November 2020

Forthcoming, *Economy and Society*, Article reference: 19-181

Decarbonizing capital: Investment, divestment and the qualification of carbon assets

Paul Langley, Gavin Bridge, Harriet Bulkeley and Bregje van Veelen

Paul Langley (author for correspondence), Department of Geography, Durham University, South Road, Durham DH1 3LE, United Kingdom. Email: paul.langley@durham.ac.uk;

Gavin Bridge, Department of Geography, Durham University, South Road, Durham DH1 3LE, United Kingdom. Email: g.j.bridge@durham.ac.uk

Harriet Bulkeley, Department of Geography, Durham University, South Road, Durham DH1 3LE, United Kingdom. Email: h.a.bulkeley@durham.ac.uk

Bregje van Veelen, Researcher, Natural Resources and Sustainable Development, Department of Earth Sciences, Uppsala University, Villavägen 16, 75236 Uppsala, Sweden. Email: bregje.vanveelen@geo.uu.se

Decarbonizing capital: Investment, divestment and the qualification of carbon assets

Abstract

Private investment capital is now widely regarded as strategically significant to the governance of climate change. A dedicated and dynamic carbon finance sector has emerged that features techniques and practices for decarbonizing capital, facilitating investment in low-carbon projects and enterprises or enabling divestment from high-carbon firms and sectors. We bring together and develop the concepts of 'qualification' and 'assetization' to analyse how decarbonizing capital is proceeding. With specific reference to green bonds and the equities of fossil fuel corporations, we show how investment and divestment entail the qualification of things as assets with more-or-less specific carbon properties. But the qualification of assets as 'low-' or 'high-carbon' is also shown to be contingent, contested and compromised, featuring contrasting modalities of qualification that are decarbonizing capital in uncertain and incomplete ways.

Keywords: decarbonization; investment; divestment; qualification; assetization

Decarbonizing capital: Investment, divestment and the qualification of carbon assets

Introduction

Private investment capital is now widely held to be strategically significant to the governance of climate change. Only 'a massive reallocation of capital' appears capable of preventing global warming in excess of even 2 degrees Celsius (Carney et al., 2019). US$800bn of additional capital investment in low-carbon activities is projected to be required in each and every year (McCollum et al., 2013), but an 'investment gap' persists between such targets and current realities (The Global Commission on the Economy and Climate, 2014). Institutional investors and asset managers are also beginning to adopt divestment strategies, such as the recent commitment by Blackrock, the world's largest asset manager, to divest from coal across its actively managed funds (Partridge, 2020). At the same time, with assistance from central banks and regulators (Network for Greening the Financial System, 2019), banks and institutional investors are attempting to calculate 'climate change risk'; that is, the exposure of their loan books and portfolios to aspects of climate change that could undermine projected returns on capital and endanger aggregate financial stability.

Afforded crucial importance in contemporary climate change governance, 'capital' is private and financial, and the creation and allocation of private investment capital is envisioned as an economy of quantities and quantifications. This imaginary of capital is deep-rooted, grounded in mainstream economics wherein capital is a material resource, measureable flow and factor input of production. 'Rapid and far-reaching transitions in energy, land, urban and infrastructure and industrial systems' are clearly necessary for decarbonizing economy and society (IPCC, 2018, p.17), but these transitions are depoliticized once they are abridged as the narrowly-defined, volumetric and calculative problems of private investment capital. Alternative 'Green new deal' responses to climate change - funded through sovereign fiscal expenditure and possibly central bank asset purchase programmes (Luke, 2009; Olovsson, 2018) - are set aside.

Although this governmental agenda demarcates the kinds of boundaries between public and private action that have sustained attempts to price and trade carbon over recent decades (Doganova & Laurent, 2019), the economic and technical problem to be acted on by private agencies is now somewhat different. The governmental challenges of instituting

mitigations and adaptations to climate change through private action are by-and-large reduced to a financial numbers game of decarbonizing investment capital creation and allocation. Related, a dedicated and dynamic sector of 'carbon finance' has emerged that combines promises of prospective returns on investment with techniques and practices for decarbonizing capital (Bridge et al., 2019). Carbon finance initially centred on the pricing and trading of emissions rights in carbon markets, and the provision of ecosystem services. But the sector has broadened to include investment in 'natural capital' to maintain and enhance carbon sequestration capacities (Kay, 2018; Sullivan, 2018), and various banking activities – green business loans and mortgages, green securitizations, and so on – that fund low-carbon ventures and initiatives (CBI, 2018). In addition, and providing the focus for this paper, the carbon finance sector now features techniques and practices for committing or withdrawing investment capital in ways that enable its decarbonization. This includes: investment in low-carbon projects and enterprises (Bracking, 2015; Christophers, 2016, 2017; Tripathy, 2017; Garcia-Lamarca & Ullström, 2020), especially to provide for the greening of urban infrastructures and renewable and 'clean tech' energy sectors (Knuth, 2018a, Knuth, 2018b); and, divestment from corporations and economic sectors – particularly fossil fuels and energy generation – deemed to be major contributors to global warming (Ayling & Gunningham, 2017; Grady-Benson & Sarathy, 2016; Hestres & Hopke, 2019; Knuth, 2017).

These recent developments in climate change governance and carbon finance should be situated and theorized in the context of the political-economic logics of contemporary capitalism. Given extensive critical research into carbon markets, it would perhaps be tempting to assume that capitalist decarbonization continues to turn on the commodification of carbon (and nature more broadly), and the opportunities this creates for secondary market trading and speculative accumulation on price volatility (for review, see Bridge et al., 2019). Speculation on the price of commodified carbon is but one mode of financialized accumulation under climate-changing capitalism, however (Bryant, 2019). Core to the decarbonizing of investment capital now promised by the carbon finance sector is not commodification, but the creation and uneven distribution of property and assets as a different 'means of speculation' (Bear, 2020, p. 2), enabling value extraction and the circulation of 'climate rent' (Felli, 2014; Kay, 2018; Ouma et al., 2018). Here we want to re-focus critical inquiry into climate-changing capitalism, then, foregrounding the relational processes of asset-making that make decarbonizing capital possible, and echoing and moving

beyond earlier research into the socio-technical and metrological work necessary to stabilize and account for carbon as a commodity to be speculated upon (e.g. Callon, 2009; Cooper, 2015; McKenzie, 2009; Lovell, 2015).

In contrast with the quantitative framing of private investment capital that prevails in climate change governance, we will critically analyse decarbonizing capital as an economy of qualities and qualifications. Informed by findings from our fieldwork with specialist practitioners of carbon finance,[1] we will argue that the contingent processes of decarbonizing capital entail relatively discrete qualifications of assets with more-or-less specific carbon properties. To this end, we will draw on a body of literature that interrogates, more widely, 'how capital obtains the qualities that distinguish it' (Pistor, 2019, p. 12). This includes: juridical provisions that serve to 'code' capital as a legal category replete with certain 'attributes', such as protected and convertible ownership claims and rights to pecuniary returns (Pistor, 2019); and, prospective valuation devices that figure the future uncertainties of investment capital creation and allocation (Chiapello, 2015; Muniesa et al., 2017; Nitzan & Bichler, 2009). More specifically, we will bring together and develop the concepts of 'qualification' and 'assetization' to extend this literature, and to analyse the 'becoming rent' of decarbonizing capital. We advance the qualification concept in its broadest sense, working with the productive tension between different elaborations offered by the research programme of economization and Convention Theory (Callon et al., 2002; Diaz-Bone, 2017). For us, the qualification of economic objects requires both collective socio-technical and metrological work *and* social conventions and moral justifications. We turn to the 'assetization' concept, meanwhile, to pinpoint how the qualification of assets for the appropriation of value and realization of rent is somewhat different to the qualification of commodities. Assets are '*capitalized property*' (Birch, 2017, p. 468, *original emphasis*), such that, from the perspective of the investor, 'value amounts to a future return anticipated

[1] Fieldwork comprised: fifteen semi-structured interviews with various agents of carbon finance, conducted between March 2018 and March 2019 at multiple sites in Europe; and, participant observations at industry workshops and conferences during 2018, including the Climate Bonds Annual Conference, and the UN Environment Programme (UNEP) Finance Initiative Global Roundtable. The research formed part of REINVENT (Realising Innovation in Transitions for Decarbonisation), a wider project funded by the European Union's Horizon 2020 Research and Innovation Programme (https://www.reinvent-project.eu). The project also included a further set of case study interviews with multiple representatives of a European company that issued green bonds to finance a transformation of its production facilities.

through a calculation of the cost of capital rather than to a "price" given to the asset on the market' (Muniesa, 2017, p. 449).

Our analysis will show that decarbonizing capital currently involves two somewhat disconnected and compromised processes which qualify assets with respect to their carbon qualities: investment in low-carbon assets, for which green bonds provide our case material; and, divestment from high-carbon assets, for which the equities of fossil fuel corporations provide our specific focus. Furthermore, we find that each of these parallel processes of decarbonizing capital feature competing modalities of asset qualification, as the collective work of qualifying carbon assets coalesces into competing 'clusters of evaluation practices' (MacKenzie, 2011; Arjaliès et al., 2017) with different alignments of metrological devices, moral conventions and investor constituencies. Our analysis will identify three main competing modalities through which low- and high-carbon assets are qualified for investment and divestment - a mainstream market modality, an ethical liberal modality, and an explicit moral modality. Investment and divestment that serve to decarbonize capital are organized through these modalities in ways that are uncertain and far from complete.

The remainder of the paper is divided into five further sections. In Section II, we bring together the concepts of qualification and assetization to understand further the attributes of investment capital. Section III develops this conceptual engagement to begin to unpack the qualification of carbon assets. Section IV examines the qualification of green bonds as low-carbon assets for investment, and Section V addresses the rendering of certain corporate equities as high-carbon assets for divestment. The sixth and final section provides some concluding reflections.

Qualification, assetization and investment

What Callon et al. (2002) term the 'economy of qualities' is a theme for research in economic sociology and allied fields that, taking inspiration from science and technology studies (STS), rethinks economies as transitive socio-technical processes grounded in the performative power of economic knowledge and devices. In the 'research programme' of 'economization' (Çaliskan & Callon, 2009, 2010), a broad concern with how activities come to qualify as economic is manifest in specific attention to the qualification of things as products and services (i.e. commodities) that can be priced and exchanged in markets. Qualification is

a ‘collective process’ (Callon et al. 2002, p. 203), such that the qualities of a commodity are not inherent and are established by the efforts of actors in the field (Beckert & Musselin 2013). Collective and iterative efforts to qualify commodities will likely feature ‘specific metrological work and heavy investments in measuring equipment’ (Callon et al., 2002, p. 199). Standardization is the ‘canonical’ form of qualification (MacKenzie, 2011), producing an economic object as ‘an entity described in both abstract and precise terms, certified and guaranteed by a series of textual and material devices’ (Çaliskan & Callon, 2010, pp. 7-8).

Convention Theory agrees that ‘the qualification of goods’ is ‘one of the central issues in the dynamic organization of markets’ (Callon et al., 2002, p. 202), but relates qualification to wider social and political logics and orderings (e.g. Boltanski & Chiapello, 2006; Karpik, 2010; Orléan, 2014). Product qualifications that enable coordinated market action are justified in the context of collective and normative conventions around valuation, evaluation and the common good. The qualification of commodities is thereby inseparable from the ‘convention-based coordination’ of social order, as actors such as producers and regulators will ‘share a collective interpretation … of what is at stake in terms of goods, other relevant realities, categories, forms and goals’ (Diaz-Bone, 2017, p. 244). There are a plurality of quality conventions, each framing and internally differentiating spaces of coordinated market action. As Ponte and Gibbon (2005) show for clothing and coffee markets, for example, conventions can provide for the social and moral justification of production methods, as well as for the properties of products themselves. Convention Theory thus broadly shares its concerns with economic sociologists who stress the importance of ‘moral projects’ to the social construction of markets (Fourcade & Healy, 2007). Multiple goods can be qualified as morally good according to different conventions, and thereby become objects of coordinated market action.

The concept of qualification developed largely through studies of commodification and marketization. Here we want to put the concept to work to interrogate a different transitive process of economization, namely ‘assetization’ and investment. An emerging interdisciplinary literature asserts that the growing role of *rentiership* in speculative capitalist economies requires a renewed focus on asset-making processes that are fundamental to capital investment and the extraction of value (Birch, 2017, 2019; Muniesa, 2017; Ouma et al., 2018). Assets in this literature are not the ‘fixed’ or ‘current assets’ of balance sheet accounting, but the ‘*capitalized property*’ of private investment (Birch, 2017, p. 468, *original*

emphasis). They are things that are, at once, 'owned or controlled' by investors 'as an object of appropriation' (Muniesa et al., 2017, p. 129), and valued (at a discount) and deemed investable because they appear able to realise future returns on capital, act as collateral and bear debt. In order for a thing to become an asset, it must be 'neatly delineated' in legal terms as private property that is detachable from its contexts (Muniesa et al., 2017, p. 129; Pistor, 2019). And, assetization also features 'capitalization', the work of 'pervasive' and 'particular' economic knowledge and devices that comprise prospective valuations of investment returns (Muniesa et al., 2017, p. 11, 14). Widely accepted and circulating throughout financial economics, these devices include: the discounted cash flow (DCF) model and associated calculations of Net Present Value (NPV) that commensurate and differentiate potential assets against a baseline assumption of interest available from merely depositing capital in the bank; and, portfolio theory which renders assets reducible to the probabilistic relationship between risk and return (Muniesa et al., 2017, pp. 37-46; also Chiapello, 2015; Nitzan & Bichler 2009). Investable propositions are thus typically categorized by these valuation devices as 'asset classes': a particular object of capital investment is, at once, commensurated and differentiated in relation to both assets in general (i.e. assets in other classes) and assets with which it ostensibly shares similar future prospects.

We certainly agree with Muniesa et al. (2017) that 'becoming an asset is not the same as becoming a commodity' (p. 129), but this should not preclude a focus on the qualification of assets. Indeed, key to the critical analytical potential of 'qualification' for understanding assetization processes is how this concept can explicitly incorporate both the collective socio-technical and metrological work of prospective valuation *and* the social conventions and moral justifications that are necessary for turning things into investable assets. This requires a broad understanding of the qualification concept, one that works with the productive tensions between the competing elaborations discussed above. In the research programme of economization, qualification is 'objectification work' that 'disentangle[s] things from their networks of connection' and reorders the social world in its wake (Çaliskan & Callon, 2010, p.5). In Convention Theory, in contrast, the entanglement of objects with the collective and normative conventions of social ordering is crucial to economic qualification. For us, an asset is an economic object that becomes possible because of a host of separations from, and associations with, social power relations.

Although professional knowledge and devices of valuation are key to the pragmatics of asset-making, they are entangled with a 'narrative plot' and 'performative scenario' that socially and politically justifies the economic role of investment capital (Muniesa et al., 2017). Central to the justification and the operation of investment as a 'political technology' is the figure of the investor (Muniesa, 2017), a gendered and masculine financial subject who bears a distinctive set of legally guaranteed liberal economic rights associated with the private allocation of capital (Preda, 2005). As Michel Feher (2018) has it, 'the distinctive prerogative of investors resides not in the extortion of income, but in the allocation of capital: more than appropriation, *accreditation* is their specific business' (p. 43, *original emphasis*). When today's investors determine which projects and enterprises are assets that can contribute to economic and social renewal, the narrative of investment broadly aligns with the conventions of creativity and innovation that are to the fore in the social ordering of contemporary, entrepreneurial and network capitalism (Boltanski & Chiapello, 2006). Ostensibly rational and scientific private investment is an inherently moral project with normative justifications: the accreditation of some assets and not others is a moral economy which rests on the purported aggregate and productive benefits to economy and society of decisions taken by individual investors.

Qualifying carbon assets

How, then, are carbon assets qualified across the carbon finance sector and, specifically, in the two processes of decarbonising capital that provide our focus in the remainder of this paper: namely, investment in low-carbon projects, initiatives and enterprises; and, divestment from high-carbon firms and sectors? From the outset, it is clear that investor attachments to low- or high-carbon assets are fundamentally different. Decarbonizing capital by investing in a low-carbon asset is the forging of a new attachment to a specific kind of economic object deemed likely to have a particular combination of qualities in the future - i.e. it will produce returns on capital *and* it will deliver a reduction in carbon emissions. In contrast, decarbonizing capital by divesting from a high-carbon asset is - in its most unequivocal form, at least - detachment from a thing that is held to have somewhat different combination of qualities. A high-carbon asset may continue to be capable of bearing debt in

such a way that will produce returns on investment, but it will only do so at the expense of carbon emissions held to be unbearable.

Low- and high-carbon assets qualified as objects of investment or divestment are also typically not from the same category of assets. Divestment principally centres on equities, especially the publicly listed and traded equities of corporations in the business of fossil fuel extraction and energy generation. Low-carbon investment, meanwhile, primarily rests on the qualification of an array of debt instruments (e.g. bonds, asset-backed securities), although important exceptions include venture capital investment in the equities of 'clean tech' start-ups (Knuth, 2018b), and experimentation with equity models to try to lower costs of capital for the renewable energy sector (Bridge et al., 2019). Regardless of specific asset category and relative to high-carbon equities, the objects of low-carbon investment will therefore be comparatively illiquid.

While these differences ensure the qualification of low- and high-carbon assets is largely disconnected and takes place in parallel, three important commonalities of asset qualification feature across the carbon finance sector. First, extensive collective socio-technical and metrological effort is expended to qualify the carbon credentials of various assets and asset classes. This work is always ongoing, as the materiality of carbon continuously resists economizing metrics and measures (Liu, 2019; Lohmann, 2011). Consider, for example, how the conservation of nature (and, specifically, its carbon sequestration capacities) is constituted by the carbon finance sector. As Sullivan (2018) explores, a host of valuation devices are necessary to produce nature as 'natural-capital' and to make it appear to investors as 'a bank of financial assets … [or] "countable capital"' (p. 56). She finds, moreover, transforming 'standing forests and other ecosystems of the global south…(into) a store of projected natural-capital-based income streams that can be leveraged' is far from routine (p. 61), and current practices fall far short of the kinds of mandatory valuation rules which mark more established asset classes. This 'deficit' in the qualification of natural-capital assets is presently being filled by a host of verifiers who, perhaps in time, will mirror the army of professional auditors swarming around the valuation, verification and trading of carbon as a commodity in carbon markets (Ehrenstein & Muniesa, 2013).

Second, the qualification of carbon assets is closely tied to the moralization of investment capital (Ouma, 2018). Indeed, the carbon finance sector features a plurality of

quality conventions and moral projects, each qualifying and differentiating assets in somewhat different ways. Following Fourcade and Healy (2007), Kish and Fairbairn's (2018) account of the moral economies of investment in sustainable agriculture projects is particularly instructive here. In effect, they show how the commensuration and differentiation of these projects as assets features contrasting and competing moral conventions mobilized by intermediaries to enable different asset-investor attachments. In short, projects are morally qualified as assets for mainstream investors who stress the intrinsic productive consequences of capital allocation for economy and society, and are qualified differently for so-called 'impact investors' (Langley, 2020a) on the basis that they will deliver measurable more-than-financial returns (as well as financial returns) on investment, such as food security and local development.

Third, the collective metrological and moral work of qualifying the carbon attributes of discrete asset classes gives rise to 'clusters of evaluation practices' (MacKenzie, 2011; Arjaliès et al., 2017). Broadly speaking, this echoes the multiplicity of divergent 'frames' and competing 'metrological regimes' that are known to be present in carbon accounting and emissions markets (Ascui & Lovell, 2011; Cooper, 2015; Lohmann 2011). It also leads to unresolved tensions and contradictions, and to what Barry (2002) would term 'calculative politics'. However, divisions and rivalries over the qualification of carbon assets for investment and divestment do not simply replicate those found in carbon accounting. Ascui and Lovell (2011) are able to draw a firm distinction between 'financial' and 'social/environmental modes of carbon accounting', but this increasingly does not apply across the carbon finance sector as a whole. As particular classes of carbon assets are qualified, competing clusters or modes of evaluation are identifiable, each featuring different alignments of metrological devices with social and moral conventions and investor constituencies.

Low-carbon assets: Green bonds

To date, green bonds (also known as climate bonds) are the principal asset class through which the carbon finance sector expressly raises private capital for low-carbon investment (Bracking, 2015; Christophers, 2016, 2017; Tripathy, 2017; Garcia-Lamarca & Ullström, 2020). Green bonds are a type of 'labelled' fixed-income debt instrument that funds investment in a

specified project, or a set of multiple projects, undertaken by their issuer. Issuers of green bonds include multilateral development institutions, sovereign states and municipalities, and corporations and banks. The European Investment Bank (EIB) was the first to issue a green bond in 2007. The market for green bonds is still in its 'nascent stages' (Tripathy, 2017, p. 240), but recent expansion of private issuance by corporations and banks has propelled this asset class to a prominent place in the governmental agenda for decarbonizing capital. The value of green bonds issued by corporations and municipalities exceeded the value of those issued by multilateral development banks for the first time in 2014, and financial institutions were the largest issuers of green bonds by value in 2018 (CBI, 2019). Indeed, understood as an economy of quantities, green bond issuance has witnessed aggregate growth since 2015 that briefly plateaued in 2018 amidst difficult conditions throughout bond markets (CBI, 2019). Globally, $221bn worth of green bonds were issued in 2017, up from $155bn in 2016 and $42bn in 2015 (CBI, 2018b).

To qualify as low-carbon assets, green bonds are commensurated and differentiated in relation to other assets through two main sets of qualifications. The first centres on how projects are turned into a particular kind of asset – i.e. a bond. In this respect, a green bond is qualified in much the same way as a 'brown bond'. Green bonds are issued against the full balance sheet and earnings potential of the issuer, such that investors do not demand the 'risk premium' usually placed on low-carbon projects that are financed on a non-recourse basis (Christophers, 2016). The asset qualities of green bonds are thereby produced through the same metrological devices and collectively agreed standards (i.e. bond ratings) mobilized for brown bonds. What is not at issue, then, is whether the specific investment project or projects to be funded are capable of generating a future income stream, acting as collateral and bearing debt. Revealingly, while Moody's are presently the only one of the three main rating agencies (the others are Standard & Poors (S&P) and Fitch) to rate green bonds, their ratings solely relate to financial processes (i.e. management of proceeds, disclosure and reporting). A green bond can thus get a high rating from Moody's regardless of 'how green the projects funded by the green bonds are' (G20 Green Finance Study Group, 2016, p. 25).

This takes us to the second set of qualifications that are necessary for stabilizing and differentiating green bonds as investable low-carbon assets. The qualification of the carbon credentials of green bonds is far from rigorous or uniform, however. Outside of those states (i.e. China, Japan, India) that have recently introduced specific juridical provisions and

regulatory standards, two contrasting and contested modalities of qualification serve to assetize green bonds. These two modes stabilise green bonds as a low-carbon asset, but they also render qualification an incomplete process in which the potential 'additionality' of green bonds (i.e. carbon savings over regular bonds) is compromised.

Mainstream and ethical modalities of qualification

The mainstream market modality that qualifies green bonds is produced and performed primarily through the collective socio-technical work of networks of institutional investors (e.g. insurance companies, pension funds, sovereign wealth funds), asset managers and other intermediaries who also have routine attachments to brown bonds. These are the principal investors in green bonds by volume. They qualify green bonds for active investment in terms of their risk-reward characteristics, largely in accordance with diversified portfolio management techniques and the regulatory requirements, fiduciary duties and mandates that govern their investment strategies (Christophers, 2016, 2017; Tripathy, 2017). They may also invest passively in green bonds by tracking the various green bond indices, such as those provided by Solactive, S&P, and Barclays and MSCI.

Under this mainstream modality, qualification of green bonds does not challenge existing social conventions and moral justifications of valuation and the inherently productive consequences of investment. Instead, green bonds can have an 'added value' (Tripathy, 2017, p. 240): they provide a 'tag' that enables so-called 'sustainable and responsible investment' (SRI), as required by changing mandates and targets, rebranding and marketing exercises, the mitigation of reputational risks, and so on (speaker, UNEP Finance Initiative Conference 2018). Those decarbonizing capital by investing in green bonds are, for example, often signatories or members of industry groups for SRI, such as Principles on Responsible Investment (PRI) and the Institutional Investors Group on Climate Change. It is the 'added value' of the label or 'tag' which typically leads green bonds to be valued at a premium that is over and above brown bonds with similar risk-reward characteristics. Illustrative in this respect is the tendency for investors and, indeed, the green bond sector as a whole, to treat the volume of green bond issuance and investment - and not the environmental or low-carbon benefits achieved through such investment - as the marker of 'success' in decarbonizing capital.

The prospectus for a green bond issue will identify the project(s) to be financed, and may provide some more-or-less robust calculations of the prospective impact of those project(s) (e.g. megawatts of renewable energy generated, tons of CO2 emissions avoided). Increasingly, green bond issues are independently reviewed by 'second opinion providers' or 'verifiers' – such as the Norwegian not-for-profit company, CICERO – who trade on their scientific expertise and professional objectivity. 80 per cent of green bonds issued in 2016 were reviewed by an independent agency, and such reviews are a key condition for the listing of green bonds on exchanges in London, Luxembourg, Shanghai and elsewhere (G20 Green Finance Study Group, 2016). However, our fieldwork interviews with verifiers underlined that their practices primarily focus on the allocation of capital to projects, rather than the low-carbon outcome thereof. Verifiers might ask whether the capital allocated to a project is appropriate, whether there are specific people in charge, and especially whether there are systems for monitoring and reporting in place. What we see here, then, is the transposition of metrologies into a new arena (see Cooper, 2015). The actors responsible for qualifying the greenness of bonds (i.e. verifiers) might be different to those operating elsewhere in the carbon finance sector, but what is to be measured is not necessarily specific to a bond's particular green qualities, and qualification is informed by metrics used in other forms of SRI. Such metrologies appear more oriented towards the up-front justification of the green label and reducing reputational risk for investors, rather than ensuring and maximising low-carbon outcomes. Verifiers deploy their own proprietary criteria, but often these are based on the Green Bond Principles (GBPs). The GBPs were developed in 2014 by investment banks and the International Capital Markets Association (ICMA). The GBPs require that an issue details the projects to be funded – the so-called 'use of proceeds' – as they fall into a number of broadly defined categories, such as 'renewable energy', 'energy efficiency', and 'pollution prevention and control'. The primary focus for the GBPs, however, is transparency, disclosure and reporting to investors, and not the carbon credentials of bonds which are qualified as green.

This voluntary, verified and principles-based modality of qualification compromises the decarbonizing of investment capital because it leaves the low-carbon qualities of green bonds relatively unspecified. It also contrasts with a second modality of qualification. The carbon properties of a growing volume of green bonds (15 per cent by value in 2016) are qualified through a more rigorous process of standardization and certification (G20 Green Finance

Study Group, 2016). To be certified as worthy of the green label, a bond has to conform to a standard produced and policed by a London-based non-governmental organization, the Climate Bonds Initiative (CBI). The CBI's Climate Bonds Standard and Sector Criteria (CBSSC) scheme furthers the transparency, reporting and verification approach of the GBPs, but also includes 'sector-specific criteria for what is green' (G20 Green Finance Study Group, 2016, p. 14). The CBSSC features working groups and criteria for eight such sectors: energy, buildings, transport, water, waste, nature-based assets (i.e. conservation finance), industry, and ICT. The CBI also approves independent verifiers to provide a third-party assessment of the use of proceeds. Here, then, the qualification of green bonds is often a matter of setting minimum thresholds for the prospective low-carbon credentials of projects in each sector, although certain projects (e.g. for recycling) qualify regardless of carbon impact. For example, while the GBPs describe 'energy efficiency' as a category suitable for green bond issuance, the CBSSC sets out emissions performance criteria that buildings must be projected to achieve to be eligible for funding through green bond issuance.

Centred on the CBI, this second mode of qualification combines the collective work of a relatively broad range of agencies, institutions, climate scientists and enthusiasts (Tripathy, 2017). It is an ethical liberal modality of qualification for assets: it foregrounds and often calculates the prospective impact and more-than-financial value of green bonds, and seeks to forge asset-investor attachments by appealing to the social values of investors who wish to decarbonize capital. As such, this modality of qualification does not feature moral condemnation of brown assets, or require that investors surrender the maximization of risk-adjusted returns. Rather, it ethically appends the implicit moral economy of mainstream capital investment. Funded largely by philanthropic capital, the CBI describes itself, for example, as 'an investor-focused not-for-profit', providing 'an open source public good' that, in addition to ongoing work on the currently incomplete CBSSC, includes policy advice and market intelligence (e.g. CBI, 2018b, 2019).

There are some signs that the CBSSC is also being incorporated into the mainstream market modality of qualification. This is largely because 'Standardising the evaluation of green credentials of the bonds reduces transaction costs for investors … as they can evaluate the green credentials of the Standard once, instead of for each individual bond issuance' (G20 Green Finance Study Group, 2016, p. 23). Under the mainstream market modality of qualification, standards for the qualification of green bonds are thus regarded as important

to furthering the so-called 'scalability' of this asset class for decarbonizing capital. However, as our fieldwork underscored, standardisation remains the focus for contestation between and within the mainstream and ethical modalities of qualification. Central to this calculative politics is whether the low-carbon impact of the investment capital raised via green bonds – i.e. its so-called 'additionality' - should be quantified by such standards. To date, neither modality explicitly requires a demonstration of additional carbon savings at an institutional level in order that a bond, issued to finance a specific project, can be labelled green. Indeed, a representative of a European company explained to us that their recently issued green bond 'makes no difference to the company's sustainability. The money is used to fund projects that would have happened anyway'. While some investors and intermediaries would like to see a stronger focus on impact and outcomes-based measurement through the furtherance of additionality requirements in green bond standards, others argue that 'Being purist about additionality will hamper growth of the market' (speaker, CBI conference 2018). Moreover, fully incorporating additionality into any standard for qualifying the low-carbon attributes of bonds will not be easily reconciled with the need to render them commensurate with similar assets. For example, while the EU's Technical Expert Group on Sustainable Finance is calling for the standardisation of environmental impact reporting, it also argues that concerns about the additionality of green bonds is actually 'the result of a misunderstanding of the structural refinancing role of bonds' (TEG, 2019, p. 18). Green bonds, in short, cannot be qualified as both a refinancing mechanism routinely employed in wider and deeper structures of corporate finance, on the one hand, and a low-carbon asset class that provides investors with a fully attributable set of more-than-financial returns to quantify the decarbonizing of capital, on the other.

High-carbon assets: Fossil fuel equities

Across the carbon finance sector, equity divestment is the principal mechanism for ending high-carbon capital investment. In the most general sense, 'divestment' refers to ruling out investments in 'sin stocks' (e.g. tobacco, weapons, gambling) through techniques of 'negative screening' pioneered by faith-based investors. Indeed, calls for fossil fuel divestment have built on earlier divestment campaigns, such as that protesting the South African Apartheid regime (Hunt et al., 2016). As of mid-2018, and understood as an economy of quantities,

almost 900 institutions across the world with over $8tn worth of assets-under-management (AUM) have made some kind of commitment to fossil fuel divestment, although the scale of divestment actually undertaken was much, much smaller - approximately $5.2bn (Go Fossil Free, 2018).

Fossil fuel divestment entails high-carbon equities are qualified by their commensuration and differentiation from other assets. First, this centres on the qualification of these assets as equities – i.e. fractional and tradeable ownership claims on a share (stock) capable of yielding future revenue. The qualities of high-carbon equities *qua* equities - such as shares in publicly-traded oil, gas and coal companies - are established and maintained through the same listing requirements and accounting standards that contribute to the assetization of all equities. These include, for example, working capital requirements, financial track record, governance arrangements and public disclosure requirements associated with listing processes on stock exchanges, and are governed by national regulations (such as those of the US Securities and Exchange Commission, SEC). Moreover, the value of shares in a fossil fuel company is supported by the reserves in the ground to which the company has exclusive access. The qualification of equities thereby features specific requirements on oil, gas and coal companies in relation to reporting and independent evaluation of proven reserves, typically based on the definitions and methodologies outlined by the Society of Petroleum Engineers. It is worth noting, however, that qualifying as an equity in this way excludes the majority of working capital dedicated to oil and gas production worldwide, which is not publicly traded and thus cannot be held as an asset by investors (Ritchie & Dowlatabadi, 2015).

In light of the history of divestment, the second set of qualifications necessary for producing fossil fuel equities as high-carbon assets features explicit moral judgements and justifications in conjunction with metrology. However, qualification of the high-carbon credentials of certain equities is currently inconsistent and contested. Limits to divestment and the decarbonizing of capital result from unresolvable tensions and contradictions between an explicitly moral modality of qualification, and one that is much more mainstream.

Moral and mainstream modalities of qualification

The moral modality of qualifying high-carbon assets is developed and performed primarily through networks of environmental NGOs and institutional investors with a public or more-than-financial mandate. It is consistent with wider and growing calls for a 'supply-side' climate policy that targets the future extraction of fossil fuels (rather than focusing on their combustion) (Le Billon & Kristoffersen, 2019). Moral injunctions to divest in ways that further the common good and minimise harm to people and planet have been focused on high-carbon assets by environmental and social activist communities – most notably Bill McKibben and 350.org's Go Fossil Free campaign (Knuth, 2017; Mangat et al., 2018). They have also been adopted by institutional investors, including faith-based groups, educational institutions and public sector organisations. The morality mode of qualification for divestable assets is marked, moreover, by the equation of 'high-carbon' with 'fossil fuels'. This equivalence is codified typically in the Carbon Underground 200, a list that brings together the top 100 public coal companies and the top 100 public oil and gas companies, ranked by the carbon content of their reported reserves by Fossil Free Indexes LLC. The Carbon Underground 200 has been adopted by 350.org as the official list for the divestment movement (FFI, 2018), serving as a negative screening tool to reduce exposure to publicly-listed fossil fuel companies and enabling the scalability of divestment practice. The simple equation of high carbon assets with fossil fuel companies has thus come to rest on a set of relatively complex calculative practices.

Our fieldwork interviews with institutional investors highlighted two problems with this metrology for the moral qualification of high-carbon assets. First, metrology in general poses a danger to morally-driven divestment practices. As one institutional investor put it to us, 'In saying we want to measure everything, [it's] just too much. Instead of doing something [it's] just an excuse for not doing anything'. Second, a narrowly-conceived metrology that equates high-carbon assets with fossil fuel companies leaves unspecified the carbon credentials of non-fossil fuel companies, including high emitters in the steel, paper or food sectors. Notable in this respect is that The Carbon Underground 200 uses figures for reported reserves - as mandated by stock exchange listing requirements - and allocates these reserves to companies based on their share of ownership. It then converts raw reserve figures to projected emissions using the IPCC Revised 1996 Guidelines for National Greenhouse Gas Inventories as a methodological framework. In this way, the divestment movement's normative moral mode of qualifying high-carbon assets is underpinned by a calculative

methodology that can be easily integrated by asset owners and managers who already use sector-based negative-screens to guide their investment approach. For example, the Carbon Underground 200 serves as the basis for a negative screen on the S&P 500 to create the FFIUS Index, a fossil free index launched in 2014 (FFI, 2018). The explicit moral qualification of certain equities as divestable high-carbon assets has thus had the added effect of rendering newly visible some forms of carbon mobilization (via extraction) that are foreclosed by conventional process-based accounting.

A second, mainstream market modality for qualifying equities as high-carbon assets has also emerged. This cluster of evaluation centres on the prospect that assets in an investment portfolio will be devalued as a consequence of 'climate change risk', and does not solely equate high-carbon assets with the equities of oil, gas and coal companies. As such, key to this modality of qualification is the possibility that high-carbon assets might become 'stranded'; that is, the prospect that they will be subjected to 'unanticipated or premature write-downs, downward revaluations, or are converted to liabilities' (Caldecott et al., 2013, p.7). The notion of stranded assets is rooted in calculative practices that date back to the 1980s, but was popularised by a financial think tank, the Carbon Tracker Initiative. The Initiative's work on 'unburnable carbon' quantified the disconnect between the current value of the listed equity of global fossil fuel producers, and their potential commercialisation under a strict carbon budget constraint (Caldecott, 2017; CTI, 2014). A number of related undertakings - most notably, the 2 Degree Investment Initiative, the Transition Pathway Initiative, and ClimateAction 100+ - have extended the notion and calculation of impermissible emissions from the fossil fuel sector to the economy as a whole.

The mainstream market modality for qualifying the high-carbon credentials of corporate equities involves the collective work of a broad range of intermediaries, including conventional asset owners and managers, experts in research institutes and think tanks, and international agencies such as the United Nations. In the first instance, qualification is a matter of the quantification and disclosure of companies' carbon footprints, grounded in a belief that corporate transparency will enable effective investor decision making and a smooth transition to decarbonizing capital (Christophers, 2019). Some initiatives, such as the UN-supported Montreal Pledge (PRI, 2018), have sought to extend this to a quantification of the carbon content of investors' portfolios. This serves as an accounting device that attributes companies' emissions to investors in proportion to the amount of stock held in their portfolio.

A portfolio's carbon footprint is thus the sum of these attributed emissions. This value will usually be normalized, using factors such as annual revenue or market capitalization (PRI, 2015). Such an approach thereby conjures up a space of equivalence, wherein financial input (capital investment) is seamlessly translated into an environmental output (carbon footprint) (see MacKenzie, 2009). Moreover, there are presently a number of attempts to standardize the calculations that subsequently enable carbon footprint information to be converted into a qualification of high versus low carbon asset portfolios. These are primarily undertaken by scientific experts, such as the Science Based Targets Initiative (SBTI), 2° Investing Initiative, and Transition Pathway Initiative, who are tasked with translating the notion of 2 Degrees global warming into company and investment portfolio carbon budgets.

In contrast with the explicit moral qualification of equities as high-carbon assets, what is especially significant about the mainstream modality is that it tends not to prompt divestment from such assets. This is because it is grounded in the belief that climate change is a systemic risk, 'one which investors cannot diversify away from' (CA100+, 2019). The qualification of the carbon credentials of assets and asset portfolios is consistent with the prospective valuations of financial risk management. And, at the same time, such qualifications perform practices of SRI and progressive corporate governance that, for at least two decades, have been understood to include active and ongoing engagement between shareholders (as 'owners') and executive boards (as 'managers'). While institutional investors (such as US public pension funds) who champion SRI are often to the fore in the calculation of climate change risk, then, they also tend to be vocal critics of divestment from equities with high-carbon qualities (Stausball, 2015). Similarly, as increasing numbers of institutional investors and asset managers seek to take a so-called '2 degree approach' for branding and marketing purposes that aligns them with the Paris Agreement, this typically prompts engagement with (rather than divestment from) companies in their portfolios which are not yet compliant with the 2-degree baseline.

The moral and mainstream modalities of high-carbon asset qualification express fundamentally different rationales for reallocating and decarbonizing investment capital. However, investors often seek to combine aspects of both modalities in practice, creating a qualification landscape of overlaps and folds which is both messy and compromised in its ability to deliver an unequivocal divestment from high-carbon assets. For example, as the divestment movement gained momentum, many faith-based institutional investors

broadened their negative screening approach to sin stocks to include other categories (i.e. high-carbon/fossil fuels). Our fieldwork interviews found, however, tensions between the historically- and explicitly morally-anchored asset qualifications of these investors, and the investment practices and conventions in the carbon finance sector. Asset owners and managers expressed concern that divesting from coal, oil and gas assets on moral grounds would require so many exclusions that it would materially elevate the level of financial risk across their diversified portfolios. One faith-based investor recounted to us, for instance, how her organisation wanted to divest from all fossil fuel assets, but found their asset manager unwilling to implement this because 'the risk mandate' could not be reconciled with the metrologies of an index tracker investment that 'excluded quite a lot of companies already'. The modes of high-carbon asset qualification adopted by the Church of England have also led it to divest from coal, but engage with oil and gas companies through the Transition Pathway Initiative and the Climate Action 100+. Not dissimilarly, the high-profile 2019 divestment decision of the Norwegian Sovereign Wealth Fund was initially forged through a moral modality of qualification, with the intention of excluding all high-carbon assets from its portfolio. When the Fund implemented this decision, however, it rowed back, adopting a more mainstream modality of qualification and a complex risk-reward metrology aimed at ensuring it 'shield[s] itself from a long-term fall in oil prices' (Solsvik, 2019). This led to the removal of integrated oil and gas companies (e.g. Shell, BP) from its list of high-carbon assets, and a narrowed focus on divestment from the assets of producer companies without downstream activities.

Conclusions

The movement of financialized and speculative capitalism onto the terrain of nature and social reproduction is presently registering in social scientific inquiry, shifting critical analytical attention away from a focus on commodification and price speculation and towards concerns with the appropriation of value and extraction of rent through capital investment. The concept of assetization greatly assists understanding of the distinctive processes of economization that this movement entails, not least because assets are private property for future appropriation that are deemed investable and capitalized in the present (see Langley, 2020b). Our key conceptual claim here has been that qualification - a concept previously

elaborated to understand the production and exchange of things as commodities - can be developed and extended to deepen accounts of assetization processes. Crucial in this respect has been the broad understanding of the qualification we have developed, working with the productive tension between the elaborations of the concept offered by the research programme of economization and Convention Theory. Speculation, as Laura Bear (2020) puts it, 'is not just calculation', but also entails 'projecting … ethical orders' (p. 2-3). For us, the qualification of things as assets involves both disentanglement *and* entanglement with social power relations, both collective socio-technical and metrological work *and* social conventions and moral justifications.

As we have shown here, this is of particular import for understanding how the decarbonizing of investment capital entails relatively discrete qualifications of assets with more-or-less specific carbon properties. Contrary to contemporary climate change governance, decarbonizing capital is not a quantitative problem and numeric game of new and redirected volumes of investment capital flows, and associated calculations of climate change risk. Rather, decarbonizing capital is actually a qualitative problem, wherein the qualification of low-carbon assets for investment and high-carbon assets for divestment is contingent, contested and compromised. As we demonstrated through the cases of green bonds and fossil fuel equities, decarbonizing capital is undercut and limited by conflicting metrological and moral modalities of qualification, each working quite differently with the prospective temporality of the asset condition.

The explicit moral modality of qualification performs a remarkable temporal shift as it qualifies high-carbon equities for divestment, recasting unmined quantities of coal, oil or gas (which underpin the future value of the asset) in terms of their potential as greenhouse gas. The calculative practices behind the Carbon Underground 200 thus achieve qualification by folding time (future emissions) and space (the geography of a corporation's fossil fuel reserves) back onto the asset. However, the resulting qualification – i.e. the ranking of corporate equities on the Carbon Underground 200 list – does not impinge directly on the valuation of assets, but creates a new marker of difference to be privileged by way of moral valuation. Not dissimilarly, the ethical liberal modality of qualifying and standardizing green bonds as low-carbon assets promises to establish and uphold sector-specific minimum thresholds for what counts as 'green'. This standardized marker of difference is foregrounded when specialist and impact investors make an ethical choice to forge attachments with green

bonds, but has a different kind of value added for mainstream investors increasingly keen to showcase and market their sustainable and responsible practices. In contrast with both the moral and ethical modalities for qualifying carbon assets, the mainstream market modality privileges the investment and valuation techniques of portfolio theory. Much of the appeal of green bonds to mainstream investors is that the GBPs and indeed the CBSSC do not constitute these assets differently and as valued on the basis of their potential low-carbon qualities. Green bonds are qualified as different from brown bonds, but they can be valued in the same way by mainstream investors committed to risk and return. Meanwhile, the qualification of high-carbon assets for mainstream investors is significant because it is these assets that are most at risk of devaluation and stranding. As a consequence, rather than operating as a marker of difference, the high-carbon qualities of certain corporate equities are folded back into the asset directly because they are material to its valuation. This mainstream mode of qualification is not (yet) routine and, instead, involves a series of bespoke calculations and assessments – by specialised intermediaries – that bestow on investors the capacity to choose how to manage their portfolios for climate change risk, whether to practice shareholder engagement, and so on. Across the piece, then, the multiple and competing qualifications of low- and high-carbon assets matter to understanding the uncertain and limited progress to date of the governmental agenda that centres on decarbonizing capital, and to how that agenda will unfold in the future under climate-changing capitalism.

Acknowledgements

The authors would like to thank the various agents of carbon finance and multiple representatives of a European company who kindly agreed to be interviewed for our research. Generous comments from three anonymous reviewers and the journal editors were greatly helpful for revising and finalising this paper.

Funding

This research is part of REINVENT (Realising Innovation in Transitions for Decarbonisation), a project supported by the EU Horizon 2020 Research and Innovation Programme (Grant Number 730053).

References

Arjaliès, D., Grant, P., Hardie, I., Mackenzie, D. and Svetlova, E. (eds.) (2017) *Chains of Finance: How Investment Management Is Shaped.* Oxford: Oxford University Press.

Ascui, F. and Lovell, H. (2011) As frames collide: Making sense of carbon accounting. *Accounting, Auditing & Accountability Journal* 24(8), 978-999.

Ayling, J. and Gunningham, N. (2017) Non-state governance and climate policy: the fossil fuel divestment movement. *Climate Policy* 17(2), 131-149.

Barry, A. (2002) The anti-political economy, *Economy and Society* 31(2), 268-284

Bear, L. (2020) Speculation: a political economy of technologies of imagination, Economy and Society, 49:1, 1-15,

Beckert, J. and Musselin, C. (eds.) (2013) *Constructing quality: The classification of goods in markets.* Oxford: Oxford University Press

Birch, K. (2017) Rethinking *value* in the bio-economy: Finance, assetization, and the management of value. *Science, Technology & Human Values* 42(3), 460-490.

Birch, K. (2019) Technoscience rent: Towards a theory of *rentiership* for technoscientific capitalism, *Science, Technology and Human Values*, https://doi.org/10.1177/0162243919829567

Boltanski, L. and Chiapello, E. (2006) *The new spirit of capitalism*. New York: Verso Books

Bracking, S. (2015) The anti-politics of climate finance: The creation and performativity of the green climate fund. *Antipode* 47(2), 281-302.

Bridge, G., Bulkeley, H., Langley, P. and van Veelen, B. (2019) Pluralizing and problematizing carbon finance. *Progress in Human Geography,* https://doi.org/10.1177/0309132519856260

Bryant, G. (2019) *Carbon Markets in a Climate-Changing Capitalism*, Cambridge, UK: Cambridge University Press.

CA100+ (2019) *Climate Action 100+: Frequently Asked Questions.* Climate Action 100. Available at: https://climateaction100.wordpress.com/faq/

Caldecott, B. (2017) Introduction to special issue: stranded assets and the environment. *Journal of Sustainable Finance & Investment* 7(1), 1-13.

Caldecott, B., Howarth, N., & McSherry, P. (2013) Stranded assets in agriculture: protecting value from environment-related risks. Oxford, UK: Stranded Assets Programme. Available at: https://ora.ox.ac.uk/objects/uuidper cent3A4496ac03-5132-4a64-aa54-7695bfc7be9d

Çalışkan, K. and Callon, M. (2009) Economization, part 1: shifting attention from the economy towards processes of economization. *Economy and Society* 38(3), 369-398.

Çalışkan, K. & Callon, M. (2010) Economization, part 2: a research programme for the study of markets. *Economy and Society* 39(1), 1-32.
Callon, M. (2009) Civilizing markets: Carbon trading between in vitro and in vivo experiments. *Accounting, Organizations and Society* 34(3): 535-548.

Callon, M., Méadel, C. & Rabeharisoa, V. (2002) The economy of qualities, *Economy and Society* 31(2), 194-217.

Carney, M., Villeroy de Galhau, F. and Elderson, F. (2019) The financial sector must be at the heart of tackling climate change, *The Guardian.* April 17. Available at: https://www.theguardian.com/commentisfree/2019/apr/17/the-financial-sector-must-be-at-the-heart-of-tackling-climate-change

CBI (2017) *Bonds and Climate Change: The State of the Market 2017*. Climate Bonds Initiative. Available at: https://www.climatebonds.net/files/files/CBI-SotM_2017-Bondsper cent26ClimateChange.pdf

CBI (2018) *Green securitisation: Unlocking finance for small scale low carbon projects*, Briefing Paper, Climate Bonds Initiative, March, Available at: https://www.climatebonds.net/files/files/Greenper cent20securitisation_CBIper cent20conference_final.pdf

CBI (2019) *Green Bonds: The State of the Market 2018*. Climate Bonds Initiative. Retrieved from https://www.climatebonds.net/files/reports/cbi_gbm_final_032019_web.pdf

Chiapello, E. (2015) Financialization of Valuation. *Human Studies* 38(1), 13-35.

Christophers, B. (2016) Risking value theory in the political economy of finance and nature. *Progress in Human Geography* 42(3), 330-349.

Christophers, B. (2017) Climate change and financial instability: Risk disclosure and the problematics of neoliberal governance. *Annals of the American Association of Geographers* 107(5), 1108–27.

Christophers, B. (2019) Environmental Beta or how institutional investors think about climate change and fossil fuel risk. *Annals of the American Association of Geographers* 109(3), 754-774.

Cooper, M.H (2015) Measure for measure? Commensuration, commodification, and metrology in emissions markets and beyond. *Environment and Planning A* 47(9), 1787-1804.

CTI (2014) *Unburnable Carbon. Are the world's financial markets carrying a carbon bubble?* Carbon Tracker Initiative. Available at: https://www.carbontracker.org/wp-content/uploads/2014/09/Unburnable-Carbon-Full-rev2-1.pdf

Doganova, L. and Laurent, B. (2019) Carving out a domain for the market: boundary making in European environmental markets, *Economy and Society* 48(2), 221-242

Diaz-Bone, R. (2017) Classifications, quantifications and quality conventions in markets - Perspectives of the economics of convention. *Historical Social Research* 42(1), 238-262.

Feher, M. (2018) *Rated Agency: Investee Politics in a Speculative Age*, New York: Zone Books.

FFI (2018) *Fossil Free Indexes FAQ.* Fossil Free Indexes. Available at: http://fossilfreeindexes.com/faq/

Felli, R. (2014) On climate rent. *Historical Materialism 22*(3-4), 251-280.

Fourcade, M. and Healy, K. (2007) Moral views of market society. *Annual Review of Sociology* 33, 285-311.

G20 Green Finance Study Group (2016) *Green Bonds: Country Experiences, Barriers and Options*. Available at: http://unepinquiry.org/wp-content/uploads/2016/09/6_Green_Bonds_Country_Experiences_Barriers_and_Options.pdf

Garcia-Lamarca, M. and Ullström, S. (2020) "Everyone wants this market to grow": The affective post-politics of municipal green bonds. *Environment and Planning E: Nature and Society*. https://doi.org/10.1177/2514848620973708

Go Fossil Free (2018) *Divestment Commitments.* Go Fossil Free. Available at: https://gofossilfree.org/divestment/commitments/

Grady-Benson, J. and Sarathy, B. (2016) Fossil fuel divestment in US higher education: student-led organising for climate justice. *Local Environment* 21(6), 661-681.

Hestres, L.E. and Hopke, J.R. (2019) Fossil fuel divestment: theories of change, goals, and strategies of a growing climate movement. *Environmental Politics.* https://doi.org/10.1080/09644016.2019.1632672

Hunt, C., Weber, O. and Dordi, T. (2016) A comparative analysis of the anti-Apartheid and fossil fuel divestment campaigns. *Journal of Sustainable Finance and Investment* 7(1), 64-81.

IPCC (Intergovernmental Panel on Climate Change) (2018) *Global Warming of 1.5 °C: an IPCC Special Report on the Impacts of Global Warming of 1.5 °C Above Pre-Industrial Levels and Related Global Greenhouse Gas Emission Pathways*. Available at: https://www.ipcc.ch/sr15/

Karpik, L. (2010) *Valuing the Unique: The economics of singularities.* Princeton: Princeton University Press.

Kay, K. (2018) A hostile takeover of nature? Placing value in conservation finance. *Antipode* 50(1), 164-183.

Kish, Z. and Fairbairn, M. (2018) Investing for profit, investing for impact: Moral performances in agricultural investment projects. *Environment and Planning A: Economy and Space,* 50(3), 569-588.

Knuth, S. (2017) Green devaluation: Disruption, divestment and decommodification for a green economy. *Capitalism Nature Socialism* 28(1), 98-117.

Knuth S (2018a) Cities and planetary repair: The problem with climate retrofitting. *Environment and Planning A: Economy and Space* 51(2): 487-504.

Knuth, S. (2018b) "Breakthroughs" for a green economy? Financialization and clean energy transition, *Energy Research & Social Science* 41, 220-229.

Langley, P. (2020a) Impact investors: The ethical financialization of development, society and nature. In: Wojcik, D. & Knox-Hayes, J. (eds.) *Routledge Handbook of Financial Geography*. London: Routledge, in press.

Langley, P. (2020b) Assets and assetization in financialized capitalism. *Review of International Political Economy*. https://doi.org/10.1080/09692290.2020.1830828

Le Billon, P. and Kristoffersen, B. (2019) Just cuts for fossil fuels? Supply-side carbon constraints and energy transition. *Environment and Planning A: Economy and Space.* https://doi.org/10.1177/0308518X18816702

Lohmann L. (2011) The endless algebra of climate markets. *Capitalism Nature Socialism* 22, 93–116

Liu, J. Chung-En (2017) Pacifying uncooperative carbon: examining the materiality of the carbon market. *Economy and Society* 46(3-4), 522-544.

Luke, T.W (2009) A green new deal: why green, how new, and what is the deal? *Critical Policy*
Studies 3(1), (2009) 14olic

McKenzie, D. (2009) Making things the same: Gases, emissions rights and the politics of carbon markets. *Accounting, Organizations and Society* 34(3-4): 440-455.

MacKenzie, D. (2011) The Credit Crisis as a Problem in the Sociology of Knowledge. *American Journal of Sociology* 116(6), 1778-1841.

Mangat, R., Dalby, S. and Paterson, M. (2018) Divestment discourse: war, justice, morality and money. *Environmental Politics* 27(2), 187-208.

McCollum, D., Nagai, Y., Riahi, K., Marangoni, G., Calvin, K., Pietzcker, R., van Vliet, J. and van der Zwaan, B. (2013) Energy investments under climate policy: a comparison of global models. *Climate Change Economics* 4(4), 1340010.

Milman, O., 2018. New York City plans to divest $5bn from fossil fuels and sue oil companies. *The Guardian*. 10 January. Available at: https://www.theguardian.com/us-news/2018/jan/10/new-york-city-plans-to-divest-5bn-from-fossil-fuels-and-sue-oil-companies

Muniesa, F. (2017) On the political vernaculars of value creation. *Science as Culture* 26(4): 445–454.
Muniesa, L., Doganova, L., Ortiz, H., Pina-Stanger, A., Paterson, F., Bougoin, A., ... Méadel, C. (2017) *Capitalization: A Cultural Guide.* Paris: Presses des Mines.

Network for Greening the Financial System (2019) *A call for action: Climate change as a source of financial risk*. Network for Greening the Financial System. Available at: https://www.banque-france.fr/sites/default/files/media/2019/04/17/ngfs_first_comprehensive_report_-_17042019_0.pdf

Nitzan, J. and Bichler, S. (2009) *Capital as Power: A Study of Order and Creorder*. London: Routledge.
Olovsson, C. (2018) Is Climate Change Relevant for Central Banks? *Sveriges Riksbank* Economic Commentaries 13, November 14. Available at: https://www.riksbank.se/globalassets/media/rapporter/ekonomiska-kommentarer/engelska/2018/is-climate-change-relevant-for-central-banks.pdf

Orléan, A. (2014) *The empire of value. A new foundation for economics.* Cambridge, MA: MIT Press.

Ouma, S. (2018) This can(`t) be an asset class: The world of money management, "society", and the contested morality of farmland investments. *Environment and Planning A: Economy and Space*, *https://doi.org/10.1177/0308518X18790051*

Ouma, S., Johnson, L. and Bigger, P. (2018) Rethinking the financialization of 'nature'. *Environment and Planning A: Economy and Space* 50(3), 500-511.

Partridge, J. (2020) World's biggest fund manager vows to divest from thermal coal, The Guardian, January 14. Available at: https://www.theguardian.com/business/2020/jan/14/blackrock-says-climate-crisis-will-now-guide-its-investments

Pistor, K. (2019) *The Code of Capital: How the Law Creates Wealth and Inequality*. Princeton, NJ: Princeton University Press.

Ponte, S. and Gibbon, P. (2005) Quality standards, conventions and the governance of global value chains. *Economy and Society* 34 (1): 1-31.

PRI (2015) *How measuring a portfolio carbon footprint can assist in climate risk mitigation and reducing emissions.* Principles for Responsible Investment. Retrieved from: https://www.unpri.org/climate-change/how-measuring-a-portfolio-carbon-footprint-can-assist-in-climate-risk-mitigation-and-reducing-emissions/608.article

PRI (2018) Montreal Pledge – Formalise your carbon footprint goals. Principles for Responsible Investment. Retrieved from: http://montrealpledge.org/

Ritchie, J. and Dowlatabadi, H. (2015) Divest from the Carbon Bubble? Reviewing the Implications and Limitations of Fossil Fuel Divestment for Institutional Investors. *Review of Economics and Finance* 5, 59-80.

Solsvik, T. (2019) Norway sovereign wealth fund to divest oil explorers, keep refiners. *Reuters.* Available at: https://www.reuters.com/article/us-norway-swf-oil/norway-sovereign-wealth-fund-to-divest-oil-explorers-keep-refiners-idUSKBN1WG4R9

Stausball A (2015) Selling out of fossil fuels no solution to climate change, *Financial Times*, March 22. Available at: https://www.ft.com/content/def47f8c-bb8d-11e4-b95c-00144feab7de#axzz3VcgvVAw7

Sullivan, S. (2018) Making nature investable: from legibility to leverageability in fabricating 'nature' as 'natural capital'.' *Science and Technology Studies* 31(3), 47-76.
TEG (2019) TEG report on EU Green Bond Standard. *European Commission.* Available at: https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/190618-sustainable-finance-teg-report-green-bond-standard_en.pdf

The Global Commission on the Economy and Climate (2014) *Better Growth Better Climate. The New Climate Economy Report.* Washington DC: Report for the World Resources Institute. Retrieved from: http://newclimateeconomy.report/2014/wp-content/uploads/sites/2/2014/08/NCE-Global-Report_web.pdf

Tripathy, A. (2017) Translating to risk: The legibility of climate change and nature in the green bond market. *Economic Anthropology* 4(2), 239–250.

Notes on contributors

Paul Langley is Professor of Economic Geography at Durham University. His publications include *Liquidity Lost* (Oxford University Press, 2015) and *The Everyday Life of Global Finance* (Oxford University Press, 2008).

Gavin Bridge is Professor of Human Geography at Durham University. His publications include *Energy and Society: A Critical Perspective* (Routledge, 2018) and *Oil* (Polity, 2017).

Harriet Bulkeley is Professor of Human Geography at Durham University. Her publications include *Accomplishing Climate Governance* (Cambridge University Press, 2015) and *An Urban Politics of Climate Change* (Routledge, 2014).

Bregje van Veelen is Researcher at Uppsala University, Sweden. Her publications include Caught in the middle? Creating and contesting intermediary spaces in low-carbon transitions (*Environment and Planning C: Politics and Space*, 2020), and she currently holds a Formas Mobility Grant for the project 'Post-carbon: Imaging the future to unmake the present'.