteed "use of proceeds" on eligible activities, and mandatory impact reporting. Evidence that

these attributes lower the cost of capital for issuers is mixed and context-specific (Brennan & MacLean, 2018; Shishlov et al., 2016). A global study by Tang and Zhang (2020) finds that although stock prices rise in response to green bond issuance, this rise is driven by several factors other than changes in the cost of debt. Analysis of China's green bond markets provides strong evidence that green bond issuance is associated with a lower corporate cost of debt (Zhang et al., 2021). Other studies, however, show no difference in yield compared to conventional bonds (OECD, 2017), while still others show a modest negative premium in the order of two basis points (0.02%), giving issuers a marginally lower cost of capital (Zerbib, 2019).

Recent studies on SLBs are critical of their current performance but do not rule out significant potential if present limitations are addressed. Berrada et al. (2022) provide a conceptual basis for assessing SLB compatibility with firm incentives and influence on real investment. Their model suggests that SLBs can influence firm investment as long as the coupon penalty tied to non-achievement of KPIs is high enough. They also demonstrate that where SLBs are overpriced at the date of issuance, their price falls in secondary market trading (by approximately 1% on a 30-day horizon), while the stock price increases with the degree of overpricing, representing a transfer of wealth from bond- to share-holders. In an empirical study of 102 SLBs, Kölbel and Lambillon (2022) find that although SLBs see an average premium (i.e., yield discount) of almost 30 basis points (bps) against comparable standard bonds, the average maximum non-compliance penalty is just 26.6 bps, implying, in their words, a "free lunch" for issuers pocketing the difference. They also find that the size of the penalty does not drive primary market pricing. These findings point towards greenwashing potential in SLB markets, although the effects of a firm failing to meet KPIs on the pricing of further SLB issuance, and the benefits of the scrutiny and contractual obligations created by SLBs are yet to be fully understood.

2.4 Mechanism 2: access to liquidity

Ready access to liquidity to meet working capital and funding needs is essential to the efficient functioning of firms. Where converting assets into cash is more difficult, operational risks are higher, and long-term investments are less attractive (Bencivenga et al., 1995). Investors and banks, as providers of liquidity in fixed income markets, facilitate firms' ability to make long-term investments and adapt to market conditions. The most direct way in which access to liquidity may influence firms' activity is through their access to primary bond markets and bank loans. However, greater liquidity in secondary bond markets has also been shown to lower issuers' cost of capital by lowering the liquidity premium on the volume and timing of concurrent and future issuance (Chen et al., 2007; Goldstein et al., 2019; Arseneau, 2015; Hanselaar et al., 2019). Secondary market liquidity is also closely linked to the overall functioning of financial markets (Bruche & Segura, 2017). In primary and secondary markets alike, the attractiveness of sustainable products, such as green bonds, improves as they become more liquid (Febi et al., 2018).

For access to liquidity to be an effective transmission channel for investors' sustainability preferences, sustainable firms or projects would need to have greater or easier access to capital than their less sustainable peers. In bond markets, there is some emerging evidence in the case of oil and gas divestment that financial institutions' lending policies towards the sector can contribute to creating this differential, where greater divestment pledges are associated with lower domestic capital flows to oil and gas in a given country, although this does not discount the possibility of capital leakage into other jurisdictions or the ability of oil and gas firms to self-finance during periods of restricted liquidity (Cojoianu et al., 2020). Case-specific evidence suggests a similar pattern in the coal power and mining industries, with limited access to liquidity directly slowing the expansion of coal activity in Indonesia as the number of banks willing to back new coal projects declined (IEEFA, 2019). Recognising the relevance of liquidity to firm activity, major stock exchanges (e.g. Hong Kong Stock Exchange, 2021; London Stock Exchange, 2020) have implemented mandatory ESG screening and/or green economy markers that may affect the provision of liquidity to firms unable to meet sustainability criteria (Grabski & Miller, 2019). A similar logic underlies the product labelling strategy used by the EU Taxonomy.

The impact of sustainability trends on bank lending is less clear. Despite banks' crucial role as providers of short-term liquidity to firms through working capital loans and rolling credit facilities, only a few US, European, and international banks have moved to actually cut off or limit access to capital for unsustainable firms. Where they have, these policies have been applied only for select examples of clearly climate-misaligned projects presenting high reputational risks to lenders, such as coal, tar sands or Arctic oil exploration (BankTrack, 2020). Beyond these cases, rather than directly limiting the amount of liquidity available through negative screening (which would result in reduced business), banks have moved primarily to tie sustainability to pricing, e.g. through sustainability-linked loans, to sustain existing lending levels while adjusting returns to reflect sustainability-related risk.

In fixed income markets, primary issuance is much more frequent than in equity markets. Large firms regularly roll over and refinance their debt liabilities to respond to changing market conditions and typically require ongoing access to liquidity at favourable rates, especially during periods of relative financial stress or instability. At present, fixed income markets channel a large share of capital raised through primary issuance into fossil fuel industries, including 14% of capital flows from the largest US Exchange Traded Funds (ETFs) (Wilson & Caldecott, 2021). The combination of firms' need to regularly access fixed income markets, and the substantial role of these markets in financing high-carbon activities, means that if investors make their willingness to participate in further issuance conditional on sustainability criteria they can have a sizeable impact relatively quickly, particularly where the decision influences other investors' behaviours.

Access to liquidity is also a function of the breadth and diversity of a firm's investor base. In this context, where green bond issuance allows firms to borrow from a wider pool if investors, they can sometimes benefit from tighter spreads. Indeed, surveys of issuers have identified expectations of greater access to capital as an ex-ante motivation for issuing green bonds (Maltais & Nykvist, 2020), and ex-post analysis

of green bond issuance supports the conclusion that green labelling does facilitate access to a wider investor pool (Climate Bonds Initiative, 2017, 2020). Early evidence suggests this broader investor base can partly insulate green bond issuers (as compared to the wider bond market) from periods of volatility and uncertainty, as observed in Italy in 2018 (Martin, 2019) or in Asia in spring 2020 (Xu, 2020).[4] A much more nascent and less well-theorised means for issuers unwilling or unable to tap green bond markets to ensure continued access to liquidity is the use of "transition bonds", which are structurally similar, but require issuers to use proceeds for the purposes of converting unsustainable assets into sustainable ones, or making other strategic changes required to align their activities with sustainability goals.[5]

2.5 Mechanism 3: changing corporate practices

Engagement on sustainability issues is now a central feature of debt and equity capital markets. In a 2019 survey by Russell Investments, 89% of surveyed asset managers with equity and bond offerings, and 71% with bond-only offerings, claim they often or always discuss ESG topics when speaking with investee companies, suggesting it is now a mainstream strategic tool for influencing corporate practices across debt and equity alike (Phillips, 2020).

The practice of equity shareholders deploying their 'voice' to influence company management is as old as the development of modern joint-stock companies themselves (Ferguson, 2008), but the theory and practice of how financial institutions—especially institutional investors, which owned 80% of US public equity in 2017, up from 47% in 1987 (Cheffins, 2013; McGrath, 2017)—can use this lever to drive change has evolved rapidly as different interpretations and practices of engagement and stewardship emerge.

While divestment has a long history as a means for shareholders to express their views on corporate activity (Chow, 2010), the notion of shareholder pressure for "good", and the term "engagement" itself, traces to the more recent idea of CSR, which only became a mainstream concept in the 1990s and early 2000s (O'Rourke, 2003). Engagement is considered by institutional investors to be a more effective transmission mechanism than divestment, as it allows investors to retain and track influence over corporate policies (Krueger et al., 2020). Investors' ability to pressure companies to adopt sustainable practices has significant empirical support in the literature, although the effectiveness of these engagements is highly dependent on factors including the size of the investor's shareholding, the asset class, the preferences of the asset owner, and the regulatory context (Bauer et al., 2019; Dimson et al., 2015; Gifford, 2010; Horster & Papadopoulos, 2019). Analysis of sustainability-related shareholder resolution requests from 1999 to 2017 shows they enjoy

[4] In addition, several market participants consulted for feedback on drafts of this paper independently emphasised that it was easier to issue green over conventional bonds at times of market instability.

[5] In the climate context, this may take at least two forms: (i) allowing a firm to continue the formation of high-carbon capital (e.g. gas plants) providing headroom to manoeuvre into a stronger strategic position; (ii) financing the formation of fixed capital assets necessary for decarbonisation (e.g. production of cement and steel for low-carbon infrastructure).

success rates ranging from 18 to 60% (Kölbel et al., 2020), though it is worth noting that with compliance cost being a key determinant factor of success alongside investor influence and company ESG experience, environment-related issues have a comparatively lower success rate than social and governance issues due to their high cost burden (Dimson et al., 2015). Shareholder resolutions have been empirically linked to subsequent improvements in the ESG ratings of the targeted firms (Barko, 2017; Dyck et al., 2019), but there are yet to be any studies evaluating whether shareholder proposals and other engagement-driven strategies systematically create measurable real economy impacts.

Moreover, some studies have suggested that it is the signalling effect of engagement on particular issues, rather than the specific content of resolutions, that primarily drives changes in corporate action. In practice, shareholder resolutions that are not backed by management rarely win a majority vote. Flammer et al. (2021) find that the mere filing of a shareholder proposal, in itself, can be a sufficiently clear signal of investors' concerns to managers to prompt changes in corporate climate risk disclosures. Recognising this effect, the Norwegian state asset manager Norges Bank Investment Management has introduced a five-day pre-voting disclosure policy intended to create a signalling effect clearly indicating its preferences and expectations to firms. An alternative explanation has been put forward by Bauer et al. (2021), who argue that the filing of proposals drives change not because of signalling alone, but because doing so opens up a space for negotiation and conversation with company management that ultimately catalyses change. Data from the 2021 shareholder voting season supports this view, with major proponents observed withdrawing proposals under the condition that firms acquiesce to shareholders' demands, such as the implementation of net zero commitments and strategies, green energy use targets, and production goals (Treviño et al., 2021). This sequential, negotiation-based approach to engagement has been adopted by large asset managers including BMO and Legal and General, who pursue "escalation" strategies in which negotiation tactics become increasingly severe as investee firms fail to respond to investor demands, with divestment and the associated market signalling implications being the ultimate consequence of inadequate responses.

The individual 'voice' of investors may be proportional both to the size of its investment holding, and to its influence over other investors (in building coalitions) and over share prices and movements (with the value of the assets under management often used as a proxy). For smaller investors, or those holding a small percentage of shares, engagement coalitions are therefore particularly important for them to effectively exert a collective 'voice'. The use of coalitions is on the rise (Gond & Piani, 2013), especially in tackling sustainability-related issues. Since individual institutional investors rarely own majority holdings in publicly listed firms, successful engagements can depend heavily on their ability to build coalitions of investors with a substantial minority or majority holding, as a means of signalling or ultimately executing measures to change corporate behaviour (Dimson et al., 2015). Activist hedge funds with very small shareholdings have used confrontational versions of this approach to target firms with high environmental impact. A particularly notable example of this is hedge fund Engine No. 1's successful vote targeting Exxon Mobil's board composition, which resulted in the appointment of three of its

preferred candidates to the firms' twelve-person board. There are early signs of this disruptive model of driving corporate change being scaled up and replicated (Lipton, 2021).

While traditional investor engagement with firms has focused on shareholders pressuring company management through the formal procedures of filing and voting on resolutions (Goronova and Ryan, 2014), investors in other asset classes, including bonds, private equity (PE) and real assets, can also exert leverage over corporate practices. Bondholders do not have voting rights, but they do (as capital providers) have direct access to company management through investor roadshows, at debt issuance, refinancing, syndication, and rollover, and in building strategic coalitions with other bondholders (World Bank, 2018). Bondholder engagement can be particularly effective where it is timed to coincide with specific points in a company's business cycle in which it taps debt markets, for instance, in withholding expected refinancing, acquisition financing, or debt rollover as outstanding bonds reach maturity (UNPRI, 2018; World Bank, 2018).

In PE, general partner funds tend to hold controlling or significant minority shares in investee companies for defined ownership periods ahead of a planned exit, which gives them significant leverage to drive change in investee companies, particularly where the company is relatively young and immature, or under financial stress. This transmission mechanism is increasingly, albeit gradually, being realised by PE funds. A recent survey finds that 56% of surveyed funds now engage the executive board of investee firms on ESG issues more than once a year (PwC, 2021).

The use of engagement tactics to drive sustainability change is not uncontroversial, especially where they might conflict with the fulfilment of fiduciary duty to asset owners (Sandberg, 2011). While regulatory guidance may help overcome some of these tensions, further research is needed to understand the absolute and relative effectiveness of different engagement strategies (shareholder resolutions and proxy voting, engagement coalitions, public campaigns, etc.) in driving real economy impact, rather than simply measuring changes in companies' ESG ratings, which dominate both industry practice and academic research, and do not necessarily result in real economy change.

2.6 Risk management and spillover effects: accounting for linkages between transmission mechanisms

The three transmission mechanisms described in this paper can be linked to one another, such that changes in one can influence or simply be correlated with the other, depending on a firm's circumstances (see Fig. 1). For instance, firms with easier access to liquidity from a wide pool of investors are also more likely to face a lower cost of capital and to have corporate practices acceptable to the market, whereas firms with lower access to liquidity (e.g. due to reliance on a small or shrinking pool of investors), are also likely to face a higher cost of capital from those investors who are still willing to lend. Investors' unwillingness to lend, or demands for greater returns, may in turn reflect unsustainable corporate practices, or a failure to respond to prior investor pressure. Instruments such as sustainability-linked

Fig. 1 Transmission Mechanism Interdependencies: A Firm Perspective

loans and bonds are even creating direct links between corporate practices and cost of capital; these instruments reward and punish practices and outcomes by adjusting interest rates correspondingly.

All of these processes affect the risk environment faced by the firm, hence also affecting its decision-making. Where the firm's decisions or the preferences of its investors generate spill-over effects on the wider universe of firms, investors and regulators, this in turn may trigger actions that feed back into investor preferences and the firm's risk environment, driving further changes (e.g. where the success of a particular engagement campaign induces further engagement activity, or where a firm's impact-focused activities generate positive externalities for other firms, or inspire regulatory changes).

Changes in firms' cost of capital, access to liquidity and corporate practices all affect, and are affected by, the risk environment in which they operate. By reducing the risk burden that firms face through lowering the cost of capital, increasing liquidity and adopting sustainable practice, investors can help firms free up resources that would otherwise be dedicated to managing risks, and direct them towards additional (sustainable) investment. While it is unusual for investors (as opposed to insurers and banks) to help firms manage risk directly. Impact-seeking investors can help firms manage and reduce risks indirectly by rewarding sustainable activity with a lower cost of capital and greater access to liquidity and improving the sustainability outcomes generated by a firm by contributing to improved corporate practices. Conversely, investments that facilitate the continuation or expansion of unsustainable activities can drive a deterioration in sustainability outcomes, which in turn can increase the resources required to manage associated risks.

It is important from an investor and policy-making perspective to be mindful of the expected macroeconomic spill-over effects of deploying different combinations of impact transmission strategies, especially when the objective of doing so is the achievement of collective sustainability goals, such as climate action, which depend on aggregate rather than firm-level impact. Investors' approach to impact can generate these spill-over effects on the wider economy (and corresponding feedback effects), in two main ways. First, the generation of public goods (or bads) derived from either sustainability outcomes, or the actions taken

in order to produce them. For example, if a drop in the cost of capital accelerates a firm's deployment of renewable technologies, positive spill-overs can result from a decline in the cost of the technology resulting from learning effects or returns to scale (prompting further deployment, and so on); and from reduced climate risks associated with lower greenhouse gas emissions. Similarly, steps taken by a large industrial facility to prevent flooding during extreme weather events may also lower flood risk in the surrounding area. In aggregate, the activities of impact-seeking investors may ultimately reduce climate-related risks faced by the wider economy. This is of particular relevance to "universal owners" with limited ability to diversify away from systemic macroeconomic risk (see Sect. 5). Where investor activity results in greater financial and/or sustainability-related disclosures by firms, greater information is also made available to other investors as well. Campaigns by financial firms to promote their sustainable offerings could also lead to changing consumer awareness of the environmental relevance of finance and drive broader behavioural change (Baker & Nofsinger, 2012). Spill-over effects can also generate negative externalities: where impact-seeking investors fail to affect real economy change, increased systemic risks can result. Where firms fail to disclose climate-related risks, persistent mispricing of underlying assets can result.

The second category of spill-over effects relates to the ability of finance actors to influence political decision-making and policy formulation. Where investors can exert influence over sustainability-related policy relating to, e.g., disclosure, carbon pricing and technology standards, can have wide-ranging implications for real economy activity. A well-coordinated finance sector can be an influential source of support for policies that facilitate sustainable economic activity. In February 2021, for instance, the Institute for International Finance, representing leading banks, asset managers and insurers, added its support to carbon pricing measures in the US (Kerber, 2021). However, Tomlinson et al. (2018) find that financial sector interests are also influential determinants of regressive sustainability policy positions. In Germany, the perceived threat posed by TCFD to the competitiveness of national financial centres, and the cost of capital of key national firms has seen some finance actors active attempt to slow implementation, despite the measures being in the interests of the sector as a whole. In the US, long-standing opposition to regulation in the finance sector remains a brake on greater climate risk disclosure regulation (InfluenceMap, 2021), although the identification of climate change as "an emerging and increasing threat to U.S. financial stability" by the Financial Stability Oversight Council in October 2021, and the Securities and Exchange Commission's establishment of a Climate and ESG Taskforce to examine the regulation of financial firms' sustainability claims signals much more active regulatory engagement, and has prompted calls for mandatory ESG disclosures in financial filings from large investing firms including Pimco and Invesco (Verney, 2021). Through these and other forms of policy engagement, investors can drive significant real economy spill-over effects by supporting regulations and policies that affect companies' behaviour directly (e.g. through carbon pricing) or indirectly (e.g. through the impact of mandatory risk disclosures on their cost of capital).

3 Assessing impact potential through an asset class lens

In this section we explore the impact that an individual investor in a particular asset class can theoretically have on the real economy through each transmission mechanism. This first-principles assessment can help devise a framework for understanding financial institutions' potential real-economy impact, and devise allocation strategies across portfolios to maximise the effectiveness of their impact strategies. We cover four key asset classes and one specific financial actor: public equity (listed companies, passive and active strategies), fixed income (bonds and loans), private equity (direct investment in unlisted companies, including venture capital (VC)), real assets (infrastructure and real estate), and hedge funds, given their unique role in the financial system—although they can and do trade across multiple asset classes.

The universe of assets in each asset class varies significantly, and this should be accounted for when designing impact strategies, depending on an investor's holding across each class. The value of outstanding bonds at the end of 2020 totalled approximately US$124tn, with the largest national market being the US, followed by the EU, Japan, and UK. Global stock market capitalisation totalled $105.8tn (SIFMA, 2021). The private equity universe is an order of magnitude smaller, standing at approximately US$7.4tn globally, and the value of real estate and infrastructure assets owned by investors through funds is estimated at just under US$2.0tn (McKinsey and Co, 2021).

In Table 2 we present an indicative ranking, by asset class and transmission mechanism, of the potential impact an individual financial institution may theoretically have. On our 1 to 5 scale, 1 represents "negligible impact" and 5 "strong impact". Each level is defined, according to the potential, likelihood, magnitude and persistence of real economy impact. Our qualitative assessments were calibrated and validated through in-depth expert interviews. Figure 2 outlines the results of this analysis, using ranges where appropriate to reflect the scope for contextual factors to influence the effectiveness of each mechanism. The available literature suggests that the impact actually realised can depend on factors beyond the asset class alone, including investor type, strategic objective and size, willingness of the target company to engage, and policies and regulatory frameworks in applicable jurisdictions. For some combinations of asset class and transmission mechanism, we find that investors may have only limited opportunities to generate impact in the real economy, or that impact is contingent on coordinated action or on factors not entirely within their control. This provides a theoretical basis for the claim that owning "green" assets is insufficient for generating environmental outcomes.

In Table 3 we summarise the possible transmission mechanisms for impact, by asset class, that we identify in our cross-asset analysis, which is presented in a more detailed narrative form later in this section.

Our scoring results are presented by asset class and transmission mechanism in Fig. 2. We find that the most theoretical impact potential is in loans, followed by private equity; and that the highest-impact mechanism across asset classes is

changing corporate practices, which is likely to be higher for investors who hold both equity and debt of the target company. In the following section, we explain, compare and discuss our assessment of the impact transmission potential of each asset class in further detail.

3.1 Public equity: passive and active strategies

Across all asset classes assessed, public equity is likely to generate least impact across each transmission mechanism (although aggregate effects may be larger, depending on interactions between them). Public equity investors have limited scope to directly affect a firm's cost of capital. In public markets, a single investor's investment in, (or divestment from) the listed shares of green (or dirty) companies is very unlikely to have a significant or persistent effect on the firm's cost of capital unless (1) the investor holds (or would hold) a large proportion of the firm's shares when it takes the decision (such as during an initial public offering, or prior to a rights issue by a distressed firms); (2) the market is highly illiquid or the firm's shares are not in demand, in which case its share price would likely be very low already; (3) a strong market signal is conveyed by a group of investors that restricts access to capital or alters the market's perception of a firm's risk profile (e.g. a permanent blacklisting, linked to disclosure of information suggesting a high probability of the firm facing major transition risks). Where these conditions do not hold, the impact (through price signals) of an investor's decision to invest or divest action will in most cases be so small as to be unidentifiable amid the "noisiness" of public equity pricing dynamics and have a negligible impact on that firm's access to liquidity, given the scale and trading volumes on most large stock exchanges.

Passive investors have portfolios that automatically track indices, and these strategies account for a significant and growing share of assets under management. Passive investment strategies, when compared with active ones, almost certainly offer fewer opportunities to influence corporate practices. Passive investors must own the index, reducing the incentives to engage with companies, and this simultaneously dulls their credibility when trying to influence companies as there is no realistic threat of disinvestment.

Large investors following their own internally defined indices, and benchmark index providers, do exert some control over the composition of indices that passive funds follow, and this could ultimately affect firms' cost of, and access to, equity capital from passively managed sources by featuring, excluding, underweighting or overweighting specific companies. Passive ETFs could also have some impact on access to liquidity and cost of capital when they are focused on firms in thematic areas (e.g. sustainable e-mobility) in which trading volumes and the universe of potential investors are both relatively small.

Shareholders in public companies can, in the right conditions, exert significant impact on corporate practices. Active investors can partake in regular direct engagement, the filing of shareholder resolutions, and the use of voting rights and negotiation to pressure companies into adopting sustainability measures. Factors

Table 2 Key results of cross-asset analysis

Asset Class	Descriptor	Example
1	Negligible: Potential for impact: low to none Likelihood of impact: low to none Magnitude of impact: small to none Persistence of impact: limited, if any	A single investor with a minority share in a listed company is unlikely to have any significant effect on the firm's cost of capital by simply divesting its position without coordinating with other investors
2	Limited: Potential: possible Likelihood: low Magnitude: small Persistence: weak	Hedge funds operate mostly in secondary markets. They are unlikely to significantly impact a firm's ability to access liquidity through primary bond issuance or bank loans. Exceptions apply for severely distressed firms, and specialist distressed debt funds
3	Moderate: Potential: yes Likelihood: medium Magnitude: moderate Persistence: variable	Private equity funds can arrange better access to liquidity to firms they control, for instance, through debt facilities with private debt investors or through connections to a greater breadth of banks than would be accessible to a typical small or medium-sized enterprise
4	Significant: Potential: yes Likelihood: high Magnitude: medium Persistence: strong	Active public equity investors can generate significant change in corporate behaviour in firms where they are large shareholders and vocal about the strategy informing their actions, especially in coordination with other investors
5	Strong: Potential: yes Likelihood: high Magnitude: large Persistence: strong	Private equity investments resulting in a controlling share in the company or asset have a strong impact on investee/acquired firms' adoption of sustainable practices, as the private equity owner can simply dictate them

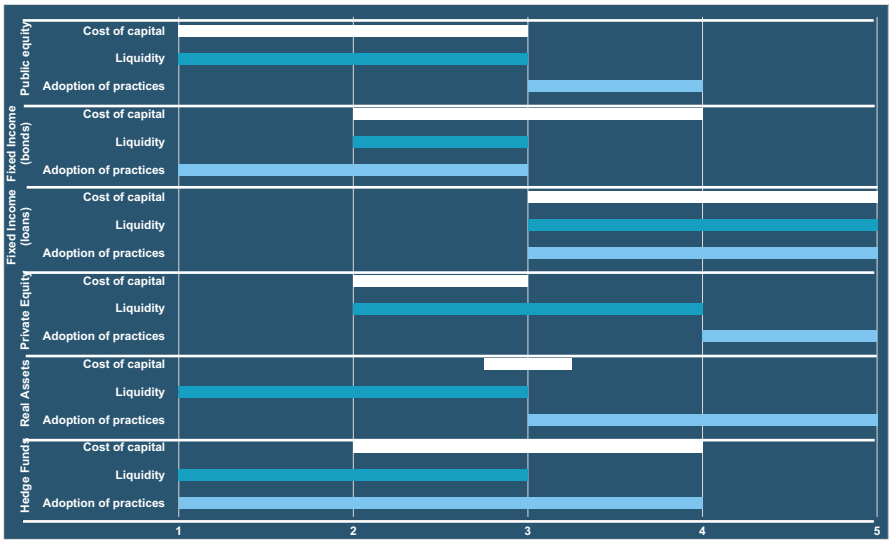

Fig. 2 Potential Impact by Asset Class and Transmission Mechanism

determining the extent of the impact include the size and shareholding of the investor, and its ability to build coalitions with other investors around key issues. To the extent that investors succeed in building stable coalitions able to pass resolutions that bind companies to take steps that require changes in real investment, public. equity ownership provides an avenue for control over large industrial firms. These firms' investment decisions can in principle generate significant scale effects, both through first-mover effects (e.g., accelerating deployment of emerging technologies) and through spillover effects on their supply chains. Where they have a credible chance of affecting a company's long-term cost of capital or access to liquidity, threats of divestment and/or blacklisting by large financial institutions if the company does not respond to engagement can also act as an incentive for companies to respond to shareholder pressure. It should be noted, however, that institutional investors are very unlikely to hold controlling shares in any given public company. The success of any engagement- or resolution-based impact strategy therefore depends on the continued stability and alignment of a coalition of investors on a desired sustainability outcome. The conditionality and scale needed for effective impact through public equity holdings makes the actions of any single investor unlikely to lead to real economy change.

3.1.1 Fixed income—loans

Loans are the highest-impact asset class overall because loan holders have moderate to strong (3–5) influence across all three transmission mechanisms. Lenders are key to determining the short-term cost of capital, because loans are a crucial, and frequently tapped, source of funding for almost all firms, particularly for smaller firms for which loans are more likely to be the only source of debt.

Table 3 Overview of possible transmission mechanisms for Impact, from an investor's perspective

Asset class	Cost of capital	Access to liquidity	Changing corporate practices
Public equity	Passive investors' impact largely limited to index choice and weighting. For active investors, identifiable impact conditional on being large shareholder, and/or a highly illiquid market, and/or strong market signal conveyed to investors restricting access to capital	Large-scale trading volumes and number of investors on stock exchanges means impact on liquidity is generally negligible. Stronger effect possible where trading volumes or investor pool are small, and firms' funding requirements are large	Direct engagement and use of voting rights can exert pressure to change, but conditional on involvement of larger shareholders, and/or those more able to build stable coalitions of investors sharing a desired outcome. Scale effects and supply chain spillovers are possible
Fixed income—loans	Impact of single lenders' rate-setting is greater where pool of lenders is small or highly consolidated. Less impact for firms with access to broad lender pool and access to capital markets	Impact potentially significant in absence of liquid secondary market for loans, and given most firms' reliance on regular access to loan markets for working capital requirements	Loan conditionality more likely to result in changes for smaller, unlisted firms without access to other financing sources. SLLs can drive behaviour directly if non-compliance penalties sufficiently high
Fixed income—bonds	Greater impact for firms that tap bond markets regularly. Yields in secondary market trading can send signals on firm risk profile and affect cost of future issuance. SLBs directly affect cost of capital as part of contract	Nature of secondary market trading activity can affect ability to access bond markets in future issuance, or grow/shrink investor base. Sustainable bond issuance can help access broader liquidity pool	Leverage over firms limited to disinvestment or refusal to participate in new issuance, which has more gravitas for large lenders with a long history of holding the firms' debt and/or equity. SLBs can drive behaviour directly if non-compliance penalties sufficiently high
Private equity (PE) & venture capital (VC)	Cost of debt in leveraged PE buyout depends more on investor than target firm, but PE firms can help to lower borrowing costs by helping target firm develop relationships with lenders. VCs typically have significant scope to determine cost of equity upon acquisition	Greater impact on smaller firms with limited alternative sources of capital. Less impact for larger firms with established borrowing channels, such as former public firms taken private through a leveraged buyout	PE/VC investors generally acquire substantial or controlling stakes. Can have decisive and direct say over corporate practices and governance, for immature and established firms alike

Table 3 (continued)

Asset class	Cost of capital	Access to liquidity	Changing corporate practices
Real asset and infrastructure	Brownfield assets generally trade on secondary markets, with limited scope to affect developer cost of capital. General lack of liquid secondary markets. Where market perceives sale of existing real assets as evidence of assets' liquidity, developers' cost of capital for new projects may fall	Asset are less liquid and standardised than other asset classes. Where market perceives sale of existing real assets as evidence of assets' liquidity, developers' access to liquidity for new projects may improve. Supply of working and long-term capital limited by small pool of investors and projects' capital intensity, so individual investors can have significant impact	Real asset funds generally hold substantial or majority shares in projects, individually or through consortia. Impact on operating practices can be significant through imposition of direct conditions. Have ability to instruct, sanction or replace management companies. For greenfield projects, funds with role in arranging finance can also influence corporate practices in construction phase
Hedge Funds	Hedge funds participating only in secondary and derivatives markets, trading large firms, have no direct route to affecting firms' ability to raise capital or its cost. Hedge funds trading in distressed debt can set cost of capital for new borrowing	Hedge funds trading in distressed debt are effectively liquidity providers of last resort	Activist coalition-building hedge funds with minority shares can use cumulative leverage to influence corporate practices and governance. Hedge funds with shares in distressed firms may seek to convert unpaid debt to equity and gain influence over corporate practices by becoming shareholders

Loans are not tradable on exchanges, limiting indebted firms' access to additional liquidity when under financial pressure. Where the pool of available lenders (typically banks) is small or highly consolidated, the rate set by a specific lender can have greater influence on the firm's cost of capital since it has fewer other borrowing options. For bigger or more mature firms that regularly access loans from a wider group of lenders across multiple jurisdictions, and regularly tap bond and equity markets, any single lender's impact is likely to be more moderate. Firms' reliance on regular access to loan markets as a source of working capital means lenders can also have a moderate to strong influence on access to liquidity and influence over corporate practices, especially for smaller or unlisted firms that do not have other sources of financing. As noted above, subject to significant caveats, the emergence of sustainability-linked and transition finance structured loan products demonstrate how lending can in theory be directly linked to company practices by linking interest rates or other loan features directly to corporate sustainability performance.

3.1.2 Fixed income—bonds

Comparatively, bondholders' potential impact is more heavily skewed towards affecting firms' cost of capital and access to liquidity. Particularly for firms that raise debt capital regularly, the risk and return requirements of bond markets can have a substantial and persistent impact on the firm's cost of capital. The activities of smaller investors can still have an impact on secondary market yields, which can send signals to other investors on the company's risk profile, potentially (though indirectly) influencing the costs of future issuance. As with sustainability-linked loans, the structure of sustainability-linked bonds, where the coupon rate is linked to the achievement of sustainability targets, or transition bonds incorporating specific use-of-proceeds conditions, can affect the cost of capital of the issuer more directly on an ongoing basis (although this market segment is still in its infancy, and it is as yet unclear whether it will become a mainstream group of products).

Access to liquidity is not directly affected by secondary bond market activity but trading activity may well affect a firm's future ability to tap primary markets and affect the pool of investors willing to hold its debt. In primary markets, green bond markets have shown how sustainable bond issuance can improve access to liquidity especially by providing smaller, less well-known issuers with a broader investor base that can improve their ability to access new capital, including at times of market dislocation.

Bond investors' potential impact on corporate practices is less clear. Since bondholders do not have shareholder rights, their leverage over firms is limited to, at most, refusing to participate in new issuance. As with sustainability-linked loans, sustainability-linked or transition bonds present opportunities for direct impact on corporate practices, especially where large creditors engage with firms to develop rigorous performance indicators and targets to be integrated into bond coupon rates. Threatening to forgo participation in future issuance is a more credible threat where it is made by large bondholders with a long history of holding a company's debt, and

who are also shareholders in the company (which provides them with a wider suite of potential actions and greater overall leverage).

3.2 Private equity and venture capital

PE has limited influence over the cost of capital. In a leveraged buyout, the cost of the debt used to finance the acquisition of an established company depends more on the creditworthiness of the PE investor than on the target company. The capacity of a PE firm's activity to affect a target firm's cost of capital directly is therefore quite limited. For early-stage companies reliant on equity financing, however, the required return set by a VC firm, or the cost of equity implied by the terms of the acquisition, can be significant, and persist until affordable refinancing or alternative capital-raising options become available. Where a PE firm helps a portfolio company to develop robust relationships with bank lenders based on sustainability disclosures or practices, any lowering of the firm's borrowing costs may persist and contribute to a lower longer-term cost of capital even once the PE firm exits its investment and sells the company.

PE firms' influence over access to liquidity is highly context-dependent. For a large firm with established sources of capital (especially for listed firms taken private through a PE buyout), the PE investor has limited impact on the access to liquidity. For smaller firms, however, with limited alternative sources of capital, the PE investor can have a more significant impact on its ability to access liquidity.

Private equity investors have the greatest scope to change corporate practices. For VC investments, and in particular, PE buyouts, the investor can have a decisive say in how the company is run, and what sort of practices it adopts (whether it is an immature or established firm). Even where a deal involves several VC or PE investors, each one will still typically own a substantial stake in the firm, and its preferences are still likely to translate into significant effects on company practices. When one PE firm acquires a majority stake in a firm, there is very little to prevent its preferences from being directly translated into corporate practices.

3.3 Real assets and infrastructure

Real estate and infrastructure assets are typically less liquid, and less standardised than more mainstream asset classes. At the same time, commercial and residential real estate, and large infrastructure projects play a central role in determining long-term carbon lock-in, suggesting they could contribute to a high-impact investment strategy. Real asset funds tend to hold projects' equity rather than debt, and to buy pre-existing (brownfield) assets on secondary markets, where there is limited potential to affect the developer's cost of capital.

Where real assets are acquired directly from developers, the proceeds provide them with the liquidity to reinvest in, and raise new capital for, additional projects. If markets perceive the sale of already-completed real assets as evidence of a secondary market for them, this may lower the risk premium (including the liquidity risk

premium) of future projects, hence also the cost of capital associated with them and the access to liquidity enjoyed by developers as their projects become attractive to a wider investor base. However, since the pool of investors seeking real asset exposure is relatively limited, and most real asset projects are capital-intensive, the supply of long-term and working capital upon which developers can draw for new projects, or to exit their positions in existing projects, is still relatively small. This increases the potential for individual real asset funds, and banks, to affect the cost of capital faced by these projects.

Real asset funds are likely (relative to other asset classes) to hold majority ownership over the projects in which they invest directly, either individually, or through membership of a consortium or shares in a holding company. This is not always the case, and the degree of influence a single investor in a real asset fund can have can be limited by the degree of alignment it has with co-investors, as well as the directness of the link with the underlying project(s) where the fund is invested in a holding company rather than the project itself (e.g., through a Special Purpose Vehicle). Where real estate investors or funds do have financial control over a project, they also have the ability to instruct, sanction and replace management companies. Real asset funds with a role in arranging and securing financing for greenfield projects, can also exert a large degree of control over the practices of management companies in the construction and operation of these assets.

3.4 Hedge funds

Hedge funds are highly heterogeneous, and their impact across the three transmission mechanisms varies widely depending on their strategy. Since most hedge funds trade exclusively on secondary markets, they do not generally directly affect firms' ability to raise new funding, nor do they have a direct channel to influence corporate behaviour. Activist hedge funds that acquire minority stakes in companies and then seek to build investor coalitions to pursue their interests or realise returns on their position, can use their leverage to influence how companies are run, including what sorts of sustainable practices they adopt. A notable case in May 2021 saw the impact-focused hedge fund "Engine No. 1" successfully nominate three of its preferred candidates to oil major ExxonMobil's twelve-person board at its annual shareholder meeting, with a mere 0.02% shareholding. It did so by building a coalition of large investors willing to support its nominees, including the asset manager BlackRock, and pension funds CalPERS, CalSTRS and the New York State Common Retirement Fund (Hiller & Herbst-Bayliss, 2021; Mufson, 2021).

Hedge funds whose strategy is largely to profit from arbitrage by trading shares or derivatives in large, liquid markets, would expect to have little to no effect on the cost of capital facing the underlying firms. However, hedge funds that trade in the distressed debt of companies that are close to bankruptcy or have difficulty raising capital are, as effectively liquidity providers of last resort, more likely to have a significant impact on the cost of capital those firms face and their corporate practices. In some cases, hedge funds may acquire debt from a firm close to default, then use

their leverage as a creditor to convert the debt into an equity position on advantageous terms, providing the fund with considerable influence over the firm's corporate practices in the process.

4 Possible implications for manager selection, strategic asset allocation and universal ownership

Our analysis suggests that for an asset owner impact potential can vary considerably depending on the strategies and tactics adopted by its asset manager(s) investing in specific asset classes, as well as the allocation that has been made across asset classes.

First, asset owners can use the framework to identify how they can approach realising the potential impact possible in each asset class in which they invest. This would naturally extend to asset manager selection to seek those most able to implement the most impactful strategies and to how mandates for asset managers are designed to incentivise the realisation of impact.

Second, Strategic Asset Allocation (SAA) decisions could use this framework and the conclusions of the asset class-based analysis to allocate capital towards those asset classes shown to generate the most impact, within the constraints of its risk-return requirements and fiduciary duty obligations. SAA is the process through which financial institutions periodically set target allocations to various asset classes and is usually based on a range of factors such as the investor's risk tolerance, time horizon, and investment objectives (Brennan et al., 1997; Campbell & Viceira, 2001). If one of these investment objectives is to generate sustainability impact, SAA decision-making should consider which available asset classes drive the most impact, and then overweight these in their SAA. Conversely, those asset classes with the lowest potential impact would be underweighted. Financial institutions looking to include impact generation in SAA decisions could add an "impact budget" to their portfolio, alongside the traditional risk and return budgets already used in SAA decision-making.

The analysis in Sect. 4 suggests that an impact-optimised SAA should allocate more of its "impact budget" to fixed income and private equity, than to passively managed public equity investments. An impact-seeking asset owner may also pursue a strategy of using its holdings across multiple asset classes in the same company as a means of increasing its leverage over that company by combining voting power with the ability to affect cost of future issuance and refinancing. Pivoting to a coherent cross-asset strategy is particularly true of cases where the current investment strategies behind equity and debt holdings in a company, respectively, are inconsistent (e.g. investors taking a long position on an oil major's debt while simultaneously shorting its stock, reflecting the divergent priorities of fixed income investors seeking protection against downside risk, and equity investors taking risks to increase upside). Achieving this consistency across asset classes is challenging and requires finding ways to reconcile these priorities, but also helps to build coherent engagement strategies across asset classes and avoids sending mixed signals to corporate management.

These findings also suggest that the growing investment in passive listed equity vehicles, as providers of financial products compete to lower their fees (Anadu et al., 2020; Mercer, 2019; Pleye et al., 2020) may be reducing investors' ability to effect changes in the real economy. Shifting to passively-managed equity portfolios is not, in this analysis, a high-impact strategy. However, for an impact-seeking strategy to be practical, it should recognise the need to be aligned with the risk-return requirements of investors in highly competitive investment markets.

5 Conclusions

Simply holding "green" or "sustainable" financial assets is not a sufficient condition for investors to have an impact on real economy outcomes. In this paper, we have introduced three possible transmission mechanisms linking the financial and real economies in the sustainable finance context, contributing to an emerging literature on how sustainable finance activities generate impact. We develop a novel approach to assessing the potential impact of each transmission mechanism across major asset classes and consider how the mechanisms might interact with one other and generate spill-over effects on other firms, investors, and the regulatory environment. Our findings suggest that fixed income, notably sustainability-linked bonds and loans, could present the greatest opportunity for impact if they are appropriately designed, passively-managed public equities the least, and hedge funds strategies the most variable. We highlight the scope for these transmission channels to interact with each other, and their implications for risk management and spill-over effects to the wider economy. Finally, we suggest how this analysis might be applied to strategic asset allocation by investors with multi-asset portfolios, suggesting that the addition of an "impact budget" as a way of operationalising these decisions. This cross-asset class analysis could also usefully inform targeted investment and engagement among financial, policy and corporate decision-makers to further reduce barriers between financial services and the real economy and extend the potential impact available from the growing field of sustainable finance.

Further research in this area could consider the implications in more detail and seek to develop empirical methods for testing and quantifying the impact of the different transmission mechanisms discussed here, especially in light of the known limits of ESG ratings and metrics, and how interactions between them serve to reinforce or weaken overall real economy impact. Specifically, the existing literature on the link between sustainable financial products and cost of capital surveyed in Sect. 2 focuses predominantly on public equity and bond markets. There is significant scope to extend this work into less studied asset classes, particularly private equity and real asset funds. Similarly, the existence of liquidity premia in sustainable finance markets merits further investigation to confirm and extend emerging findings. It would be valuable to assess the extent to which firms' access to liquidity is associated with their degree of sustainability in private capital markets. Further empirical work comparing the ability of debt and equity holders respectively to influence corporate sustainability practices is needed, as is greater study of the role of private markets

(including hedge funds) on determining the sustainability practices and governance of real asset developers. Understanding the compatibility of this approach with fiduciary duties in different jurisdictions is another important area for future research, building on the "legal framework for impact" published by Freshfields (2021).

Acknowledgements The authors would like to thank internal and external reviewers who provided many insightful comments. We would also like to thank the following individuals for providing helpful feedback and comments, or for their participation in expert interviews: David Bentley, Martin Bernstein, Ulf Erlandsson, Ilmi Granoff, David Harris, Christopher Kaminker, Krister Koskelo, Wolfgang Kuhn, Matt Scott, Tim Stumhofer, and Han van der Hoorn. The views expressed in this paper are those of the authors alone and are not necessarily endorsed by interview participants. Any errors or omissions are the responsibility of the authors.

Declarations

Conflict of interest This research has been funded by the IKEA Foundation under a grant made to the University of Oxford.

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