**Modern finance theory and practice and the Anthropocene**

**Abstract :**

The Anthropocene, as a geological epoch, has come to be defined in terms of the variability within the Earth System’s operations as measured through various markers such as surface temperatures and CO2 emissions. These variations are generated by human activity, characterised by catastrophic processes and outcomes, and beyond any previous natural variability. This paper focuses on how modern finance theory and practice respond to one of the overflows that it has helped generate - namely, adverse anthropogenic effects such as climate change and soil degradation. Although modern finance theory and practice are capable of generating alternative socio-technical arrangements such as socially responsible investing and abatement markets to alleviate such adverse effects, these alternatives, for the very fact of their embeddedness in the financialised form of thermo-industrial capitalism, are prone to suffer from what some scholars describe as capitalism’s creative self-destruction.

**Key words**: Anthropocene, Bretton Woods, Finance theory, Performativity, Financial practice, Externalities

# Introduction

The Anthropocene as a geological epoch has come to be defined in terms of the variability within the Earth System’s operations as measured through markers such as surface temperatures and CO2 emissions. These variations, which have taken a steep upward trajectory since 1945 and thus been called ‘the Great Acceleration’, are argued to be generated by human activity; characterised by catastrophic processes and outcomes such as famines, floods and extinctions; and beyond any previous natural variability (Steffen et al. 2011). As the Intergovernmental Panel on Climate Change (IPCC) (2018) - the authoritative scientific body on the subject matter has warned governments that the world has only a decade or so to set global greenhouse gas (GHG) emissions (henceforth GHGs) on a sharply downward path, the parties to the 2015 Paris Agreement and the United Nations Framework Convention on Climate Change (UNFCCC) are gearing up to devise ever more regulatory and market-based mechanisms in their jurisdictions (Stavins and Stowe 2017).

Starting from the previous rounds and protocols of the UNFCCC, mechanisms such as abatement markets have been given a prominent role (Paterson 2010). Moreover, those calling for more sustainable businesses have been urging corporations to take on more responsibility towards alleviating uncosted harms that they directly or indirectly generate. One of the prominent outcomes is socially responsible investing (SRI), which urges its volunteer subscribers to take active roles as shareholders in corporate decision-making processes (Sparkes and Cowton 2004). Puzzlingly, both types of solutions have been gaining institutional ground and practical traction in recent decades, despite the fact that their performance in reversing adverse environmental effects (henceforth anthropogenic effects) has been falling short of what is required by the immense decarbonization challenge ahead (Bryant 2018).

In this paper I attempt to unpack this puzzle by contextualizing these market-based mechanisms within the gradual convergence of modern finance theory and practices since the 1970s. I argue that the puzzle should be understood within the rise of ‘reflexive modernization’ responses such as the ‘sustainability and precautionary principle’ (Beck et al. 1994) and ‘climate capitalism’ (Newell and Paterson 2010) that can give yet another lease of legitimacy and accumulation to the capitalist world economy (Wallerstein 1979) , which has been a thermo-industrial one since the nineteenth century (Di Muzio 2011). Accordingly, both SRI and abatement markets are responses by political and economic actors, including scientific and practitioner communities of modern finance, to the manufactured yet overlooked risks of anthropogenic effects - also known as ‘externalities’ or ‘overflows’ (Callon 1999).

Yet, as shall be demonstrated, these two reflexive modernisation responses to the Anthropocene are prone to be undermined to the extent that they operate within a ‘financialised’ capitalist world economy (Wright and Nyberg 2015) where scientifically calculable yet narrow financial interests, devices and metrics such as return on equity ‘economise’ the purpose, design and process of the production, ownership, exchange and consumption of goods, services, and assets (Caliskan and Callon 2009). I argue that this type of financialised economisation, which MacKenzie et al (2007) describe as the ‘performativity’ of economics and more specifically modern finance theory, when investigating its market and system level applications, started to become institutionalised in the early 1970s when the post-WWII Bretton Woods system of gold-backed fixed currencies and restrained capital markets collapsed. Since then, financialised economisation has been helping private and public actors govern the world under the cloak of ostensibly apolitical but substantively neoliberal economic and financial metrics and techniques in many jurisdictions of the world economy (Lohmann 2010, Di Muzio 2011). The resultant and projected adverse social, economic and environmental effects and outcomes have led Wright and Nyberg (2015) to describe financialised economisation as global corporate capitalism’s ‘creative self-destruction’ for the sake of such myopic economic and financial metrics of capitalist accumulation.

By combining performativity (MacKenzie et al. 2007) and political economy (Erturk et al. 2013) approaches to economics and markets, and by presenting a stylised history of modern finance theory, I show how the recent evolution of SRI and abatement markets constitute responses to not only the Anthropocene but also the very 'counter-performativity' (MacKenzie et al. 2007) of modern finance theory, more specifically its information efficient market hypothesis (Fama 1970). When performed in the post Bretton Woods’ era markets, this hypothesis seems to have bracketed out anthropogenic effects among other externalities as irrelevant. I then show how these solutions also suffer from overflows and counter-performativities of modern finance theory and practice. I conclude with a summary of the findings and a note on the performativity and political economy approaches to markets.

# Modern Finance Theory and Practice and the Anthropocene

Sharing with neoclassical economics, methodological individualism and elegant mathematical reductions on economic, social and behavioural complexities, modern finance theory has been built on two pillars. The first is the late 19th century mathematical treatises by finance scholars and practitioners on applying the notion of Brownian Motion to randomly moving stock prices (Preda 2004). The second is the 18th century expected utility theory and its 20th century mathematical expression for rational judgement and decision-making (Von Neuman and Morgernstern 1944). In the 1950s, modern finance theorists started to combine these previously scattered theories into a unified modern finance theory to solve the puzzle of random prices in markets (Samuelson 2009). Having attributed price randomness to a hypothetical ‘frictionless’ market that generated free information that was instantaneously and unequivocally processed by rational individuals who could not know future information, finance scholars started to test the ‘information efficiency’ of markets and confirmed close to zero serial correlations in historical prices, and prices that quickly adjusted to information as they became publicly available (Fama 1970).

Before modern finance theorists solved the puzzle of random prices, they had already developed theories, such as Harry Markowitz’s capital asset pricing model in 1952 and Franco Modigliani and Merton Miller’s capital structure theorem in 1958, which helped finance practitioners make decisions in real life, as envisaged in these models (Sharpe 1991). As demonstrated by sociological, institutional and political economy studies (Lounsbury 2002, MacKenzie 2005, Millo and MacKenzie 2009, Lohmann 2010), there had been a gradual shift from the regulatory logic of the Bretton Woods system, which minimised financial risks by supressing global finance practices in an ‘embedded’ or ‘Keynesian’ global financial order (Ruggie 1982, cited in Best 2003), to a market logic of open capital markets on the back of these theoretical advances and techniques of asset valuation, portfolio and risk management for an axiomatically efficient and self-regulating market.

Given the widespread adoption of modern finance theory by practitioners and regulators in the post-Bretton Woods era, the theory and its practical applications are argued to have performative effects over the design, functioning and outcomes of financial markets and systems, bringing the latter closer to the aforementioned hypothetical states (Mackenzie et al. 2007, Lockwood 2015, Braun 2016). One can also argue that the convergence of modern finance theory and practice in the post-Bretton Woods era has also been performative with regard to the relatively uninterrupted and counter-intuitive expansion of economic globalisation - world trade to world GDP doubled its 1970 level in 2004, as well as the resumption of financial globalisation with a vengeance - foreign assets and liabilities to world GDP increased fivefold between 1970 and 2004 reaching $100 trillion (Kose et al 2010).

To substantiate, MacKenzie et al. (2007) put forward four types of performativity ‘generic’, ‘effective’, ‘strong’, 'counter' for any scientific theory, depending on the way they affect economic processes and outcomes. Generic performativity refers to mere usage of a scientific theory in economic processes, whereas effective performativity means the use of the theory must make a difference to economic processes and outcomes. Strong performativity refers to the theory transforming economic processes in the image of the theory itself. Counter-performativity refers to the use of the theory in economic processes generating the opposite effect of what it axiomatically enacts on paper.

To wit, the convergence of modern finance theory and practice in the post-Bretton Woods era, especially in relation to managing uncertainties around fiat currencies and interest rates of a 'nonsystem' (Truman 2012), attests to the generic performativity of the theory. Moreover, the continued expansion of global trade and the resumption of financial globalisation in the aforementioned magnitudes would not have been possible without the help of this convergence. However, it might be difficult to econometrically isolate the convergence’s effective performativity or specific contribution to economic and financial globalisation given the global scope of finance practice as measured through the number of countries accessing global markets - ~75% of all countries, covering almost the whole world economy (Kose et al 2010).[[1]](#endnote-1) Nonetheless, this convergence has surely increased the judgement and calculation capabilities of the socio-technical arrangements in the face of an ever complex and uncertain global economic and financial landscape, by helping any type of uncertainties to be commodified and traded as risk (Lohmann 2010).

As the convergence has helped economic and financial globalisation, it has played a role in the latter's positive contribution to economic growth (Kose et al. 2010), which is hard to 'decouple' from GHGs (Hickel and Kallis 2020) and thus the trajectories and ongoing effects of the Anthropocene in the same era (Steffen et al 2011).[[2]](#endnote-2) As Callon (1999) stated, the use of any economic theory means that there will eventually be overflows or counter-performativities, some of which are gradual (for example, anthropogenic effects), and some more abrupt and dramatic than others (for example, market crashes). It is these types of overflows and counter-performativities where the relationship among modern finance theory and practice and the Anthropocene can become clearer than econometric relationships between globalisation and economic growth demonstrate. More importantly, these can also explain the rise of SRI and abatement markets as a response to adverse environmental effects of thermo-industrial capitalism, and why these solutions are also prone to suffer from yet other overflows and counter-performativities. I substantiate these in the following sections.

# The Anthropocene - Overflows in a perfect market?

In the post-Bretton Woods era, one can count as examples of overflows on modern finance theory persistent price and return predictabilities (Subrahmanyam 2008), many individual financial failures, such as the Long-Term Capital Management hedge fund run by the Nobel prize winning theorists Myron Scholes and Robert Merton (MacKenzie 2005), and not infrequent system-wide financial crises following credit and asset bubbles (Di Muzio 2011). Not unlike these types of overflows and counter-performativities that problematise the existence of information efficient markets, the financial facilitation of anthropogenic activities-namely, economic activities that have adverse anthropogenic effects seems to bracket out their existing and future impact on the Earth System as value-irrelevant.

The mathematical elegance of modern finance theory comes from its modelling frugality on the complexity of the real world (Samuelson 2009). It might therefore be naive to expect its performativity to incorporate environmental issues as one of the determinants of price or risk. Examples of such models are the Nobel prize winning Black-Scholes-Merton model on derivatives, which happens to underpin hundreds of trillions of dollars of notional contracts for risk and futures management in real and financial assets (MacKenzie 2005), ‘index-funds’ passively tracking ‘information efficient markets’ instead of ‘active fund management’ (Braun 2016), and the practice-based Value-at-Risk management model, which happens to determine, under the auspices of the Bank for International Settlements - the central bank of central banks, how much equity banks should have to cope with losses from their lending and investment activities (Lockwood 2015), which are to a large extent linked to anthropogenic activities.

However, it is the frustration of this naive expectation that matters. To put it another way, the generic, effective and even strong performativity of these specific theories and applications, and their intermittent but spectacular counter-performativities, make any exclusion or bracketing out, including anthropogenic effects, matter. As put by Freund (2015, p.1531), such exclusions ‘that exacerbate ecological disruption, waste and pollution’ can be seen as tantamount to ‘a delusion’ and calls for ‘re-programm[ing] the global financial operating system to reward activities that reduce’ such adverse processes and outcomes.

# Attempts at Re-programming: SRI

SRI works by denying direct and indirect financing to anthropogenic activities and diverting financial funds and services to socially and environmentally sustainable businesses. From its religiously driven origins in the 1920s, that is, divesting from ‘sin stocks’, the focus of SRI has turned to broader socio-economic and environmental concerns in recent decades (Sparkes and Cowton 2004). As such, its share in total assets under management has expanded spectacularly. For example, in the USA, SRI funds expanded from $640 billion in 1995 to $3 trillion in 2011 (Valdez and Molyneux 2013), which then quadrupled to $12 trillion in 2018. This constituted 26 per cent of all assets under management in the USA (GSIA 2018). Similarly, in Europe, the share of investments that have an SRI aspect in their management jumped from 11 per cent in 2008 (Crifo and Mottis 2016) to 49 per cent in 2018 (GSIA 2018).

Behind these spectacular expansions lie the increasingly popular voluntary corporate reporting efforts. These include environmental social and governance (ESG) reporting, and external screening, for example via indices, rankings and certifications, formed and run by a range of intergovernmental, non-governmental, profit, and not-for-profit organisations (Beunza and Ferraro 2018). Despite their diversity, these organisations’ aim has been to hold corporations to account on ESG issues in a globalizing economy and finance that is devoid of a global public governance structure (Waddock 2008). For companies, voluntarily disclosing information on ESG issues and devising rectification plans/actions can be seen as irrational from a narrow shareholder value maximization or ‘agency logic’ viewpoint, operating in quarterly terms (Zajac and Westphal 2004). However, ESG reporting and action provide companies with a source of ‘procedural legitimacy’ and increase their ‘cognitive legitimacy’ (Suchman 1995) in an operating environment where national and/or global public regulations and governance may be absent or inapplicable, but adverse ESG outcomes keep companies vulnerable to scandals, economic harm, and reputation ruin. Such reporting and action are therefore seen as both legitimacy-seeking and practically driven (Bernstein 2011). Not surprisingly, voluntary ESG disclosure is also reported to increase (decrease) companies’ market valuations on the back of good (bad) environmental performance, including inclusions (exclusions) from ESG indexes (Doh et al. 2010), especially when it gives clear signals on ESG-related cash-flows to investors (Fatemi et al. 2018). Moreover, non-disclosure on adverse anthropogenic outcomes such as CO2 emissions are shown to exacerbate negative market valuations on comparable firms (Matsumura et al. 2013).

Despite these performative achievements of SRI and its ESG tools in financial markets, they are also shown to be prone to suffer from a number of issues. At the micro level, there can be ‘decoupling’ between what is professed and done by reporting companies (Zajac and Westphal 2004). Such decoupling, when concerned with environmental issues, constitutes ‘greenwash’ - namely, corporations using a spectrum of communication tactics, including subtle commensuration of seemingly incompatible goals, to manage stakeholders’ perceptions on corporate green credentials (Wright and Nyberg 2016).

Relatedly, although markets recognise and reward companies’ ESG efforts by better valuations and pricing, it is demonstrated that these rewards focus more on the procedural efforts than the actual carbon performance of reporting companies. Global Reporting Initiative (GRI) and Carbon Disclosure Project (CDP) subscriptions, on which SRI relies, among other such schemes, do not necessarily reduce companies’ and sectors’ contribution to anthropogenic markers such as CO2 (Haque and Ntim 2020). As explained by Harmes (2011), it seems that SRI and ESG tools are well-capable of addressing anthropogenic effects by first converting them from ‘externalities’ to ‘information asymmetry’ issues, and then providing information on the latter. Yet, as reviewed above, puzzlingly, SRI subscribers and other market participants are not effectively incorporating relevant information in their valuations and pricing of assets.

Perhaps more worrying is what effect passive fund management via index-funds is poised to cause on SRI and information efficiency in markets. In 2019, index-funds, as performed by the efficient market hypothesis (Braun 2016), have surpassed actively managed funds in the USA, and are poised to do so in other markets (Fichtner et al. 2020). Because passive investment heavily relies on readily made-indices by the market and index owners, and the latter generally ignore SRI and ESG concerns owing to the still marginal uptake of SRI in markets, the fast-passivizing global fund management industry will undermine existing SRI efforts by active fund managers, who are already too fractured, in terms of fiduciary mandates, time horizons, and competition dynamics, to present a united SRI front against the Anthropocene (Harmes 2011) .

At the macro level, there are differential audience attitudes towards the source (private or public) and legitimacy of business norms and regulations, which affect the scope and spread of the voluntary ‘best practice’ scheme subscriptions such as GRI and CDP (Bernstein 2011). In fact, public and private financial organisations, which rely on such ESG reporting schemes to manage trillions of US dollars’ worth of assets, are shown to exert more performative market valuations on corporations when there are stronger signals towards intergovernmental treaties and national level implementations (taxation, bans) on preventing anthropogenic activities (Kim and Lyon 2011).

Irrespective of these issues, given the complexity of the Earth System, it would be naive to assume that with these schemes’ uptake increasing considerably, finance markets and systems are on the way to becoming information efficient regarding the long-term trajectories and outcomes of anthropogenic activities. In a way, sharing and performing an alternative economic model such as SRI is ‘finitist’ (MacKenzie 2009) in the sense that the socio-economic reality it reproduces (for example, a company being rewarded in share price for its ESG reporting) does not necessarily account for the Earth System’s reality, so to speak. Adapting the famous institutional economist, Joseph Schumpeter’s concept of ‘creative destruction’ to explain the evolution of capitalism, Wright and Nyberg (2015) describe this finitism and disconnect as ‘creative self-destruction’- namely, humanity being locked into the thermo-industrial capitalist world economy, and thus annually economic-growing towards an Earth System failure or what Earth scientists call tipping elements in the hands of an ever-innovative global corporate capitalism. Such Earth System events as the melting of perma-frost could put global warming on a non-linear trajectory of +6 to +10 °C, and cost an additional $1.5 quadrillion to the global economy, on top of the UNFCCC’s +1.5 °C target’s estimated cost of $600 trillion by 2300 (Yumashev et al. 2019).

For example, one of the issues that has been persistently bracketed out by ESG reporting schemes, such as GRI, which was introduced by the UN and a not-for-profit organisation in the late 1990s, is man-made soil degradation. This issue concerns not just the global agricultural sector, but all other businesses, given the soil’s crucial role in carbon and climate cycles, water management, and so on (Davies 2017). Perhaps, the biggest issue with ESG reporting, according to reporting companies and modern finance practitioners (PwC 2016) is the fact that ESG reporting forms and indices have not culminated in regional or international standards akin to financial and management accounting standards, such as the International Financial Reporting Standards, issued by international professional organisations and incorporated into regulations in most national jurisdictions. Moreover, the proliferation of ESG rankings and certifications in the absence of such regulatory standards means that the same company may be ranked differently by different issuing bodies, providing even more room for greenwashing by voluntarily disclosing companies (Nauman 2020), and plausibly contributing to the counter-performative ESG and SRI pricing practices mentioned before. These issues are reported to undermine SRI volunteers’ trust in ESG reporting as a source of value-relevant information (PwC 2016).

Despite these issues, there is a considerable momentum of growth in the size and scope of SRI, as evidenced in the aforementioned figures. Nevertheless, SRI is firmly embedded in secondary equity markets. Accordingly, this type of market ‘hardly provides new finance to firms’ once initial funds are raised in primary equity markets (Scholtens 2006, p.28). For example, national and international corporate bond (debt) markets have become important sources of corporate credit in recent decades but creditors there do not seem to pay as much attention to the SRI performance of debtors as they do in equity markets (Menz 2010). Some observers estimate the share of so called ‘green bonds’ in the total bond issuance at a mere two per cent (Wilde 2017).

Perhaps even more worryingly, among what is labelled by regulators as the “too-big-to-fail” 40 or so giant banks, many continue to provide wholesale or private equity financing and underwriting to “creditworthy” borrowers, without any meaningful internal or external scrutiny and action plan regarding the relationship of these loans to anthropogenic activities (Cogan 2008). One of the actors these banks have in their loan books are ‘activist hedge funds’, that are shown to take control of corporate management to increase operational efficiencies and shareholder value in the short-term, and in the process adversely affect companies’ long-term ESG performance (DesJardine and Durand 2020).

It is therefore not surprising that the global energy sector, whose capital structure should be indifferent to debt and equity, according to the capital structure theorem, has increased its debt-to-equity ratio in recent years, and financed the exploration of new hydrocarbons such as shale gas with this ‘overleveraged’ structure (Domanski et al. 2015). Unsurprisingly, financing and underwriting provided by the “too-big-to-fail” banks to the global energy sector for existing and new fossil fuel production projects have been increasing annually and reached a total of $3.8 trillion since the Paris Agreement in 2015 (Rainforest Action Network et al 2021). The financing of anthropogenic activities in this unabated manner has been happening in a context where almost all the “too-big-to-fail” banks and many others have long adopted a number of private governance frameworks (for example, ‘Equator Principles’ for socially and environmentally responsible project financing since 2003) (Wright 2012) and made headline grabbing pledges recently to align their lending and underwriting services with the Paris Agreement (Rainforest Action Network et al 2021).

The SRI framework, despite its troubles, can still help change corporate behaviour. This is dependent on the extent to which SRI and its ever-growing voluntary ESG reporting and management standards can succeed in denying financing and legitimacy to anthropogenic activities. However, the ways in which such standards work and (fail to) alleviate anthropogenic effects are quite telling as to why voluntary reporting and management standards are a case of “talking the talk” not translating into “walking the walk” for the producers and financiers of anthropogenic effects. If and when these schemes and their guiding principles become widely and strongly performed in different asset markets, this will be an important step towards establishing an ‘ecological regime of accumulation’ as Paterson (2010) puts it.

# Attempts at Re-programming: Abatement Markets

Perhaps, a more ambitious step at establishing such an ecological regime , especially from the point of ‘performing [...]economics in the wild’ (MacKenzie et al 2007) has been on the basis of commodifying anthropogenic markers such as CO2 and trading them in dedicated markets with an overall emission cap (MacKenzie 2009, Paterson 2010). The original idea behind abatement markets comes from neoclassical economics, Nobel prize winning Robert Coase’s assetisation (ownership) and commodification (trading) response to the tax- and subsidy-based solutions to the intractable problem of national and transborder externalities in capitalist economies (Newell and Paterson 2010). In this respect, the so-called ‘cap-and- trade’ markets also capitalise on the neoclassical economic belief in the superiority of market exchange in creating efficiencies in information generation and price discovery over ‘blunt’ state interventions (Schmalensee and Stavins 2017). This is a belief that not only modern finance theory (Fama 1970, cf. Subrahmanyam, 2008) but also environmental economists (Lane 2012) have striven to demonstrate since the 1970s, and in the process entangled themselves with politicians and regulators in neoliberal market design and policy making. On the environment front, this started first in the US and then continued in the rest of the world with the Kyoto Protocol (MacKenzie 2009).

Since the Kyoto Protocol’s introduction of a compliance-based emission trading mechanism, there are now 31 regional and national ‘cap-and-trade markets’ for the abatement and elimination of GHGs – foremost among them is the European Union (EU) Emissions Trading Scheme (ETS) – a regional carbon permits exchange with spot and derivatives products. The EU ETS commands 90% of the estimated market capitalisation of $280 billion in these markets as of 2020 (Refinitiv 2021). China’s nascent national emission trading system inaugurated in 2020 and poised to become the world’s biggest is worth noting too (World Bank 2020). Nonetheless, there are serious detractors of these compliance-based cap-and-trade markets as well as voluntary abatement mechanisms on the basis of their distorted political economic underpinnings, for example, private actors’ influence over market design, including the initial permit allocation numbers and how they are distributed (free vs. auctions), cross-border regulatory short-comings seized by fraudsters and criminals, and perhaps the more serious issue of these schemes’ ineffectiveness in reducing and reversing anthropogenic activities, which some detractors see as tantamount to ‘climate fraud’ (see Paterson 2010, for a detailed discussion, including on voluntary abatement/elimination schemes, which are poised to take a prominent crediting role with the Paris Agreement - World Bank 2020). As the world is gearing up for the expansion of cap-and-trade markets and their integration for more liquidity and efficiency, it is worrying to see industry observers (Martunizzi and Ashworth 2020) still talking about the types of issues that Paterson (2010) discussed.

At the micro level, national and regional abatement markets can fall prey to market design issues (Schmalensee and Stavins 2017) and the counter-performativity of modern finance theory and practice. On the market design issues front concerning these ‘economic experiments’, one can count the commensurable emission permits and credits despite underlying gases’ differential abatement costs (for example, “expensive” CO2, vs “cheap” HCFC-23), and perhaps more generally the assetisation and exchangeability of GHGs underpinned by the IPPC’s scientific ‘black-boxing’ of GHGs’ ‘exchange rate’ in a politically yet to be ‘cooling’ market design, and the consequent activities of market participants, including individual and corporate financial speculators for profit generation (MacKenzie 2009). It is not surprising that major global banks as well as professional investors quickly set up carbon investment funds and trading desks (Lohmann 2010) to seize, in the words of an industry insider, 'wonderful volatility plays' brought by cap-and-trade markets (Ellenberger 2011).

The commensuration processes by the IPCC has mattered since the advent of market-based mechanisms and their linked nature in the early 2000s. For example, the Clean Development Mechanism (CDM) and Joint Implementation (JI) mechanisms of the Kyoto Protocol, which allow actors to earn certified emission reduction credits (CERs) and emission reduction units (ERUs) with abatement/elimination projects at relatively cheaper costs in the developing world could be traded in EU ETS (Lohmann 2010). This has meant not only increased emission of “cheaper” gases to earn these credits (Schneider and Kollmus 2015) but also what can be called an “abatement carry-trade”. This means (forward) selling cheaply obtained credits which command market prices in cap-and-trade markets such as the EU ETS (MacKenzie 2009, Lohmann 2010). Not surprisingly, this carry trade, designed and/or financed by banks and specialised carbon investment funds, had led to downward price volatility in the EU ETS as its biggest market before regulatory changes that virtually stopped this perverse incentive and thus CERs’ and ERUs’ issuance long before the Paris Agreement came into force in 2020 (Green 2017, World Bank 2020). As another symptom of the abatement carry-trade, it is not surprising to see that around 72% of credits to date appear to have been earned with what can be called “low hanging fruits” in industrial emissions and renewables. Other prominent GHGs generators such as transport and agriculture have not lent themselves to CERs and ERUs as they are still “uneconomical” to pursue (World Bank 2020).

What will replace these voluntary mechanisms and their links with cap-and-trade markets remains uncertain as there are political disagreements in the Paris Agreement over whether developing countries should participate via market or non-market mechanisms in the abatement efforts (World Bank 2020). The resolution of this uncertainty matters a lot as it will determine whether Earth System scientists’ hopes for technological leapfrogging in the developing world in the current era of what they call anthropogenic “democratisation”, attesting to increased GHGs in the developing world, will come to fruition (see Steffen et al 2011). The evidence so far is not encouraging as studies on energy efficiency in economic output and on anthropogenic markers such as CO2 point to a decrease in the former and increase in the latter in developing countries since 2000, as opposed to what has happened in developed countries during the same period (Hickel and Kallis 2020).

The specific issue discussed above is symptomatic of potential overflows on Coase’s solution in a global carbon economy. As regulators have been fixing such issues within and across abatement mechanisms (Schmalensee and Stavins 2017), there will nonetheless be other overflows on cap-and-trade markets and their ultimate aim of abating and elimination. This is because once commodified and furnished with exchangeable ownership rights/obligations, GHGs then turn into any other asset that modern finance theory and practice will take an avid interest in with narrow concerns of financial returns and market efficiency through arbitrage too (Lohmann 2010). This is where market design issues meet the counter-performativity of modern finance theory and practice, to which I turn below.

As introduced before, the 'wonderful volatility plays' in carbon trading include writing option contracts on carbon permits and credits to benefit from market issues and regulatory reactions (Ellenberger 2011). Organised exchanges have offered carbon derivatives (for example, options, and futures) on spot permit trading in cap-and-trade markets as long as the latter existed. In fact, the bulk of the market capitalisation calculated in carbon markets come from trading in these derivative markets (Bryant 2018). Just like in any other derivative markets, these contracts allow hedging, arbitrage and speculation in anticipation of market events such as supply and demand imbalances, regulatory changes, and mispricing. As such, they rely on not just the state-of-the-art option and futures contract valuation models applicable to any spot asset (Valdez and Molyneux 2013) but also narrative models (Rebonato 2013) on the trajectory of asset prices. The valuation models for derivatives, which take into consideration factors such as the underlying asset price, risk free interest rates, and yields generated from holding the underlying asset or an alternative one, and implied volatility of underlying asset help hedgers such as energy utilities to minimise risks relating to their operations (for example, emitting more than the allocated allowance) (Bryant 2018), and financial arbitrageurs to correct mispricing among similar assets (for example, carbon permits and credits, spot and derivative permits) irrespective of market events (Beunza et al 2006). The common feature for hedgers and arbitrageurs is that the derivative valuation models assume risk free operations in between efficient spot and derivatives markets to uphold a no-arbitrage equilibrium. Speculators, on the other hand, need not rely on these and can buy and sell with prevailing narrative models in the market to generate returns.

Two aspects derivatives bring to any asset market worth noting are leveraged trading (marginal capital requirement to buy/sell contracts on underlying assets ) and a tenuous link between speculators and underlying asset, especially when settlement of contracts can be done in cash. The latter applies to carbon derivative markets too (Bryant 2018). Relatedly, aforementioned market roles are not static. Unsurprisingly, commodity derivatives trading has long been criticised for the plausible effect of this tenuous link on spot prices and pushing people’s livelihoods to the brink via speculative price surges and crashes (see Huchet and Fam 2016 for empirical evidence). In the case of carbon markets, if one takes the EU ETS as the benchmark market given its dominance, one can see price surges and crashes in this market, which undermine the market’s ability to abate GHGs (Bryant 2018, Quemin and Trotignon 2021). These price swings are attributed to the aforementioned issues of permit/credit gluttony, economic cycles and prices of fossil fuels, and political wrangling over unfolding market design (Fan et al 2017, Friedrich et al 2020), and subsequent rational myopia of compliance actors (polluting firms) (Quemin and Trotignon 2021). In a comprehensive review of the econometric studies on the efficiency of the EU ETS spot and derivative markets so far, Friedrich et al (2020) observe the following. The markets do not always reflect demand (economic) and supply (regulatory) fundamentals efficiently. Financial actors are more active than compliance actors in generating trading volume by taking on a speculator role. There are market inefficiencies caused by behavioural biases, that is, overreaction and underreaction to news, herding, use of technical trading rules, which modern finance theory equates to ‘Astrology’ (MacKenzie 2005) and by myopia induced hedging demand. As a result, both spot and derivate carbon markets are observed to be not always ‘cointegrated’, that is, they do not continuously exhibit prices that can be achieved in efficient spot and derivative markets that are linked through the state-of-the-art valuation and arbitrage models on futures contracts (Friedrich et al. 2020).

It is worth noting that the models by which these observations are made on cap-and-trade markets do not have any reference to Earth System “fundamentals” so to speak, for example, what the 1.5 °C requirement intrinsically implies for carbon price. This is perhaps not surprising as the mathematical elegance of modern finance theory and practice comes from their bracketing out as many phenomena possible from their calculative models 'in the lab [and] in the wild' (MacKenzie et al. 2007). Even if modern finance practice had performed the theory perfectly in carbon markets, it would not have had anything to say about what the right carbon price is from an Earth Systems’ perspective. While it is true that ascertaining the demand (emission) driven price of carbon in markets is not without uncertainty (MacKenzie 2009), the World Bank (2020) and the IMF (2021) are already discussing what the carbon price should be in different jurisdictions given their (required) pledges to achieve the Paris Agreement targets. It is clear that market actors do not find this information relevant under current circumstances given the global average price of carbon in abatement and tax mechanisms is a mere $2 per ton of GHGs (IMF 2021) and almost half of the market and tax mechanisms command a carbon price less than $10 (World Bank 2020).

These findings on the state of modern finance practice in carbon markets would not surprise the detractors of the efficient market hypothesis of modern finance theory (Subrahmanyam, 2008). Financial actors seem to be important performers of these overflows on the Coasean solution of finding the right price for carbon, and on modern finance theory’s notion of efficient markets via risk free arbitrage in an asset market like the EU ETS. Ironically, as more developed and developing countries are making unprecedented pledges to cut emissions, industry observers and insiders are in an exuberant mood, reminiscent of the early 2000s (Bryant 2018), and describe carbon market prices as a 'one way [up] bet' for hedge funds, global investment banks, and more traditional investors such as pension funds (Sheppard 2020). These observations may be heralding a new narrative model that anticipates the continuation of this era despite the Covid-19 induced economic contraction. This seemingly historical turn of events has recently anchored the carbon price in the biggest cap-and-trade market within the lower end of what the World Bank (2020) presents as the right price bracket (i.e., $40-80/tCO2). In fact, in the face of this price surge, some policymakers in the EU are calling for a carbon price ceiling owing to competitive concerns in a global economy devoid of a global cap-and-trade market or carbon tax, and concerns about spot price manipulation via ‘market cornering’ in derivative markets (Carbon-Pulse 2021).

The events in cap-and-trade markets as exemplified in the EU ETS as the dominant

market demonstrate that the scientific black-boxing by the IPCC, which constitutes a very important infrastructural underpinning alongside the state-of-the-art theories and tools of modern finance are not sufficient to cool down these markets. Although GHGs in the EU have gone down since the inception of the EU ETS, only a fraction of this reduction is attributed to the EU ETS directly, and the rest to long-term trends in the economy (for example, deindustrialisation), a “dash for gas” and renewables on the back of national regulations and subsidies (see Green 2021 for an exhaustive review). None of these reductions, not to mention those achieved by other cap-and-trade markets are anywhere near what the IPCC warns as the required cuts in GHGs to keep global warming at 1.5 °C. In the meantime, a counter-performative Coasean solution in the form of depressed carbon prices is shown to have created perverse incentives in the form of further investment in fossil fuels in the EU such as coal as it made sense economically (Neslen 2016).

There are solutions to market design issues in Coasean markets, for example, shifting to auctions for permit distributions, reforming the commensurability scheme for underlying gases to prevent price depressing carry trades, and putting floors and ceilings or so-called ‘price collars’ on carbon emissions (Schmalensee and Stavins 2017). These design solutions might be ethically more palatable than the Coasean solution of environmentally conscientious market actors keeping emission prices right (Choy and Ho 2018). As the EU ETS’s history for almost two decades shows, cap-and-trade markets need constant political and economic tinkering with market design to deal with market issues and overflows of a financial and non-financial nature. Yet, economists are quick to show with their models possible adverse and unintended effects of such tinkering. Given these and the Paris Agreement’s call for more abatement markets and more integration among them, economists (Li et al. 2021) and political scientists (Green 2017) are warning against pitfalls of such an integration for the environmental integrity of cap-and-trade mechanisms. These warnings resonate with finitism or the argument that economisation works by bracketing out as many phenomena as those bracketed in, which then come to generate overflows on the latter. In the meantime, the clock set by the IPPC for the 1.5 °C target is ticking.

# Conclusion

The stylised history of modern finance theory and practice presented in this paper shows that since the 1970s thermo-industrial capitalism and for that matter the Anthropocene has taken on a political economic form that political economists and economic sociologists describe as ‘disembedded liberalism’ (Best 2003) or financialised economisation. With the Paris Agreement, just as the world has entered a new phase of the UNFCCC to combat climate change, SRI and market-based solutions to climate change will have gained ever more momentum and will have broader scope in coming years and decades. Yet, these solutions, owing to their embeddedness in the capitalist accumulation regime with its contemporary form of financialisation, will continue to suffer from market issues and counter-performative practices, their voluntary nature, and related greenwash and decoupling by corporations. This embeddedness is the source of what I have identified as the puzzle of ineffective yet ever growing SRI and abatement solutions to the Anthropocene. These solutions therefore need to be complemented with or even re-embedded in policies and devices that are not oriented to the measuring, monitoring and reward mechanisms of the capitalist accumulation regime.

The paper’s findings also relate to recent debates about the performativity of economics and market devices in political economy (see MacKenzie et al. 2007, Erturk et al. 2013, Beunza and Ferraro 2018). As underlined in this paper, political economy and performativity approaches to the economy and markets are complementary to each other. In the case of political economy on international finance, the state of the art has come a long way to incorporate private actors into its traditionally state-centric analysis since the early calls, for example, by Strange (1994). However, the same cannot be said for the analysis of socio-technical arrangements and their performativity and counter-performativity in international political economy (c.f., Braun 2016, Lockwood 2015). A greater focus in political economy studies on the micro institutions of global finance will provide more holistic explanations of macrolevel dynamics, such as the persistence of thermo-industrial capitalist accumulation, and our failure to take appropriate and timely action to deal with its major outcome - namely, the Anthropocene. On the other side of the same coin, the performativity approaches to understanding micro-institutions, such as SRI and abatement markets, and their successes and failures, should pay more attention to political economic dynamics for similarly holistic explanations (cf., Lean 2012, Beunza and Ferraro 2018).

**References**

Anderson, K. 2016. ‘Contributions of the GATT/WTO to Global Economic Welfare: Empirical Evidence’. *Journal of Economic Surveys* 30 (1):56–92.

Bernstein, S. 2011. ‘Legitimacy in Intergovernmental and Non-State Global Governance’. *Review of International Political Economy.*18(1):17–51.

Beunza, D., Hardie, I., and MacKenzie, D. 2006. ‘A Price Is a Social Thing: Towards a Material Sociology of Arbitrage’. *Organization Studies.*27(5):721–45.

Beunza, D., and Ferraro, F. 2018. ‘Performative Work: Bridging Performativity and Institutional Theory in the Responsible Investment Field’. *Organization Studies.*40(4): 515-543.

Beck, U., Giddens, A., and Lash, S. 1994. *Reflexive Modernization: Politics, Tradition and Aesthetics in the Modern Social Order*. CA: Stanford University Press.

Best, J. 2003. ‘From the Top–Down: The New Financial Architecture and the Re-Embedding of Global Finance’. *New Political Economy.*8(3):363–84.

Braun, B. 2016. ‘From Performativity to Political Economy: Index Investing, ETFs and Asset Manager Capitalism’. *New Political Economy.*21(3): 257–73.

Bryant, G. 2018. Nature as Accumulation Strategy? Finance, Nature, and Value in Carbon Markets. *Annals of the American Association of Geographers.*108(3): 605–619.

Caliskan, K., and Callon, M. 2009. ‘Economization, Part 1: Shifting Attention from the Economy towards Processes of Economization’. *Economy and Society.*38(3): 369-98.

Callon, M. 1999. Actor Network Theory- the market test. In: J. Law, and J. Hassard, eds. *Actor Network Theory and After*. Oxford: Blackwell Publishing, 181-195.

Carbon-Pulse. 2021. Exclusive – EU lawmakers eye price ceiling, speculation curbs to prevent “cornering” of ETS. Available-from: https://carbon-pulse.com/103522/ [Last-accessed:2-March-2021]

Choy, L.H.T., and Ho W.K.O. 2018. ‘Building a Low Carbon China through Coasean Bargaining’. *Habitat International.*75(2018):139–46.

Cogan, D.G. 2008. *Corporate Governance and Climate Change: The Banking Sector: A Ceres Report.* Boston MA: Ceres.

Crifo, P., and Mottis, N. 2016. ‘Socially Responsible Investment in France’. *Business & Society.*55(4):576–93.

Davies, J. 2017. ‘The Business Case for Soil’. *Nature News.*543(7645):309.

DesJardine, M.R., and Durand, R. 2020. ‘Disentangling the Effects of Hedge Fund Activism on Firm Financial and Social Performance’. *Strategic Management Journal*. 41(6):1054–82

Di Muzio, T. 2011. ‘The Crisis of Petro-Market Civilization: The Past as Prologue?’ in S. Gill, ed. *Global Crises and the Crisis of Global Leadership*. Cambridge: Cambridge University Press, 73–88

Doh, J.P. et al. 2010. ‘Does the Market Respond to an Endorsement of Social Responsibility? The Role of Institutions, Information, and Legitimacy’. *Journal of Management.*36(6):1461–85.

Domanski, D., et al. 2015. ‘Oil and Debt’. *BIS Quarterly Review*, March: 55–65.

Ellenberger, J. 2011. Carbon Trading. Saving the Planet? *The Hedge Fund Journal.* Issue-65. Available-from https://thehedgefundjournal.com/carbon-trading/ [Last-accessed:2- January-2021].

Erturk, I., et al. 2013. ‘(How) Do Devices Matter in Finance’ *Journal of Cultural Economy.*6(3):336–52.

Fama, E.F.1970. ‘Efficient Capital Markets: A Review of Theory and Empirical Work’. *The Journal of Finance.*25(2):383–417.

Fan, Y. et al.2017.‘What Policy Adjustments in the EU ETS Truly Affected the Carbon Prices?’ *Energy Policy.*103:145–64.

Fatemi, A., Glaum, M., and Kaiser, S. 2018. ‘ESG Performance and Firm Value: The Moderating Role of Disclosure’. *Global Finance Journal.*38(C):45–64.

Fichtner, J., Heemskerk, E. and Petry, J. 2020. ‘Three Financial Firms Could Change the Direction of the Climate Crisis – and Few People Have Any Idea’. *The Conversation*. Available-from: http://theconversation.com/three-financial-firms-could-change-the-direction-of-the-climate-crisis-and-few-people-have-any-idea-131869[Last-accessed:4-March-2020].

Friedrich, M. et al. 2020. From fundamentals to financial assets: the evolution of understanding price formation in the EU ETS. ZBW - Leibniz Information Centre for Economics, Kiel, Hamburg. Available-from: http://hdl.handle.net/10419/216726[Last-accessed:30-August-2020].

Freund, J. 2015. ‘Rev Billy vs. the Market: A Sane Man in a World of Omnipotent Fantasies’. *Journal of Marketing Management.*31(13–14):1529–51.

Green, J.F. 2017. ‘Don’t Link Carbon Markets’. *Nature News* 543(7646):484.

Green, J.F. 2021. ‘Does Carbon Pricing Reduce Emissions? A Review of Ex-Post Analyses’. *Environmental Research Letters.*16(4):043004.

GSIA. 2018. *Global Sustainable Investment Review*. Available-from: http://www.gsi-alliance.org/wp-content/uploads/2019/03/GSIR\_Review2018.3.28.pdf [Last-accessed:10-January-2020].

Harmes, A. 2011. ‘The Limits of Carbon Disclosure: Theorizing the Business Case for Investor Environmentalism’. *Global Environmental Politics.*11(2):98–119.

Haque, F., and. Ntim. C.G. 2020. ‘Executive Compensation, Sustainable Compensation Policy, Carbon Performance and Market Value’. *British Journal of Management*. 31(3):525–46.

Hickel, J., and Kallis, G. 2020. ‘Is Green Growth Possible?’ *New Political Economy*. 25(4):469–86.

Huchet, N., and Fam, P.G. 2016. ‘The Role of Speculation in International Futures Markets on Commodity Prices’. *Research in International Business and Finance.*37(May):49–65.

IMF.2021. Managing Director’s intervention at the Leaders’ Summit on Climate. 22 April 2021. Available-from: https://www.imf.org/en/News/Articles/2021/04/22/sp042221-md-remarks-at-the-leaders-summit-on-climate [Last-accessed:1-May-2020]

IPCC.2018. *Global warming of 1.5°C*. Switzerland: IPCC.

Kim, E.H, and Lyon, T. 2011. ‘When Does Institutional Investor Activism Increase Shareholder Value?: The Carbon Disclosure Project’. *The B.E. Journal of Economic Analysis & Policy.*11(1):1-27

Kose, M. et al. 2010. ‘Financial Globalization and Economic Policies’. In D. Rodrik and M. Rozenzweig, eds. *Handbook of Development Economics* Volume 5. Amsterdam: North-Holland, 4283–4359.

Lane, R. 2012. ‘The Promiscuous History of Market Efficiency: The Development of Early Emissions Trading Systems’. *Environmental Politics.*21(4):583–603.

Li, M., Weng, Y., and Duan, M. 2019. ‘Emissions, Energy and Economic Impacts of Linking China’s National ETS with the EU ETS’. *Applied Energy.*235:1235–44.

Lockwood, E. 2015. ‘Predicting the Unpredictable: Value-at-Risk, Performativity, and the Politics of Financial Uncertainty’. *Review of International Political Economy*.22(4):719–56.

Lohmann, L. 2010. ‘Uncertainty Markets and Carbon Markets: Variations on Polanyian Themes’. *New Political Economy.*15(2):225–54.

Lounsbury, M. 2002. ‘Institutional Transformation and Status Mobility: The Professionalization of the Field of Finance’. *The Academy of Management Journal.*45(1):255–66.

MacKenzie, D. 2005. ‘Opening the Black Boxes of Global Finance’. *Review of International Political Economy.*12(4): 555–76.

———. 2009. ‘Making Things the Same: Gases, Emission Rights and the Politics of Carbon Markets’. *Accounting, Organizations and Society.*34 (3–4): 440–55.

MacKenzie, D., Muniesa, F. and Siu, L. eds. 2007. *Do Economists Make Markets? On the Performativity of Economics*. Princeton: Princeton University Press.

Martunizzi, E, and Ashworth, M.2020. ‘City of London Wants to Clean Up the World’. Bloomberg Opinion, 20 November 2020. Available-from: https://www.bloomberg.com/opinion/articles/2020-11-20/city-of-london-wants-to-be-the-global-hub-for-carbon-trading [Last-accessed:5-January-2021]

Matsumura, E.M., Prakash, R. and Vera-Muñoz, S.C. 2013. ‘Firm-Value Effects of Carbon Emissions and Carbon Disclosures’. *The Accounting Review.*89(2):695–724.

Menz, K.M. 2010. ‘Corporate Social Responsibility: Is It Rewarded by the Corporate Bond Market? A Critical Note’. *Journal of Business Ethics.*96(1):117–34.

Millo, Y., and MacKenzie, D. 2009. ‘The Usefulness of Inaccurate Models: Towards an Understanding of the Emergence of Financial Risk Management’. *Accounting, Organizations and Society.*34(5):638–53.

Neslen, A. 2016. ‘Greece Set to Win €1.75bn from EU Climate Scheme to Build Two Coal Plants’. *The Guardian*, 3 November 2016. Available-from: https://www.theguardian.com/environment/2016/nov/03/greece-set-to-win-175m-from-eu-climate-scheme-to-build-two-coal-plants [Last-accessed:4-March-2020].

Newell, P., Paterson, M., 2010, *Climate Capitalism: Global Warming and the Transformation of the Global Economy*, Cambridge, MA: Cambridge University Press.

Nauman, B. 2020. ‘Heavy Flows into ESG Funds Raise Questions over Ratings’. Financial Times, 4 March 2020. Available-from: https://www.ft.com/content/0bd9d2ea-5c15-11ea-8033-fa40a0d65a98 [Last-accessed:4-March-2020].

Paterson, M. 2010. ‘Legitimation and Accumulation in Climate Change Governance’. *New Political Economy.*15(3):345–68.

Preda, A. 2004. ‘Informative Prices, Rational Investors: The Emergence of the Random Walk Hypothesis and the Nineteenth-Century “Science of Financial Investments”’. *History of Political Economy.*36(2):351–86.

PwC.2016. ‘Investors, Corporates, and ESG: Bridging the Gap’. PwC Governance Insights Center. Available-from: from https://www.pwc.com/us/en/governance-insights-center/publications/assets/investors-corporates-and-esg-bridging-the-gap.pdf. [Last-accessed:31-December-2018].

Rainforest Alliance Network et al.2021. Banking on Climate Chaos: Fossil Fuel Finance Report 2021. Available-from https://www.ran.org/wp-content/uploads/2021/03/Banking-on-Climate-Chaos-2021.pdf [Last-accessed:1-April-2021]

Rebonato, R. 2013. ‘What Models Do We Need for Risk Management?’ in *QFINANCE: The Ultimate Resource, 4th edition*. London: Bloomsbury Publishing.

Refinitiv.2021.Carbon Market Year in Review 2020. 26 January 2021.Available-from: https://www.refinitiv.com/content/dam/marketing/en\_us/documents/reports/carbon-market-year-in-review-2020.pdf[Last-accessed:10-April-2021]

Quemin, S, and Trotignon, R. 2021. ‘Emissions Trading with Rolling Horizons’. *Journal of Economic Dynamics and Control* 125:104099.

Samuelson, P.A. 2009. An Enjoyable Life Puzzling Over Modern Finance Theory’. 2009. *Annual Review of Financial Economics.*1(1):19–35.

Schmalensee, R., and Stavins, R.N. 2017. ‘Lessons Learned from Three Decades of Experience with Cap and Trade’. *Review of Environmental Economics and Policy.*11(1): 59–79.

Schneider, L., and Kollmuss, A.2015. ‘Perverse Effects of Carbon Markets on HFC-23 and SF6 Abatement Projects in Russia’. *Nature Climate Change.*5(12):1061–63.

Scholtens, B. 2006. ‘Finance as a Driver of Corporate Social Responsibility’. *Journal of Business Ethics.*68(1):19–33.

Sharpe, W.F.1991. ‘Capital Asset Prices with and without Negative Holdings’. *The Journal of Finance.*46(2):489–509.

Sheppard, D. 2020. ‘Carbon Trading: The “One-Way” Bet for Hedge Funds’. Financial Times, 23 August 2020. Available-from: https://www.ft.com/content/a5ff89ec-323c-4fb8-85a1-9d0225ae3cdb [Last-accesed:14-January-2021]

Sparkes, R., and Cowton, C.J. 2004. ‘The Maturing of Socially Responsible Investment: A Review of the Developing Link with Corporate Social Responsibility’. *Journal of Business Ethics.*52(1):45–57.

Stavins, R, and Stowe, R.2017. *Market Mechanisms and the Paris Agreement*. Cambridge, MA: Harvard Project on Climate Agreements.

Steffen, et al. 2011. ‘The Anthropocene: Conceptual and Historical Perspectives’. *Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences.*369(1938):842–67.

Strange, S. 1994. *The Retreat of the State* *The Diffusion of Power in the World Economy.* Cambridge: Cambridge University Press.

Subrahmanyam, A. 2008. ‘Behavioural Finance: A Review and Synthesis’. *European Financial Management.*14(1):12–29.

Suchman, M.C. 1995. ‘Managing Legitimacy: Strategic and Institutional Approaches’. *The Academy of Management Review.*20(3):571–610

Truman, E.M. 2012. ‘The International Monetary System or “Nonsystem”?’ In F. Bergsten and R. Henning, eds. *Global Economics in Extraordinary Times: Essays in Honor of John Williamson*. Washington DC: PIIE, 27–52.

Waddock, S. 2008. ‘Building a New Institutional Infrastructure for Corporate Responsibility’. *Academy of Management Perspectives.*22(3):87–108.

Wallerstein, I. 1979. *The Capitalist World Economy*. Cambridge: Cambridge University Press

World Bank. 2020. *State and Trends of Carbon Pricing 2020*, World Bank, Washington, DC.

Wilde, S. 2017. ‘Green Finance? Why Global Banks Are Pledging Billions to Fight Climate Change’. *The Conversation.* Available-from: http://theconversation.com/green-finance-why-global-banks-are-pledging-billions-to-fight-climate-change-87273 [Last-accessed:1-January-2019].

Wright, C. 2012. 'Global Banks, the Environment, and Human Rights: The Impact of the Equator Principles on Lending Policies and Practices'. *Global Environmental Politics*.12(1): 56–77

Wright, C. and Nyberg, D. 2015 *Climate Change, Capitalism and Corporations: Processes of Creative Self- Destruction*. Cambridge: Cambridge University Press.

Valdez, S. and Molyneux, P. 2013. *An Introduction to Global Financial Markets*, 7th edition. London: Palgrave Macmillan

Yumashev, D. et al. 2019. ‘Climate Policy Implications of Nonlinear Decline of Arctic Land Permafrost and Other Cryosphere Elements’. *Nature Communications* 10(1):1-11.

Von Neumann, J. and Morgenstern, O. 1944 (2007). *Theory of Games and Economic Behavior*. Princeton, NJ: Princeton University Press.

Zajac, E.J., and Westphal, J.D. 2004. ‘The Social Construction of Market Value: Institutionalization and Learning Perspectives on Stock Market Reactions’. *American Sociological Review.*69(3):433–57.

1. It should be underlined that the convergence is one of several driving forces behind the continued expansion of global trade in goods and capital. For example, to see the effects of decades-long intergovernmental negotiations to remove tariffs and other trade barriers on goods and services including the financial sector, and their evolution into the World Trade Organisation, see Anderson (2016). [↑](#endnote-ref-1)
2. As Kose et al (2010) remind us , there is a mixed picture on individual economic growth trajectories and countries' experiences with economic and financial globalisation. Nonetheless, they find evidence for the positive contribution of financial globalisation to economic growth via what they call 'direct' (i.e., capital flows) and 'indirect' ('financial development and institutional quality' ) channels, the latter being more robust than the former in their contribution. They also find that better economic growth performances can be explained to a considerable extent by higher levels of 'trade/financial openness' (Kose et al 2010). It is also worth noting the World Bank data on economic growth since the end of Bretton Woods (available from <https://data.worldbank.org/indicator/NY.GDP.MKTP.KD.ZG?locations=1W>, [Last accessed 1 February 2020]). Despite a slowdown in global economic growth since then, globally better integrated developing economies, which Steffen et al (2011) identify as the beneficiaries of "democratisation" in the Great Acceleration of the 21st century, have increased their growth rates. Unsurprisingly, Hickel and Kallis (2020) observe a continued increase in the GHGs of what they call 'the global South'. [↑](#endnote-ref-2)