

Article

# A Quiet Revolution: Central Banks, Financial Regulators, and Climate Finance

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**Abstract:** If the free market cannot deliver a low carbon financial revolution, what sort of interventions in financial markets might be necessary to do so? Using interviews, participant observation, document analysis, and applying regulatory theory, this article argues for (i) cross cutting mechanisms designed to curb short-termism, to leverage the social license of financial institutions and to expand corporate conceptions of fiduciary duty to embrace climate change; and (ii) approaches tailored to the characteristics of each individual industry sector. Institutional investors and banks are used as case studies to highlight the importance of third-party benchmarking, expanding rights to litigate, requiring pension funds to address climate risks when making investment decisions, and disincentivizing high carbon investments by bank clients. Finally, it shows that a multi-instrumental approach can create a web of regulation that is more resilient and effective than its individual constituents. Its principal contribution is to show how Central Banks and Financial Regulators (CBFRs) might best fast-track a low-carbon financial transition.

**Keywords:** central banks; financial regulators; climate change; climate finance; governance; regulation

## 1. Introduction

Only a rapid transition to a low carbon economy will prevent dangerous climate change and its catastrophic consequences [1]. This will require a massive shift in investment from high to low carbon assets, and initiatives to reduce the carbon-intensity of remaining high carbon activities. Yet only recently has the central importance of the financial sector in facilitating a rapid and deep low carbon transition and in driving climate change action been recognized [2].

However, realizing this potential and scaling up ‘climate finance’—ie capital flows directed towards low-carbon and climate-resilient development interventions, including low-carbon infrastructure, renewable energy, energy efficiency, and other mitigation measures—will involve transforming a sector that has only recently begun its journey towards sustainability. What will be needed is nothing short of a ‘quiet revolution’ [2] (p. 4) involving massive investments now in long-lived low carbon assets and in those that are resilient to the physical impacts of global heating, in tandem with new business models, extensive innovation, and new technologies.

What might prompt a shift in risk perceptions such that institutional investors become willing to invest in low carbon and climate adaptation projects on a large scale, whilst also retreating from fossil fuel investments? How might a wide range of financial institutions be incentivized to address climate risks across the financial system? What policy instruments might best accelerate progress towards low-carbon finance? This article argues that climate finance regulation, developed and applied by Central Banks and Financial Regulators (CBFRs) in conjunction with measures that empower third parties to impose social license pressures on recalcitrant financial actors, could play crucial roles protecting investors from market failure, informing the market and reducing systemic climate related risk, incentivizing financial institutions to factor climate risks in their decision making, and directing capital flows to meet climate objectives.

In doing so, it contributes to the nascent research literature on that topic. For the most part that literature—which is reviewed in Section 2 below—provides valuable overviews of the journey towards low carbon finance, tracking how far along the path financial actors have come, conducting surveys or interviews to identify the attitudes or behavior of financial market actors towards climate change risks and opportunities, and advancing arguments as to what types of financial instruments might facilitate faster progress.

The present article builds on these studies but offers both a more fine grained and a wide-angled analysis: one which recognizes that different market actors (and actors at different levels within organizations) may be subject to different incentive structures, cultural influences, social license pressures, behavioral biases, and external pressures and that regulatory design can and should take account of these characteristics. Banks for example, have different incentives and structural constraints than large institutional investors. Moreover, senior management may see the world from a very different vantage point than those who are tasked with ‘hands on’ decision-making, suggesting that different regulatory mechanisms and incentive structures may need to be developed for different financial actors.

Against this backdrop, the article’s approach is twofold. First, it argues that some regulatory instruments can be applied across the board and that where this is practicable there may be considerable benefits in an all-encompassing approach. Second, it makes that case that in other contexts different financial actors will respond to different incentives and experience different constraints and that a targeted approach—tailored for example to the distinctive characteristics of banks and types of institutional investors—is likely to be optimal. The article’s principal contributions are to critical analysis and synthesis. It also shows that regulation can take place in many rooms: In the case of climate finance, it may well be that central bankers and financial regulators can accelerate a low-carbon transition far more effectively than either domestic climate law or international agreements.

Following this introduction, Part 2 (background) provides a stock-take of progress towards low-carbon finance, showing that while some institutional lenders and investors may be shifting away from their traditional heavy investment in and lending for high carbon assets, this shift is at best uneven and slow. Evidence as to the obstacles that constrain more rapid progress, and of research findings that suggest that a sea change may be taking place in the attitudes and behavior of financial sector actors towards climate change, are also discussed. Part 3 describes the article’s methodology. The Results and Discussion sections (Parts 4 and 5) make the case for CBF intervention in financial markets to accelerate the low carbon financial transition and explore the forms that CBF intervention might take, making the distinction between cross-cutting initiatives which have application to all or most sectors of the financial services industry and those which are sector specific. Part 6 concludes.

Space precludes a detailed analysis of why mandatory provisions are usually to be preferred to voluntarism. In short, there is considerable evidence that voluntarism, self-regulation, or mechanisms of informal social control rarely succeed [3]. Instead, regulation will be necessary if the public interest is to be protected. For example Jouvenot and Krueger show that when a prescriptive firm-level carbon disclosure law was introduced in the United Kingdom “U.K. firms reduced their relative (absolute) GHG emissions by 16% (15%) more than European firms that were not subject to the disclosure requirements” but only to voluntary regimes [4] (p. 4). Similarly the US Securities and Exchange Commission’s reliance on climate risk disclosure guidance rather than regulation resulted in vague, minimalist risk disclosures by many companies [5–9].

## 2. Background

### 2.1. A Climate Finance Stock Take

Perhaps the most remarkable thing about the extremely slow pace of the transition to low carbon finance is that resisting the low carbon financial revolution is irrational. There have been numerous reports and articles, applying multiple measurement methodologies, yet overwhelmingly coming to the same conclusion: an emphasis on ESG (Environment, Social and Governance) or a preference for

low-carbon investments, is not only environmentally beneficial but economically rational. Companies with the highest ESG ratings outperform the lowest-rated firms by a considerable magnitude [10]. When it comes to climate change then, as outgoing Bank of England Governor Mark Carney has put it: “Firms that align their business models to the transition to a net zero world will be rewarded handsomely. Those that fail to adapt will cease to exist” [11] (p. 3). Yet notwithstanding the compelling case for embracing a low-carbon economy, financial markets do not appear to be listening.

The starkest evidence concerns investment in the coal industry. Coal fired power plants are the single biggest global source of carbon emissions and thermal coal is the most vulnerable industry sector in a low carbon transition, in which coal mines might become “stranded assets” precipitating a ‘disorderly transition’ to a low carbon economy, and havoc in financial markets. Yet most banks and institutional investors and their asset managers have either been oblivious to the risks or acted in the belief that they can make hay while the sun shines and will be smart enough to get out of the market before the storm clouds gather and burst [12] (p. 772). Between 2017 and 2019, financial institutions invested US \$745 billion in companies planning new coal plants and as of late 2019 “publicly listed fossil fuel companies remain among the most profitable companies in the world” [13], notwithstanding predictions that falling demand and rising investment risk will slash profits [14]. The governments of China, Japan, and Korea are also are pumping huge amount of public finance into new coal plants in developing countries.

Nor is the ongoing enthusiasm for high carbon assets confined to coal. In 2016 little more than 1% of global institutional investments were ‘low carbon’ [15] and this percentage, while increasing, is doing so at a glacial pace. Two years later, less than 0.5% of assets invested by the world’s 80 largest insurers were invested in low carbon projects [16]. Moreover, the non-fossil share of the global energy mix has not changed in the last two decades, notwithstanding remarkable improvements in renewable energy technology and plummeting prices [17]. Additionally, while over 1110 institutions with more than USD \$11 trillion in assets under management have committed to divest from fossil fuels [18]—thanks largely to the efforts of the global divestment movement [19]—this is a tiny fraction of total assets under management [20].

Moreover, institutional investors’ perceptions of how financial markets work appear to be deep seated and woven into the very fabric of those markets. As Guyatt and Poulter show, the psychological underpinnings of investment decisions, the prevalence of cognitive biases, bounded rationality, and personal relationships (both at the individual level and inside and outside organizations), can and do have a substantial influence on climate-related decision making, serving primarily to inhibit change [8]. So too do broader cultural factors. For example, Christophers found that firms find it “difficult to extricate themselves from the forms and mode of reasoning and calculating on which they have historically relied” [12] (p. 771) making many financial market actors unwilling to recognize the impact of climate change and its implications for future investment outcomes.

Yet notwithstanding this bleak picture, some studies suggest that a sea change—albeit a slow one—may be taking place in the attitudes and behavior of financial market actors, driven in large part by concern about how climate risks might impact on the future value of high carbon investments. In 2020, Krueger Sautner and Starks found that of the 439 financial analysts they interviewed, only 7 per cent had demonstrated no inclination to consider climate risks over a five-year period [21]. Breitenstein et al.’s 2019 literature review also suggested growing investor awareness of the implications of climate change [22] while Eccles and Klimenko’s extensive interviews in 2020 found that integration of environmental, social, and governance factors (ESG) into the fundamental investment process “was almost universally top of mind for these executives” [10] (p. 109). While the present focus is on the sub-category of climate risk rather than the broader category of ESG, the trend appears to be common to both [21].

Nevertheless, it is difficult to know how to interpret the available evidence. While some studies suggest a trend towards greater recognition of climate risk, others indicate that such risk has yet to become a mainstream concern. There are various plausible explanations for these evidential inconsistencies,

not least that there is a substantial gap between the aspirations of senior executives and the analysts and portfolio managers who are responsible for key investment decisions. It may also be that there is a disconnect between what large asset managers or bank executives say they care about (in interviews and surveys), and how they behave in practice. Perhaps many are simply not “walking the talk” or are continuing to invest in fossil fuels but factoring “the climate policy risk of fossil fuel firms in the cost of borrowing” [22] (p. 23).

This is certainly the implication of Guyatt and Poulter’s research, which found evidence of myopia and cognitive dissonance, there being “general acknowledgment of climate change as a systemic risk, but in practice at the day-to-day level, there is a degree of separation from the issue in terms of what that means in practice” [8] (p. 7). They also found that decision makers were often constrained by habit, resistance to change, had conflicting goals, and that while “there is growing effort and momentum in some areas (such as engagement with companies on climate change), it is still “not really incorporated into investment analysis.” [8] (p. 7).

From the above it would appear that, notwithstanding some shifts in attitudes towards and awareness of the risks to financial markets posed by climate change, climate finance has yet to become mainstream: Most investors still prefer high to low-carbon investments and bank lending continues to favor carbon intensive industries. If there is a low-carbon financial transition in the wind, it is coming too slowly, and the case for policy intervention to accelerate that transition is compelling [23].

## 2.2. Why Intervene in Financial Markets

Neoliberals and neoclassical economists, even if they acknowledge the reality of climate change, argue that no intervention in the functioning of financial markets is necessary and that the free market alone will be capable of achieving the public interest in this, as in many other spheres. However, the real world departs radically from that which is assumed by free market ideology. Markets demonstrably fail to take account of non-financial issues in decision making and their “dominant logics”—short-termism, predictability of the future based on ex-post data, price efficiency, and risk-adjusted returns—do not facilitate their taking account of issues such as climate change, the related financial consequences of which are likely to impact primarily in the medium and longer term [24] (p. 10). The multiple and deep flaws in the neoliberal model were exemplified, to catastrophic effect, by the global financial crisis (GFC). As Adam Tooze’s magisterial analysis of the GFC makes clear, financial markets left unregulated or under-regulated can and do cause profound economic and social harm [25].

The failures of the market to address climate change suggest the importance of government intervention, but what form of intervention will be most appropriate is much debated and highly contested. As Krogstrup and Oman point out: “The theoretical benchmark ‘first-best’ response to climate change comprises a path of taxes on emissions combined with subsidies to R&D” [26] (p. 17). Taxes, as conventional economic analysis points out, are the most powerful and efficient tool for this situation, because they allow firms and households to find the lowest-cost ways of reducing their carbon footprint. But first best solutions are rarely politically acceptable. Political cycles are short, which inclines politicians towards short-termism. Moreover, the imposition of new taxes is rarely popular with voters (and the higher the tax, the greater the resistance), and vested interests, including the fossil fuel industry, often exercise considerable power behind the scenes [27].

The limited traction of first best options, suggests the need to explore the viability of the second best. Here, the entities best capable of pulling many of the principal policy levers are CBFs. CBFs also have considerable “skin in the game”: A “disorderly transition” to a low carbon economy could prompt global losses in the order of US \$20 trillion, more than enough to trip the global financial system into crisis and likely collapse [28]. Nevertheless, some critics question whether it is appropriate for CBFs to engage with climate change risks, unless democratically elected governments explicitly direct them to do so, given that such intervention is not explicitly provided for in their mandates. However, the Global Financial Crisis (GFC) and its aftermath saw them adopt a much more ambitious approach. A turning point was when then Bank of England Governor Mark Carney and his colleagues

scanned the horizon seeking to identify where the next GFC might come from and concluded that climate change presents the greatest systemic threat to the global economy.

Carney and the Bank of England were also clear that CBFs can and should play central roles in addressing climate risks, given their responsibilities for ensuring financial and macroeconomic stability. In this view, they are not alone. President of the European Central Bank Christine Lagarde has stated that climate change is a “mission critical” for the European Central Bank [29], while France has positioned itself as a leader in climate finance [30] and the Canadian Expert Panel on Sustainable Finance has made clear that ‘climate-related risks are a source of financial risk and that relevant financial institutions and supervisors need to develop analytics and supervisory approaches to manage these risks’ [31] (p. 24). China’s Guidelines for Establishing a Green Financial System also seek to mobilize and incentivize capital towards green investments [32].

### 3. Materials and Methods

The focus of this article is on regulatory design and specifically on how to design regulatory policy to best advance a low carbon financial revolution. To this end, the article involved three approaches: Interviews, participant observation, and document analysis.

In the UK, 18 interviews were conducted with members of central banks, financial regulators, market actors, and related professionals with experience in this sphere. Interviews were conducted using snowball sampling (having first identified a sub-group of key informants). Given the relatively small sample, no claims can be made as to representativeness. All interviews were undertaken in person in 2019. Lines of inquiry pursued with various stakeholders included: perceptions of barriers to mobilizing private finance, the extent to which have policy measures to stimulate private climate finance have been or could be effective, and an exploration of the attitudes, motivation, and culture of mainstream financial actors in the banking and institutional investment communities. Interviews with regulators also explored their perspectives on policy options and their viability.

In Australia, participant observation, with a similar research focus to the above, was made possible by the writer’s membership of the Australian Sustainable Finance Initiative (ASFI), in late 2019 and early 2020. Over 90 organizations and 130 individuals contributed to ASFI’s primary objective: Developing a sustainable finance roadmap [6]. Membership facilitated numerous conversations with diverse financial market actors and regulators involved in the initiative, including many that focused on the potential roles of central banks and financial regulators.

The aim of the interviews and participant observation was to facilitate empirically grounded analysis, through which the strengths and weaknesses of potential regulation and governance mechanisms can be better understood, thereby facilitating the central normative agenda of the article: Better policy design.

To advance this agenda, the article draws on three distinctive bodies of literature: Studies of regulation and governance beyond the sphere of financial markets (but which may nevertheless yield insights applicable to those markets) [7]; the embryonic literature on the role of CBFs in accelerating a low carbon financial transition including studies of the motivation and behavior of market actors regarding climate change; and the literature on the behavioral and cultural barriers that often constrain financial market actors from advancing a low-carbon financial transition [8].

A literature review was also undertaken which extended beyond peer reviewed works to policy and practice sources, such as reports by national government and international agencies, online news and analysis services, newspaper articles, and multiple web-based sources.

The article focuses on banks and institutional investors (addressing separately major asset managers and the roles and motivations of portfolio managers and analysts). Institutional investors are examined because “by virtue of their size and their role as conduit of savers’ climate concerns to the capital markets, [they] are ideally positioned to steer corporate capital allocation towards more sustainable uses” [9] (p. i). Banks, self-evidently, play a crucial role because they provide large scale financial support to the fossil fuel industry, without which much of it might not be viable.

#### 4. Results and Discussion

As Section 2 made clear, central banks and financial regulators are increasingly recognizing the pivotal role they might play in accelerating a low carbon financial revolution, but they are at an early stage of their learning curve and the academic and policy literature is also nascent. Against this backdrop, this and the following section address the central normative question posed by the article: What policy instruments might best enable CBFs and third parties to incentivize financial institutions to accelerate the transition from high to low carbon investment and thereby facilitate the rapid scaling up of climate finance?

It will be argued that by pulling a number of well-designed policy levers, CBFs could make a powerful contribution toward delivering a low-carbon and climate-resilient economy, triggering massive investments now in long-lived, low-carbon assets and in infrastructure that is resilient to the physical impacts of global heating. But what are those policy levers and how might they best be designed? Sections 4 and 5, which address these questions, involve a synthesis: They draw from the interviews and participant observation; build on the existing climate finance literature; and inject insights from the sphere of regulatory governance and from behavioral and cultural studies. As such, the results and discussion sections are integrated rather than discrete.

This and the following section make a distinction between cross-cutting initiatives, which apply to financial services actors across the board (addressed at 4.1–4.4 below), and those which are tailored to individual industry sectors (addressed in Section 5). In principle, there is considerable attraction in the former approach, given not only its extensive reach to all publicly listed companies, both financial and non-financial, but also the virtues of consistency and of thereby ensuring more accountability across the financial value chain. However, as Section 5 will go on to examine, there are various circumstances where a more targeted approach, which takes account of industry specific characteristics, should be adopted.

The broader argument of both sections is that that climate finance regulation, developed and applied by CBFs, in conjunction with measures that empower third parties to impose social license pressures on recalcitrant financial actors, could play crucial roles protecting investors from market failure, informing the market and reducing systemic climate related risk, incentivizing financial institutions to factor climate risks in their decision making, and directing capital flows to meet climate objectives.

##### 4.1. Information and Risk Disclosure

When the Bank of England engaged with institutional investors and companies on climate risk, it found that markets were not factoring such risks into their decision-making, seemingly because they lacked adequate information. Such information as was available was piecemeal, of variable quality and did not facilitate comparison between different enterprises. Unsurprisingly, neither investors nor companies were much influenced by such disclosures [33] and in the absence of credible information, climate risks were seriously underpriced [34].

This recognition led the G20's Financial Stability Board to establish a Task Force on Climate-related Financial Disclosures (TCFD). As is well known, the TCFD concluded that companies should disclose the risks and opportunities presented by climate change and their strategies for addressing them, with a focus on risk management [35]. Organizations, it recommended, should also describe their processes for managing climate related risks, including how they make decisions to mitigate, transfer, accept, or control those risks.

The TCFD report is an important step forward. Fully informed investors, so it is assumed, would understand the risks of holding high carbon assets in a climate constrained future and gravitate to low carbon alternatives as a matter of self-interest. Or they would impose pressure on high carbon companies in which they were invested to shift their business to a lower carbon trajectory. As such, the problem is framed as one of imperfect—rather than excessive—marketization: Once the market is fully informed, then it will come to price-in climate change risk [12].

However, it is doubtful whether the TCFD recommendations, even if mandated, will prove to be a game changer. On the contrary, it may well be that this framing has lulled policymakers—And CBFs in particular—into a mistaken sense that information disclosure and risk management is *all* that is necessary to enable financial actors to play their part in a low carbon transition? Unfortunately, there is evidence that this is not the case [36].

First, holders of high carbon assets have an incentive to understate their carbon footprint and regulators will encounter severe challenges identifying such misrepresentations. Not only is there severe asymmetry of information between regulators and regulated that not even TCFD implementation will fully compensate for, but regulators frequently have insufficient technical skills, little understanding of complex financial arrangements, high turnover, and limited resources, all of which prevent them from scrutinizing corporate disclosures to much effect. Lest it be forgotten, in the GFC, “widespread failures in financial regulation and supervision proved devastating to the stability of the [USA’s] financial markets” [37] (p. xviii) as they did elsewhere [38].

Second, many financial market actors are short term animals: They are constantly fearful that if their short-term performance flags, they may have no long term to look forward to. Accordingly, their willingness to take a broader and longer-term perspective is seriously constrained even if they have access to much richer information about the longer term than is presently the case. Both Governor Carney and the TCFD recognize this challenge, but place confidence in the ability of informed investors to penetrate beyond the slanted self-presentations and disclosure statements of many market actors and to transcend their traditional short-termism. However, the history of market behavior, and the inability of regulators to contain its worst abuses, suggests that this confidence is misplaced and that major investors will pay no heed to the carbon-intensity of the underlying asset [12]. Few of Christophers’ interviewees felt that the threat of climate change required new ways of thinking about investment risk or viewed climate change as substantially different from other types of risk, breeding confidence (and arguably over-confidence) that they can deal with it under a ‘business as usual’ approach [12] (p. 772). Compounding the problem is that risk management disclosure, like information disclosure more broadly, is vulnerable to manipulation by reporting entities that have a disincentive to revealing their vulnerabilities, given that doing so may result in their being punished by the market [39]. None of this is intended to suggest that the TCFD recommendations are unimportant but rather that they need to be complemented by other mechanisms. But what might these be?

#### 4.2. Addressing Short Termism

On most accounts, the single most important reason why financial markets fail to take adequate account of climate change is short termism, which is rife within public companies and amongst asset managers and other key financial actors, including banks and corporates. It is encouraged and embedded in the structure of performance fees, incentive structures, and evaluation of investment managers over short time horizons and high equity turnover rates by institutional investors (for example, see [40] (p. 69)).

Asset management analysts and portfolio managers are the quintessential short-term actors. Both are assessed according to criteria such as market and peer benchmarking and short-term performance metrics and incentive structures that incline them to heavily discount, or ignore entirely, issues such as climate change whose main impact will be felt beyond their narrow horizon. These structures can, according to one experienced financial market analyst, drive them “to pressure investee companies to maximize short-term performance often viewed through league tables, share prices or performance metrics and often linked to short-term incentive payments”. It can also discourage investee companies from pursuing strategic capital growth plans and instead hoard or return cash to investors. Accordingly, since the market has proved incapable of curbing short-termism and voluntarism has such a disappointing track record [3], various regulatory mechanisms will be necessary, but what would these involve?

Drawing on the experience of the ASFI, a multi-faceted approach to reducing short-termism will be required, recognizing that there is no single strategy that is likely to be effective in addressing such a complex and deep-seated challenge. Indeed, it might be wise to invoke multiple different types of regulation, since each has its own strengths and weaknesses, suggesting the value of compensating for the weaknesses of each mechanism with the strengths of another [41].

*Information Based Regulation:* One approach, consistent with the TCFD recommendations above, would be to require that company reporting requirements include a mix of financial and non-financial information, with the aim of mitigating the emphasis that is conventionally placed on maximizing share prices (a short-term measure) via earnings.

*Performance Based:* Performance-based regulation, to be effective, requires the regulator to be able to specify, with some precision, what outcomes it requires, and in the case of financial markets this is often not possible. However, as mooted within the ASFI, two exceptions would be:

- To tie key management long term incentives to carbon emissions reductions [42]. To be effective, this would require not just credible metrics but also external auditing or policing by financial regulators, to ensure that any purported incentives were not merely cosmetic.
- To mandate the ‘gating’ (i.e., the practice of temporarily blocking withdrawals from an investment fund) of products with medium or long-term investment horizons, thereby providing greater opportunity for investment managers to support investments consistent with the investment horizon.

*Process-based regulation:* This approach requires duty holders to identify a process, or series of steps, to be followed in the pursuit of a regulatory goal. Such a strategy is often used when the regulator has difficulty specifying a goal or outcome but has confidence that the risk of adverse consequences will be reduced if particular steps are followed [43]. Consistent with this approach, Dimon and Buffett propose overcoming short-termism by requiring “clear communication of a company’s strategic goals—Along with metrics that can be evaluated over time. But this information, which may include non-financial operational performance, should be provided on a timeline deemed appropriate for the needs of each specific company and its investors, whether annual or otherwise” [44].

*Incentive based:* Short-term incentive plans reward managers for short-term returns but some investment products aspire to deliver in the medium or long term. To enable them to do so, and avoid falling foul of short-termism on the part of investment managers, they could, as one analyst suggested, be ‘be linked to the expected time horizon of the investment, with a larger portion of the overall incentive escrowed to align with the conclusion of the expected time horizon’. This implies the necessity for reliable metrics and accurate reporting (as contemplated by the TCFD), designed in such a way as to encourage long-term thinking [44].

*Regulating culture:* Recognizing that aspects of short-termism are culturally embedded, institutional investors might be required to take steps to assess the entity’s culture (and the culture of its portfolio managers and analysts in particular) and identify any problems with that culture (and associated governance issues) as they relate to climate change; “deal with those problems; and determine whether the changes it has made have been effective” [45] (p. 36). This form of process-based regulation was advocated by an Australian Royal Commission into misconduct in financial markets whose logic might readily be extended to climate change. The same inquiry recommended that the financial regulator: “Build a supervisory program focused on building culture that will mitigate the risk of misconduct; use a risk-based approach to its reviews; assess the cultural drivers of misconduct in entities; and encourage entities to give proper attention to sound management of conduct risk and improving entity governance” [45] (p.37). Similarly, firms might be required to develop codes of conduct and to incorporate their remuneration policy within a broader culture which they would be required to articulate in a formal document [46] (p. 274) as a means of sheeting home responsibility. The approach of the UK Prudential Regulation Authority of making a designated senior manager responsible for overseeing the firm’s culture would be a credible means of making such a requirement enforceable.

### 4.3. Leveraging the Social Licence

Business actors must not only comply with their legal license to operate but they are subject to a broader “social license” as a result of which they are constrained to meet societal expectations and avoid activities that societies (or influential elements within them) deem unacceptable, whether or not those expectations are embodied in law [47]. Far sighted regulators can harness the social license in order to influence corporate behavior not just directly through regulation, but also indirectly (and perhaps more powerfully) by empowering various institutions of civil society [47].

For example, the recommendations of the TCFD regarding information disclosure, if mandated and enforced, could provide civil society actors (Share Action, Carbon Tracker, BankTrack etc.) with power to enforce the terms of the social license through shaming and adverse publicity. It might also influence the terms of the economic license (encouraging investors to shift to less carbon intensive assets) and of the regulatory license (e.g., through citizen suits or political pressure for regulatory initiatives). Thus, the interaction of the different types of license often exceeds the effect of each acting alone [47]. Evidence from behavioral studies suggests that such social license pressure “can be effective at overcoming behavioral barriers by (for example) helping key decision-makers to prioritize climate change internally across asset owners’ executive functions” [8] (p. 10).

There are multiple other ways in which the ability of third parties to bring social license pressures to bear, might be amplified. For example, social license pressures might also be harnessed by providing for shareholder rights as with the Shareholder Rights Directive II in the European Union, or by enabling third party legal actions to be brought by broadening the rights of standing in a particular jurisdiction, again suggesting the importance of an underpinning of rights provided by the state. These options are further explored in the specific context of institutional investment in Section 5 below.

The social license could also be expanded through the introduction of principles-based standards which espouse a wider value or ‘principle’, to which duty holders are required to adhere. For example, Rouch argues that “firms could be required to incorporate their remuneration policy within a broader culture and character formation policy. This would set how the firm goes about shaping its culture and the character of its staff, including the role of positive and negative incentives as compared with aspirations for human dignity. Linking this with the firm’s codes of conduct should help to sharpen the impact of codes in practice” [46] (p. 274). A social license statement might for example be made a condition for obtaining a continuing authorization. Similarly, he points out that a firm’s remuneration policy (a key factor in constraining short-termism) might also be incorporated into a broader culture and character formation policy. Examples of leveraging the social license, targeted to specific asset classes will be provided at 5.1.2 below.

### 4.4. Expanding Fiduciary Duty

A company board’s fiduciary duty is the requirement to do all that is reasonably possible to advance the interests of the company, its shareholders, and arguably other stakeholders too [48] (sometimes referred to as foreseeable, actionable, and material risk). It has been described as “a bedrock principle of corporate law” [48] on which there is an extensive literature and for that reason need not be further rehearsed here.

For present purposes the point is that this fiduciary duty applies to climate change because, like many other matters with which directors must be concerned, it demonstrably involves foreseeable, actionable, and material risk [49]. There is no need for the law to be amended to achieve this because climate risks already fall within the above umbrella definition. Accordingly, companies, across all sectors, have a responsibility to develop and apply tools to assess the financial impact of projected climate impacts and must have a plan to deal with them.

This obligation, however, is barely recognized by most boards of directors. For example, pension fund trustees have been reluctant to divest from depreciating fossil fuel assets because they feared being accused of neglecting their members’ pecuniary interests, even if this was at the cost of abandoning social or environmental responsibilities [50]. Yet there is authoritative legal opinion both in the UK and

in Australia that this is not the case and this is accepted by regulators in both countries (see [51]; for Australia see [52]; see also [50]). Accordingly, what is most needed is for board members to be educated as to their *existing* climate related responsibilities and to provide incentives for them to comply with those responsibilities. This writer is not alone in suggesting that perhaps selective prosecutions where there has been egregious failure to discharge this responsibility, coupled with extensive publicity as to the outcomes of such prosecutions, might be a cost-effective way for regulators to achieve compliance.

## 5. Sector Specific Interventions

While the policy instruments above might sensibly be applied to all financial market entities, other policy instruments, for reasons stated earlier, will be more effective if they are crafted to the circumstances and characteristics of individual industry sectors, or even sub-sectors. Accordingly, for illustrative purposes, the profiles and distinctive characteristics of two key financial actors –institutional investors (with a focus on large asset managers and pension funds)—and banks, will be examined in order to identify, regarding each of these actors, which regulatory measures might be most effective in shifting their behavior to a low carbon trajectory.

### 5.1. Institutional Investors

Today's stock market is dominated by institutional investors, with the largest asset managers owning "staggeringly large amounts of stock on behalf of their clients" [53] (p. 10156). Accordingly, whether, to what extent, or in what ways these large institutional investors seek to influence their portfolio companies could have major implications for the speed at which a low carbon financial revolution takes place. In principle, large asset or fund managers have a considerable interest in how their portfolio firms manage, or fail to manage, their climate risks. Some portfolio firms for example, are likely to be impacted disproportionately by extreme weather events and sea level rise, others by the risk of becoming stranded assets and still others by technological innovations that may render their current business models redundant.

Yet notwithstanding these risks and opportunities, those large asset managers have been slow to respond to climate change. The three largest institutional asset managers, BlackRock, Vanguard, and State Street, which together oversee assets worth more than China's entire GDP, "have continued to grow billion-dollar stakes in some of the most carbon-intensive companies since the Paris agreement" [54]. However, the attitudes and actions of some of the major asset managers may be changing, albeit slowly, with Blackrock announcing a coal exclusion policy and Amundi, the 10th largest asset manager globally, introducing a coal divestment policy, both in 2020. Others are making encouraging noises in the same direction [55].

Pension funds, who are also important institutional investors, might equally be anticipated to take climate change seriously, given that they have liabilities that extend many decades into the future. Unfortunately they have not and many remain heavily invested in fossil fuels: Currently global pension funds hold at least €800–940 billion in liquid assets of fossil fuel firms [56]. While such an influential class of investors might have chosen to chart their own distinctive, and increasingly climate-friendly, investment path (and a few have) most have instead relied heavily on major asset managers to operate substantial parts, with the latter, by and large, paying scant regard to the carbon intensity of those portfolios.

#### 5.1.1. How Do Institutional Investors Respond to Climate Risk

What do these institutional investors do in responding to climate concerns? Several actions can be identified. First, institutional investors often engage with their portfolio companies [21] (see also [57]). For example, shareholder resolutions that seek to nudge the company to shift to a lower carbon trajectory. However, this strategy has had only very limited success [58,59] and there is evidence that such proposals have often done little if anything, to change corporate behavior [33].

Second, some major asset managers have purportedly pressured companies to take greater account of climate change is by informal engagement through meetings and other 'behind the scenes' initiatives. However, there is little evidence of robust engagement [55]. According to extensive research by UK non-profit InfluenceMap, of the world's 15 largest asset managers, only two "strongly and consistently" engage with investee companies about aligning their business models to meet the Paris Agreement goals [55].

Finally, shareholders can divest of their high carbon assets, or exclude others from their portfolio. However, these strategies are relatively unpopular. Globally less than 1% of institutional assets have been divested. Many asset managers argue that if they divest, those assets will invariably find a purchaser, and often one without any climate change concerns who will exert even less pressure for climate change action.

In sum, large asset managers have brought only the lightest of pressure to bear on portfolio companies, and this has had little demonstrable impact on the behavior of those companies and has certainly not brought about change "as broadly and as quickly as desired" [53] (p. 10171). Indeed, many large asset managers might be regarded as double agents: On the one hand, they may espouse concern for climate change while on the other, seeking to maintain good relations with and ongoing privileged access to large firms in which they invest by not 'rocking the boat'. Blackrock, at least prior to 2020, is commonly cited as an exemplar of this strategy because "it will not act on [Corporate Social Responsibility] meaningfully unless forced by the threat of monetary loss or adverse publicity" [53] (p. 10175). Such asset managers, it is claimed, "aim to give the appearance of acting responsibly while minimizing engagement expense [and] remaining on good terms with their portfolio companies" [53] (p. 10176). Various policy implications flow from this analysis.

#### 5.1.2. Regulating Institutional Investors

Given that many asset managers have little perceived self-interest in pressuring their portfolio companies to become more climate sensitive, what might persuade them to take a more proactive stance? What will be necessary to ensure that large asset owners either (i) influence their portfolio companies to commit to shifting from high to low carbon trajectories or (ii) divest from or screen out investment in high carbon assets.

This section makes the case that what will be needed is not only policy instruments that fall within the remit of CBRs but also measures capable of amplifying the influence that other social actors can bring to bear on asset managers and of leveraging that pressure to prompt more climate-sensitive decision-making on the part of the latter.

*Disclosure and Risk Management:* Beyond implementing the recommendations of the TCFD, greater transparency and better risk management may be achieved by sector specific initiatives. For example, pension funds—an important sub-category of institutional investors who have largely failed to engage with climate change—might be mandated to articulate how they intend to do so in the future and required to publish their policies and report against them on an annual basis [60]. This is precisely the approach contemplated by the UK, which would require trustees to document how they assess risks from climate change and risks from the low carbon transition including taking greater account of the risk of investing in carbon intensive companies and developing projections of how members' funds would be impacted by different climate change scenarios [61].

In Australia, the prudential regulator has also indicated that climate risks and opportunities should be taken into account in the formulation of investment strategies and that superannuation trustee boards (i.e., pension funds) will be required to have access to capacity and competence on ESG issues in general and climate change in particular [62]. Going one step further, pension fund trustees might be made subject to a code of best practice on climate change (although none has yet been contemplated) developed by the relevant prudential regulator, intended to make them take climate change risks seriously and to develop strategies to address them, perhaps as a precursor to mandatory provisions.

*Third party benchmarking:* A climate benchmark is designed to incorporate specific objectives related to carbon emission reductions and the transition to a low-carbon economy. Such a mechanism would facilitate underlying assets being “selected, weighted and excluded in such a manner that the resulting portfolio is on a decarbonization trajectory” [63]. Such benchmarks enable investors to make informed climate-related investment decisions, which, given increasing evidence that ESG (Environment, Social, and Governance) outperform the market [10], may shift investment towards low carbon assets. Benchmarks would also facilitate asset managers both to hedge against climate transition risks and to direct their investments towards opportunities related to the energy transition. However, whether investors will respond as predicted will be better understood once the EU Climate Transition Benchmark (CTB) and the EU Paris-aligned Benchmark (PAB) with the EU Climate Transition Benchmark (CTB) and the EU Paris-aligned Benchmark (PAB) become active.

*Mandatory Responsibility for Portfolio or Fund Managers:* In the European Union, as from mid-2021, these investment intermediaries will, provided they have more than a prescribed number of employees or meet other specified requirements, be required to integrate sustainability risks in their investment decision-making. Integration for these purposes implies going beyond obligations that would flow from fiduciary duties. Those involved in larger enterprise will be required to account for how they manage sustainability risk. Under the templates contemplated by the European Securities and Markets Authority, the “types of adverse impact that investment intermediaries should learn to engage with and measure” [64] (p. 7) will leave little room for discretion and by the same token may degenerate into box ticking. Only once this provision is implemented will more be known whether this is indeed the case or how effective this provision will prove to be.

*Empowering passive investors:* Passive investors seek greater diversification (and to reduce brokerage costs involved in buying and selling), by strategies such as index investing. By replicating and holding a broad market index such as the S&P 500, they avoid the need for active investing (and the risks that entails). Instead, through an index fund, their fortunes will rise and fall with the broader market. In a few markets, passive investment is approaching half the of total investment [65] and in almost all markets, the proportion of passive investors is increasing. Until recently, passive investment precluded exercising a preference for low carbon investments, since this entire strategy involves *not* exercising any discretion as to which products to invest in.

Exceptionally, this is one area where the market appears to be in the process of providing a viable solution. New products are being developed that enable passive investors to hedge climate risk without sacrificing returns. Specifically, indices developed by commercial third parties are evolving, taking account of ESG (Environment, Social, and Governance) or climate impacts—as in the case of the MSCI Low Carbon Leaders Index, a substantially decarbonized index that has the specific goal of enabling passive investors to hedge climate risk. According to one key informant, given that by definition, passive investors do not want to make a decision, “the best way for the market to go low carbon is for the index providers to exclude higher carbon emitters and companies that aren’t transitioning such that the passive investors don’t need to make the decision. That’s part 1. Part 2 is getting passive investors to change their entire offerings to clean benchmarks not just having it as an option!” If this can be achieved, then the role of regulation may be limited to ensuring that such funds do not make misrepresentations and otherwise preserving the credibility of the market. Potential conflicts of interest, ownership concentration and the effect of passive investing on the capital markets are other issues where regulation might potentially play a role [66].

The development of novel low carbon indices catering for the needs of passive investors could be a game changer in accelerating a low-carbon financial transition although this appears not yet to be widely recognized. Massive amounts of money are flowing into passive investments: For example, about two-thirds of the money that Blackrock manages is allocated to index-tracking funds [67]. If Blackrock and its peers were to shift the majority of this money into the new low-carbon or ESG indices (which as indicated earlier, are designed to track the market and so should still deliver what passive investors are most looking for) [68] then this would provide a win in terms of accelerating

low-carbon finance and for the social license of asset managers who embrace this strategy, and would likely be neutral in terms of the financial outcome for investors. But given the behavioral and cultural impediments to change, social license pressure on major asset managers (and the acquiescence of their investors) may well be necessary to achieve such an outcome.

*Amplifying social license:* While the broader recommendations concerning social license (4.3 above) remain apposite, a sector specific approach will also be necessary: capable of overcoming the bounded rationality, myopic 'business as usual' thinking and short termism of asset managers and pension funds and enabling them to be shamed, cajoled or otherwise pressured to shift to a low carbon trajectory. Groups such as Climate Action100+, the Institutional Investor Group on Climate Change, the Australian Council of Superannuation Investors (ACSI), and activist NGOs such as Carbon Tracker, Share Action, and Influence Map are already adept at harnessing social license pressures as a mechanism to shame and otherwise pressure large asset managers to influence their portfolio companies (or their asset managers) to address the risks and opportunities of climate change.

Large asset managers, highly visible and reputation sensitive, have been particularly vulnerable to social license pressures. For example, Extinction Rebellion recognized Blackrock's vulnerability to such pressure when it chose to pour ash in front of Blackrock's London headquarters to protest against its holdings of fossil fuels, in full glare of media publicity and other NGOs have similarly made Blackrock a prime target. Blackrock's apparent (and at least partial) about-face on climate risk has been attributed, in part, to precisely such pressure [69]. Pension funds can be similarly shamed [70]. For present purposes, the point is that social license pressures can be amplified by law and there are compelling reasons of public policy for doing precisely that. Two such mechanisms are set out below.

*Expanding Shareholder Rights:* As major shareholders, asset managers could pressure their portfolio companies to reduce their carbon footprints, without need for external empowerment although they have rarely done so in practice. However, measures that empower *other* shareholders—as for example by increasing the impact of shareholder resolutions—would not only facilitate their initiating their own action against climate recalcitrant companies *but would enable them to exert pressure on large asset managers to join them*. For example, the European Union Shareholder Rights Directive II (SRD II) strengthens the position of shareholders in various ways. Not least, it 'better aligns executive pay with corporate performance by forcing companies to allow shareholders to vote on remuneration policies (which might provide an opportunity to address short-termism) and also "requires public disclosure of how an asset manager's investment decisions contribute to the medium to long-term performance of the companies in which it invests:" [71]; it also increases voting transparency.

*Extending rights to litigate:* Legislation that provides for the right of shareholders to bring lawsuits (in legal terms this is known as the 'right of standing') against high carbon enterprises, for example alleging that they have misleading disclosures regarding their contribution to, or the costs of climate change, might also play a role. It is unlikely that major asset managers would wish to be parties to such litigation against their portfolio companies, given their inclination to act as double agents. Nevertheless, such actions, brought by other shareholders, may bring social license pressure to bear on those companies. For example, the various legal actions brought against Exxon in the United States generated considerable adverse publicity as to Exxon's central role in orchestrating climate change denial and raised questions as to the ethics of major asset managers in continuing to invest in the company [72]. Similarly, shareholder class actions that expose companies to environmental litigation regarding climate change non-disclosure and in doing so threaten their social license to operate [73] may prompt companies to address climate risk. Perhaps what is most significant about such actions and related campaigns is that they may increase the cost of raising capital for the fossil fuel industry [74] or cause investors to demand compensation for their exposure to fossil fuels [75].

In the case of pension funds, trustees who fail to protect their members from the financial risks of climate change may well be in breach of their duties. An illustration of the potential power of third party actions (where there is a right of standing) to be used strategically is a case currently before the Federal Court of Australia, which must decide whether a prominent Australian pension fund

has breached superannuation and corporate legislation by failing to disclose and manage the way climate change could impact its assets and investments. If successful, the defendant will be required: “To provide a detailed, granular view of how it thinks its investments might be affected by climate change—Including higher temperatures; more frequent and intense storms, droughts, floods; disrupted supply chains; potentially plummeting values of certain companies whose businesses involve emitting greenhouse gases (‘stranded assets’); and all of the social and political turmoil those changes will continue to exacerbate” [76].

Even before the court’s decision is known, the social license impact of the related publicity seems to have been significant: The superannuation fund has increased its disclosures of climate related matters, it has a freshly minted Climate Change Position Statement which commits it to incorporate climate change risks in its ‘investment strategy and decision-making’ and it has joined the Principles for Responsible Investment (‘PRI’).

## 5.2. Banks

Through corporate loans, bonds, underwriting, and institutional investment, banks have been heavy investors in carbon intensive industries and have been the lifeblood of fossil fuel projects. According to an analysis by an alliance of US-based environmental groups, 35 global banks have invested some £2.66trn in the fossil fuel industry’s continued growth since 2016 [77], and bank financing for the companies most aggressively expanding in new fossil fuel extraction since the Paris agreement, increased by almost 40% in 2019 [77] (see also [78]; for broader analysis, see [79]). While some banks are experiencing social license pressure not to bankroll the fossil fuel industry (For example, no bank has been willing to lend to Adani to enable them to dig a mega-mine in Queensland, Australia) for the most part, such pressure has generated little more than statements of support for climate change mitigation and vague commitments to change their behavior in the longer term (Johan Frijns, quoted in [77]).

A structural problem is that most bank loans are for periods of 3–5 years: A classic illustration of a mismatch between the time horizons of financial institutions and those in which climate change will have major impacts [80]. The problem is exacerbated by the fact that managers will usually have a shorter-term perspective than the bank itself, not least because of the practice of ‘high-powered contingent compensation based on short-term stock performance’ [81] (p. 10). Moreover, bankers appear “more comfortable taking a passive approach that responds to client demand” [82] (p. 4) than in taking a proactive approach that sees a low carbon future as inevitable, and such attitudes appear to be deeply embedded [82].

The challenge of addressing short-termism was addressed in Section 4.2 above. That of addressing more deep-seated attitudinal issues was the subject of a detailed empirically based report by the University of Cambridge Institute for Sustainability Leadership [82], which examined various approaches that might result in a shift in attitudes and behavior but gave scant attention to regulation as a policy tool to accelerate attitudinal change. Instead, it took the view (as did the bankers that were interviewed) that the key “to enabling its clients to transition to a low carbon economy is an ‘active mindset’—One that prioritizes relationships over transactions and which is underpinned by a forward-looking attitude that sees a low carbon future as inevitable”. An insightful Grantham Institute report makes a further contribution, showing how, for example, banks might make a ‘just transition’ to a low carbon economy central to their core purpose and culture, by embedding it in strategic objectives and their business models and by other means [83]. However without doubting the importance of both these initiatives, there is little evidence that voluntary or market driven approaches will achieve a low carbon financial transition within the near to medium term future, and much to suggest the need for intervention by CBFs to accelerate that transition, with regulation playing a central role [83].

But where might regulators most effectively intervene? Here, the UK Prudential Regulation Authority has taken the lead, publishing a supervisory statement making clear its expectations of banks (and insurers) and emphasizing that they should embed the consideration of the financial risks

arising from climate change in their governance arrangements and ensure that climate change is brought within existing risk management practices [84]. It acknowledges that firms are enhancing their approaches to managing the financial risks from climate change, but cautions that few firms are taking a strategic approach that considers how actions today affect future financial risks [84] (p. 1).

That statement (another example of a process based approach) emphasizes the obligation of banks and others to develop and articulate clear responsibilities for managing the financial risks from climate change, to apply scenario analysis as a mechanism to facilitate long-term risk identification and a commensurate strategy to deal with it, and to disclose those risks to the market. Subsequent statements make clear the Bank's trajectory from advisory statements towards regulation and how they are ratcheting up expectations of the roles they expect banks to play in climate change mitigation. Others, such as the Australian Prudential Regulation Authority (APRA), have also signaled their intention to intervene in the industry's affairs to steer it towards a low carbon future. As one board member has indicated: "We intend to probe the entities we regulate on their risk identification, measurement and mitigation strategies. We expect to see continuous improvement in how entities are preparing for the transition to the low-carbon economy." [85]. APRA had previously warned that that some climate risks are distinctly financial in nature, and that many of those risks are foreseeable, material and actionable now, and it is paying increasingly close attention to those who do not appear to have assimilated this message.

Regulators in other jurisdictions are also contemplating incorporating climate risks into the way they supervise insurance firms from a prudential perspective, encouraged by the Sustainable Banking Network within which various national international and state-level bodies come together to share experiences and responses to environmental, social, and governance issues [86].

A particular challenge, flagged by the Bank of England's Sarah Breeden, is how to ensure that climate change scenario analysis, which is likely to become a central tool in future climate risk management by financial institutions, is undertaken in depth and addresses worst case scenarios as well as those which conveniently conclude that business can continue in a climate constrained world. As she points out: "Companies sometimes use scenarios that don't reflect some of the more extreme possible outcomes. thereby allowing their current business model to continue largely unchanged . . . Our job, as supervisors, is to ensure that banks are safe and sound in a variety of future states." [87] (quoting Peter Cripps).

While regulation may play only limited roles in persuading banks to take a more strategic approach to climate change, it has considerable potential to disincentivize investment by the clients of banks in high carbon investments and in encouraging them to invest in low carbon assets. The most important means by which it might do so, and one currently being given attention within the European Union [88], would be to prescribe different risk weightings and capital requirements for different types of assets. Doing so would be a logical extension of the Basel III framework introduced in the aftermath of the Global Financial Crisis to reduce systemic risk. This already requires "a countercyclical capital buffer to dampen risks associated with periods of excess aggregate credit growth" [89] (p. 6). However, BASEL III did not address climate change and it is increasingly recognized that targeted mechanisms that do so are desirable.

The rationale for imposing different capital requirements on 'green' and 'brown' assets is *prima facie* that they involve different levels of risk and that this justifies their differential treatment. In a low carbon transition, many brown assets will lose value, variously because green technologies improve and out-compete them, because governments will intervene to impose a price on carbon or other mechanisms that disadvantage brown assets, and because fossil fuel assets risk becoming "stranded" in a disruptive low carbon transition. Accordingly, requiring financial institutions—And banks in particular—To have a sufficient capital buffer to absorb losses in circumstances where the value of those assets may drop substantially, would be prudent. Risk weights might be calculated using forward looking scenario models to complement calculations based on past performance [90].

Raising risk weights for brown assets, would have dual benefits: Strengthening the capital base of banks and increasing the resilience of the financial system while also discouraging lending for high carbon investments. It might also result in banks charging higher rates for such assets, thereby making loans for carbon-intensive activities more expensive and low carbon alternatives more attractive. A more radical extension of such a policy would be to impose ceilings or quotas on brown credit, to constrain or prohibit ownership of specified types of brown assets, and/or to establish minimum levels of ownership of green assets. There is a far less convincing case for financial regulators to incentivize green lending through the mechanism of a Green Supporting Factor (GSF) [91].

Notwithstanding the multiple benefits of introducing a brown penalizing factor, there remains a risk that “high-carbon companies could bypass the tightening of prudential policy in one jurisdiction by raising funds on the international financial markets, unless such policies are implemented across all major jurisdictions” [92] (p. 6). An international agreement would be one means of addressing this issue but will be problematic if some jurisdictions perceive a competitive advantage in their laggard status. Another would be to bring to bear informal pressures on laggard jurisdictions, perhaps via relevant international organizations and networks, such as the Sustainable Banking Network [86].

Other mechanisms with broadly similar aspirations to that of a brown penalizing factor include: Extending the existing ‘counter-cyclical capital buffer [93] (p. 30) to require banks to hold increasing amounts of capital commensurate with carbon-intensive credit growth; Introducing exposure restrictions, containing the amount of high-carbon assets financial institutions might hold, mindful that these could plummet in value in any abrupt low-carbon transition. (e.g., quantitative limits on certain types of bank loans) [94]; imposing a “large exposures” limit to contain “the maximum possible losses a bank could incur in the case of a failure of either a single counterparty or a connected group of counterparties to a level that does not compromise the bank’s solvency.” [93] (p. 33); imposing maximum credit limits for high carbon investment and/or minimum credit floors for low carbon investment [95]; redesigning banking prudential regulation so as to risk-weight assets according to their environmental impact -which could include climate physical and transition risks—thereby “realign[ing] the lending policies of the banks towards the systemic goal of green transition” [96] (p. 1); and introducing green credit allocation policies imposing limits on the amount of commercial bank lending to particular ‘brown’ sectors’ or quotas for green lending [94]. These would encourage and facilitate lending and investment towards low-carbon assets or sectors, serving to help develop ‘missing’ green financial markets until they reached an appropriate scale.

These measures, for the most part, provide tangible financial incentives to shift from high to low carbon investments. Assuming the brown penalizing factor or other measures were sufficiently substantial and that they were enforced by financial regulators, they could incline investments at the margin to shift from high to low carbon. They could for example, respectively constrain or facilitate the supply of credit and incentivize the decarbonization of banks’ balance sheets, having “similar effects to a tax, with capital regulation employed as a supply-side brake on the flow of finance, making such activities costlier to fund” [39] (p. 65). However, again, much depends not only on the extent of the incentives provided by such measures, but also on their implementation.

## 6. Conclusions

There is overwhelming evidence, set out in Section 2.2 above, that the free market cannot deliver a low carbon financial revolution, raising questions as to what sort of interventions in financial markets might be necessary to do so. Central banks and financial regulators, aroused from their slumber by Mark Carney’s heroic efforts to place climate change on their agendas, have endorsed the recommendations of the ensuing TCFD and embraced informational and risk-based disclosure standards. However, these approaches have their own limitations, identified in Section 4.1, and much more will be necessary to accelerate a low carbon financial revolution.

This article has argued that two kinds of additional responses will be necessary. The first involves cross cutting mechanisms which, in addition to the TCFD, include strategies designed to curb short-termism, to leverage the social license of financial institutions and to expand corporate conceptions of fiduciary duty to embrace climate change, as set out in Section 4 above. The second requires approaches tailored to the characteristics of each individual industry sector or sub-sector. In Section 5, institutional investors (and large asset managers and pension funds in particular) and banks were used as case studies to illustrate the importance and scope of sector specific approaches and to highlight the crucial roles of measures such as third party benchmarking, expanding rights to litigate, requiring pension funds to address climate risks when making investment decisions, and disincentivizing high carbon investments by bank clients.

While none of these measures in and of themselves, may be enough to precipitate far reaching change, in combination, they may deliver far more than the sum of their parts. One of the values of a multi-instrumental approach, if carefully designed, is that the weaknesses and limitations of individual instruments can be compensated for by combining them with others so as to create a web of regulation that is far more resilient and effective than its individual constituents. For example, information-based provisions may empower NGOs such as BankTrack and Share Action to bring social license pressure on major institutional investors as well as better informing market actors of the carbon risk of their investments. But underpinning those measures with various forms of performance, process, and incentive based mechanisms may deepen their impact, as institutional investors and banks, for example, experience themselves as under pressure to shift towards low carbon investments from multiple sources, perhaps creating a tipping point at which they relinquish some or all of their carbon intensive investments. In this way, a mosaic of cross-cutting and sector specific measures may be developed, with different measures or different combinations of measures providing most effective in different contexts.

This is as far as the analysis above, can take us, but it is worth reflecting on whether central banks should go further and actively contribute to a greening of the financial system or of the entire economy. This would be a far a more contentious proposition [95] than the more moderate reformist measures proposed in this article. In principle, it would be possible to impose constraints on the ways that financial institutions invest their capital, or even to mandate that some of it be applied in particular ways: As through restrictions on investing in (or lending to) new fossil fuel projects; a large exposures limit to constrain banks' exposures to brown sectors, mandatory divestment of existing fossil fuel assets or prescribing minimum levels of investment in clean energy projects (see [97]). However, such action would be anathema not only to institutional investors, but also to their political masters, not least because unless they were to be implemented globally, such measures might prompt a strong market backlash, including capital flight to other jurisdictions. Put differently, while the era of *laissez faire* capitalism may be over, the grip of regulatory capitalism—involving intervention in markets to make them more vibrant rather than to curb their excesses [98,99]—is not.

However, this may not be the end of the story. A theme of the analysis above is that the transition from high to low carbon investment is coming too slowly. Yet it is plausible that far reaching change will come abruptly and relatively soon, shattering the assumptions of financial markets which have heavily discounted any near-term consequences of climate change. As the Principles for Responsible Investment (PRI) argues in its pathbreaking “Inevitable Policy Response” project: “The question for investors now is not if governments will act, but when they will do so, what policies they will use and where the impact will be felt” [100]. Crucially, the IPR project forecasts a response by 2025 that will be “forceful, abrupt, and disorderly” because of the delay [100]. As one prominent Central Bank G20 representative emphasized at interview: “When change comes it will come very fast”.

On one scenario, the embryonic sea change described earlier, accelerates as a result of a confluence of several factors: The shift in attitudes which is already in process translates into action as large numbers of market actors realize that that shedding their high carbon assets makes sound economic sense; this prompts a fragmentation of culture within the investment community as more investors are persuaded of the merits of this course of action and this destabilizes the status quo [8], and herding

(long associated with asset bubbles) results in the decarbonization of institutional portfolios as investors mimic the behavior of others and flock from brown to green stocks [101]. Perhaps a tipping point is reached as a critical mass of investors embrace the compelling business case for decarbonizing and the low carbon financial revolution reaches a point of no return. Or perhaps a series of extreme climate events prompts strong political action, such as imposing a high price on carbon and a massive sell-off of high carbon intense assets.

If either of these scenarios plays out, it might also realize central bankers' worst fear: That of a disorderly transition to a low carbon economy with a financial market collapse far worse than that experienced during the GFC. Governor Carney foresaw the risk of such a meltdown but took the view that information and risk disclosure would be enough to avert it. This paper has argued to the contrary, that far more will be necessary, including perhaps, implementing some of the 'radical' proposals flagged immediately above. However, the more radical the action CBFRs seek to take, the more tenuous their legitimacy for taking it will be and the greater the political resistance to their doing so. How CBFRs and other policy makers steer a path between these different objectives will have profound consequences both for climate change mitigation and for the economy. We had better hope for all our sakes that they maintain their nerve and have the courage to steer a course that accelerates a low carbon financial revolution without precipitating an economic collapse.

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