

Green Keynesianism: Bringing the entrepreneurial state back in(to question)?

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Abstract (250 words)

Since the global financial crisis of 2007/8, proliferating calls for a Keynesian Green New Deal have cast the publicly (and environmentally) minded state as a necessary driver of technological innovation and social transformation, while, *vice versa*, innovation has moved to political centre-stage. The history and genesis of this particular Green Keynesian paradigm illustrates that some of its most high-profile proponents selectively and problematically frame 20th century Keynesianism and the 'public good'. It is important to examine critically the calls for an 'entrepreneurial state' in which Green Keynesian ideas are mobilized in support of an agenda for continued and accelerated development of commercially-focused, privately-developed green technologies. The entrepreneurial state represents a neoliberal re-appropriation of Green Keynesianism, where dominant financial actors (in Silicon Valley, as opposed to on Wall Street) are tapped as the visionaries who can and should set our collective innovation agenda. Although there is a need for large-scale, coordinated techno-social efforts to address climate change, supporting 'green' innovation cannot simply be framed as maximizing

‘innovation’ while taking the ‘state’ for granted. Instead, it must entail a careful assessment of the specific trajectories of innovation being enabled and the underlying socio-natures that they maintain and promote. STS-informed analysis allows, and compels, asking how socio-technological innovation and their constitutive power relations are crucially interrelated, making the reshaping of the state – still the primary institution and system of social relations of collective governance – a core but neglected political, technological and ecological project of our time, with a key role for STS.

Keywords: Keynesianism, Neoliberalism, Green New Deal, state, innovation, disruptive technology.

Word count: 10010 (Main text, footnotes and references)

Introduction

Arguments about ‘avoiding’ climate change are increasingly problematic and politically fraught. Alongside contemporaneous fears of secular stagnation (Teulings & Baldwin, 2014), a wide range of proposals have called for massive programs of state-supported green innovation, meant to revive economic growth while resolving the problems of environmental decline and social inequity bequeathed by an era of neoliberal dominance. This position, referred to herein as ‘Green Keynesianism’, interprets the crises of neoliberalism, including economic malaise and financial crisis, as an opening for a more economically-active state to re-assert itself in fostering industrial, social and technological advance for the public good.

Green Keynesianism became popular in the wake of the financial crisis of 2007/8. Over the ensuing years a range of proposals have deployed the idea of a Green New Deal to historically situate – and legitimize – the transformation of national and global economies. As part of a broader discourse about the “green economy”, proposals range across the political spectrum. There are decidedly left-wing calls to reign in corporate and industrial excess and rebalance employment, if also perhaps working towards a steady state or even shrinking global economy. And there are also more liberal and centrist calls to use green stimulus, in terms of both infrastructural and technological development, to revive economic growth. This would involve shifting capital’s dynamism away from dirty industries predicated on fossil fuel extraction and use, and towards cleaner, greener industries predicated on renewable energy and the sustainable use of resources (Bina, 2013).

While the election of Donald Trump in the US (and Brexit in the UK) appears to have dimmed prospects for any social democratic turn, Green New Deal approaches remain actively promoted within this still-neoliberal, albeit increasingly authoritarian, context. Indeed, there is still reason to believe that

the technological aspects of some of these proposals will resonate with this new administration and its focus on economic and industrial growth by any means possible; for instance, regarding geoengineering (Lukacs, 2017) and ‘industrial strategy’ (HMG, 2017) respectively. This seems to be a dimension of Green New Deal proposals that is likely to remain politically salient in the medium term.

Our analysis focuses on one specific thread of Green New Deal politics most forcefully promoted in the United States. This paradigm, centered on technology and innovation, has been developed by the Breakthrough Institute, as well, more recently, by Bill Gates and his Breakthrough Energy Coalition. While this particular strain of Green Keynesian cannot stand as a paradigmatic example of the entire, diverse, and ever-changing array of proposals falling under the Green New Deal banner, it does help reveal a slippage between what Olivia Bina (2013) describes as “almost business as usual” and “greening” forms of green economy proposals.

Though most Green New Deal (GND) proposals have explicitly social democratic intentions, we ask whether it is possible that their shared focus on innovation, competition and entrepreneurial dynamism led by the private sector can inadvertently legitimize a strategic renewal of neoliberal agendas. Specifically then, in this paper we ask: how do these Green New Deal discourses link environmental sustainability to innovation and growth within the framework of the entrepreneurial state? What are the consequences of this framing for trajectories of innovation, political ecology, political economy and the very meaning of the ‘entrepreneurial’ state itself?

Green Keynesian proposals generally advocate for a strong state role in innovation that is meant to deliver a rebalancing of public vs. private forces, mitigating some of neoliberal capitalism’s most environmentally disruptive effects. However, the long term impacts and potentially self-defeating implications of these sociotechnical trajectories often go under-examined. There is a seeming refusal to interrogate both the ecologically devastating effects of actual, historical Keynesian developmentalism as well as the many ways that the past half-century of neoliberalism has transformed both the state – which is being embraced as a potential ecological savior – and the socio-political relations of innovation that it is supposed to direct. This occurs, we argue, through a limited understanding of Keynesianism, presented in binary opposition to an equally simplified conception of neoliberalism, *along with* an uncritical endorsement of the currently dominant model of ‘green’ or ‘clean’ technological innovations coming out of privately funded entrepreneurialism.

This paper is divided into three sections. First, we review our theoretical orientation, a cultural political economy of research & innovation (CPERI, Tyfield 2012) that explores co-produced systems of power relations, including states, and socio-technical innovation. This relational approach to science and technology studies (STS) illuminates the dynamic and complex mutual shaping of politics and

innovation in ways that go beyond Keynesian - or Polanyian (Cf Bina 2013) - accounts. From this perspective we introduce key examples of Green Keynesianism and an overview of the history and genesis of these ideas.

Second, we explore one specific variant of Green Keynesianism that advocates for an ‘entrepreneurial state’ which can inject patient capital into the innovation of clean and green technologies. With calls for an ‘entrepreneurial state’, incumbent political actors are able to use Green Keynesian discourses to push an agenda for continued and accelerated development of commercially-focused, privately-developed green technologies. This variant of Green Keynesianism shifts away from a neoliberal frame that idealizes markets and demonizes states towards a new frame that idealizes innovation and demonizes wasteful (dirty and speculative) capital, all while remaining faithful to the pre-eminence of markets. In the final section, we discuss the need for a politics of innovation suitable for the Anthropocene that profoundly reframes the relations between state and innovation.

A Cultural Political Economy of Research and Innovation in the Green Economy

In a thorough review of green economy literature, Olivia Bina (2013) distinguishes between three broad paradigms. At one extreme are “almost business as usual” proposals, most often put forth by government and financial elites. At the other extreme are “all change” proposals, advocated for by academics and representatives of civil society. And in between these two lies a category of “greening” most often put forth by international agencies and some of the more environmentally conscientious governing institutions. Green New Deal proposals largely fall in this middle category, as an attempt to advocate for significant social and ecological transformations without going so far as to demand total systemic (political and economic) change; ‘fixing’ instead of ‘shifting’ dominant socioeconomic paradigms (p.1023). This is far from a clean typology. As Bina notes, the greening proposals are “pulled in opposite directions” (p.1034), sometimes towards the ‘all change’ category, and other times towards the ‘almost business as usual’ side of things.

This spectrum appears to offer a green incarnation of the familiar Left dualism pitting a politics of reform (of a now *rampant* capitalism) against one of revolution (rejecting capitalism wholesale). In fact, this framing is explicitly adopted by many Green New Deal proponents, who then reject the latter in favor of the more politically ‘realistic’ former. Bina puts a good deal of emphasis on the ways in which this middle paradigm can and often is pulled towards the left – towards visions of total systemic transformation and radical social democracy. In what follows, we instead focus on the ways this middle paradigm – specifically Green New Deal proposals – can be and often is pulled towards the right. This

would leave these proposals inextricably entangled with aspects of the ‘business as usual’ paradigm that may in fact be antithetical to their stated social and environmental aims.

In this shift of focus we highlight not just the socio-economic issues of state capture highlighted by Bina. Rather, in taking an STS approach, our lens explores the transformation of innovation itself by specific political projects and agendas, and the reciprocal implications of that transformation for further shaping of the state, in iterative and never-ending feedback loops. As previous literature illustrates, STS has much to offer regarding our understanding of innovation. For example, Benoît Godin (2006) puts the concept and practices of innovation in historical perspective, unearthing the complexity of this process and critically challenging prevailing linear models of innovation. More generally, an STS perspective unpacks innovation as a complex, multi-agent process of introducing novel heterogeneous assemblages of human, machinic and vital matter that constitute a changing hybrid ‘socio-technical’ reality (e.g. Law, 1991; Latour 2005)

In order to understand how innovation fits into broader circuits of economic and political relations, we orient our approach to these core STS questions around a cultural political economy of research and innovation (CPERI). This approach explores the co-production (Jasanoff 2004) of R&I and socio-political regimes (e.g. neoliberalism) in terms of dynamic systems of power/knowledge relations and technologies (Tyfield 2015). Alongside earlier STS perspectives on socio-technical change, therefore, this CPERI approach draws together cultural political economy (CPE) (Jessop & Sum, 2006; Jessop, 2012), political ecology (Lawhon & Murphy, 2013), theories of socio-technical systems transition (Smith *et al.*, 2010) and a Foucauldian analysis of government regarding the ‘conduct of conduct’ of polities and selves (Dean, 2010; Lemke, 2011), while focusing specifically on issues of research and innovation (Mirowski & Sent, 2008; Mirowski 2011, 2013; Tyfield, 2012).

The CPERI approach has the potential to address two key aspects of societal transformations imagined and promoted by Green Keynesianism. First, it addresses the way in which STS (and innovation studies) has tended to downplay issues of (capitalist) political economy (Tyfield et al. 2017) and to under-examine issues of power and the systemic dynamics conditioning R&I (see also Avelino & Rotmans 2009; Schneider & Lösch, 2016). Here CPERI goes beyond contemporary common-sense understandings of power as a zero-sum and brute capacity held by the powerful over the powerless. Instead, it builds upon Foucault’s discussion of power, or power/knowledge, as dispersed, ubiquitous, strategic, relational and productive, both of emergent systems of government and individual subjectivities (Foucault, 2001; Hindess, 2006).

Shifting from a structural account of power, as something possessed by some over others, to a relational and constitutive conception complicates concepts of system ‘lock-in’ and transition (Garvey

et al., 2015 Cf Unruh, 2000; Geels, 2014). This, in turn, leaves open possibilities to explore (and perhaps assist) emergent, alternative regimes of socio-technical change. A CPERI perspective thus not only illuminates (possibly changing) system dynamics of innovation-*as-politics*; it also exposes the strategically self-defeating inadequacies of approaches that fail to grapple with the complex, dynamic and inseparable co-production of socio-technical and socio-political change.

Second, a CPERI approach addresses the key aspects of STS and related scholarship on environmental change, which shows how environmental change is inextricably interwoven with socio-technical change, creating ‘socio-natures’ (Castree & Braun, 2001; Lawhon and Murphy, 2012; also Huber, 2013). Accordingly, our CPERI approach provides a way to analyse capitalism as a nature-making process, in line with Jason W. Moore’s (2015) arguments, in order to understand how different regimes within the history of capitalism (such as mid-20th century Keynesianism or ongoing neoliberalism) shape and transform, in distinct ways, specific socio-natures. For example, Matthew Huber (2013) illustrates the entwining of oil, capitalism, and environmental degradation in 20th century American capitalism and life (also see Mitchell, 2011; Urry, 2014). It should be clear then that we regard the social relations of capitalism, whether in neoliberal or Keynesian form, as a profound driver of anthropogenic climate change (Brand & Wissen 2013; Mann, 2015).

It is certainly the case that humankind has been transforming its environment since the dawn of organized social relations. Yet it is only with this most recent period of nature- and world-making, coinciding with the expansion of colonization and capitalism on a world scale, that (some) human activities have been able to transform the planetary climatological system in dangerous and unpredictable ways. Instead of pitting reform against revolution, as in the Green Keynesian framing, we attempt to work strategically with the sociotechnical and environmental complexities of ‘doing politics’ in the toxic wake of ‘late industrialism’ (Fortun, 2012).

With this in mind, we now turn to our analysis of Green Keynesianism and its complicated relationship with the neoliberal present from which it purports to offer respite and relief.

Green Keynesianism after the Financial Crisis

Over the last decade of post-Great Financial Crash neoliberal revanchism, with states profoundly beholden to financialized capital and a faith in free markets, Green Keynesianism has increasingly been presented as a much needed reprieve. The logic is not hard to understand; if unencumbered free markets and the financial flows that they support (a.k.a. “Wall Street”) are the problem, then perhaps reining in these flows and embedding them within a strong, state-supported

regime of environmentally-conscious accumulation could offer a solution (*Cf* Barnes, 2006; Brown, 2011). Green Keynesianism is not just about ‘regulating’ financial flows, but also centrally implies the ability of the state to provide direct infrastructural and material support to the economy, to ‘prime the pump’ with initiatives meant to support the public good. For Keynesian policies this has historically meant job creation, public infrastructure development, and regulations intended to empower labor and to restrain employers. So why not extend these ideas into the present: green jobs, green infrastructure, tougher environmental regulations and stronger pollution controls?

Green New Deal (GND) discourses gained steam in the wake of the 2008 financial crisis. With massive state bailouts required to save a financial sector that was ‘too big to fail’ the stage was set to explore the different types of active roles that states could and should play in the global economy (Knuth, 2014). For example, in 2008 the New Economics Foundation (2008) convened the Green New Deal Group (comprised of economists, journalists and environmentalists) and produced a comprehensive report outlining their proposed response to the dual financial and ecological crises. Central to their proposal, and to most subsequent GND proposals, was an ambitious plan of state-led investment into renewable energy and conservation technologies. Restraining and disciplining speculative finance capital was married to support for infrastructural development (project financing) and new technology development (venture capital), all with the aim of shifting investment back towards the productive economy.

Other examples of GND proposals included UNEP’s Global Green New Deal (2009), which stated that it was fully committed to a model of green growth driven by “accelerated investment in a renewable energy future.” UNEP estimated that US\$100 Billion of additional investment per year over 15 years in renewable energy technologies should be sufficient to scale up the industry and drop the price of renewable energy to a sufficiently low point where “private investment crowds in” and state support is no longer necessary. Similarly, various scientists and CEOs proposed massive state-supported cleantech initiatives – for some a green ‘Manhattan project’, for others letting ‘1000 innovators bloom’ (King & Layard, 2013; Oreskes, 2013). And, finally, the Breakthrough Institute advocated for the creation of a Clean Energy Deployment Administration (CEDA) through which state support for early stage green innovation could be coordinated (Jenkins and Mansur, 2011).

In each of these proposals and others like them, support for the development of renewable energy technology was targeted as a primary means of societal transition. For example, Edenhofer and Stern (2009) argued for the support of green financing as a central concern. They proposed a number of mechanisms meant to stimulate green innovation such as feed-in tariffs, renewable portfolio standards, tax credits and loan guarantees. Moreover, they suggested that G20 nation-states “should establish

publicly financed venture capital funds that target innovative clean-energy technologies and develop a G20 Strategic Energy Technology Plan” (p.5). As they go on to explain, such state-backed venture capital would be able to take a more patient (and less risk-averse) approach than typical private venture funds, adding social and ecological goals to the need to realize adequate returns.

These are only a few examples of the broad range of GND proposals that present more or less middle road, status-quo affirming plans. In the next section we narrow our focus to one particular variant of GND proposal predicated upon the promotion of an “entrepreneurial state.”

The Entrepreneurial State

Over the last few years the ‘entrepreneurial state’ has attained a lot of interest and high-profile media coverage. While there is very little to show for it in terms of meaningful effect on policy and political outcomes, at least in terms of any Green New Deal that it expressly advocates, we argue that this discourse recuperates Green Keynesian ideas by legitimizing both neoliberal conceptions of the state and approaches to innovation. By ‘entrepreneurial state’ we refer to two distinct positions; those of Mariana Mazzucato in Europe and those of the Breakthrough Institute in the USA. For Mazzucato (2011, 2016), who coined the phrase, the entrepreneurial state emerges from a Schumpeter-inspired approach that conceptualizes the innovation process as highly uncertain and open-ended and thus dependent on risk-taking agency and institutions.

Conventional common-sense today would identify these entrepreneurial agencies with the specialized capacities and resources of competitive private venture finance, in contrast to states that are shown to be terrible at ‘picking winners’. Mazzucato argues that this is a grievous misreading of both theory and the historical record, instead offering a powerful critique of the neoliberal innovation system, its financialisation, short-termism, and more recent commitment to fiscal austerity. Conversely, she argues, it is quintessentially the state, and only the state, that has taken and can continue to take on the large, shot-in-the-dark risks of constructing entirely new systems and radical innovations that promise significant public benefit.

Mazzucato argues against neoliberal common-sense portrayals of the state as a lumbering dinosaur in opposition to fast-evolving, nimble venture financiers. Instead, she positions the entrepreneurial state as a lion of innovation, to be compared with the posturing pussycats of private finance who will only bet on a sure thing once the state has supported the initial work. Considering the argument that profound public-good innovation is needed to address the current predicament of economic stagnation *and* ecological risk, it follows that the state alone can, and so must, stimulate

institutional, economic and technological change that will not otherwise happen. Bill Gates has been intrigued with Mazzucato's work, explaining in a recent interview his somewhat hesitant endorsement of active state involvement in the promotion of green technologies (Bennet, 2015) as a least-worst option.

The US-based Breakthrough Institute, founded in 2003 by Michael Shellenberger and Ted Nordhaus, offers a similarly revived appreciation of the state's active role in promoting green innovation. Their work highlights the ongoing role that state-funded research and innovation has played in the field of energy research (Shellenberger et al., 2012), arguing that the state will continue to be essential to ongoing industrial innovation. Any new green economy will therefore have to entail a state actively committed to funding the right, green technologies that can transform modern society in environmentally beneficial ways. In their most recent publication (Asafu-Adjaye et al. 2015), we learn that these 'right' ways consist primarily of advanced solar technology and continued development of nuclear power.

Self-proclaimed eco-modernists and champions of technological innovation, they are quick to point out the central role that state funding has played in the development of previous technological breakthroughs such as hydraulic fracturing (Shellenberger et al., 2012). While "reject[ing] the planning fallacy of the 1950s", they advocate the development of green industrial policies meant to direct innovation and industrial advance (Asafu-Adjaye et al., 2015, pp.29-30). Though they have moved beyond their proposal for the creation of the aforementioned CEDA, which would function as a central government funding agency that could provide financial support to early-stage technology companies, they remain committed to the centrality and necessity of state support for 'breakthrough' environmental technologies.

Breakthrough differs with Mazzucato in the relative emphasis placed upon the state as a creator of industrial policy. For Mazzucato the state can and should steer the private sector towards its own, publicly-determined sense of what technologies are in the public good. The Breakthrough Institute, conversely, is more inclined to see the state as a willing and largely unquestioning facilitator of innovation agendas already underway in the private sphere. The state is meant to provide patient capital that can help de-risk new technologies as a non-diluting investor in the earliest stages of development. This will allow these innovations the time and (tax-funded) resources to become viable investments for the private venture capital industry eventually to fund, once the riskiest stages of development have passed.

Hence, we might say that where Mazzucato offers a scathing (and compelling) indictment of the risk-averse nature of venture capital and the innovation agenda that forms around (and despite) it, the

Breakthrough Institute sees this risk-aversion as a market-failure for the state to correct. The state can do so by facilitating and strengthening the venture-capital dominated innovation agenda with targeted grants, loan guarantees and other transfers of public wealth into private commercial applications. For them, the entrepreneurial state is thus actually envisioned as a venture financing state (*Cf* Janeway, 2012).

We see in both these positions a subtle shift, where visions of a transformed economy form around the risk-taking state. This state can focus on the twin public goods of mitigating ecological change as a new and crucial techno-social domain, as well as the innovation risk that prevents venture investors from entering into the funding of new technologies. Yet neither of these visions questions how the entrepreneurial state resonates with, and so enables, important and relatively painless shifts in a strategically dominant neoliberal positioning. This concerns a neoliberalism reconstituted in the wake of disorientation from the Great Financial Crisis and compelled to respond to the growing weight of evidence regarding ecological destruction.

Looking at this from a CPERI perspective that considers innovation-as-politics can help reveal the limitations of this approach (Tyfield, 2012; Tyfield et al., 2017). For a generation or more, neoliberalism's boosters have told us that the market is the most important social coordinating mechanism, and therefore it should be embraced at all levels and in all dimensions of social life, including the state. Yet markets have spectacularly failed in recent years, most obviously – e.g. in ongoing dependence on QE stimulus – for the very financialized power blocs that were previously neoliberalism's most ardent and enabled supporters. Waiting in the wings of this justificatory schema and political project, however, the figure of the entrepreneur is imagined as an agent ready to combat these market failures and help realize the market's optimal (and optimally productive) socio-political order.

Neoliberal common-sense – and, indeed, neoliberal socio-technical change itself – has sedimented innovation and entrepreneurialism as unquestionable, self-evident goods (Szeman, 2015). Innovation becomes an individualized but also Promethean world-creating power mediated and rewarded by the market, although the political currency of the latter has become increasingly tarnished. In this context, accepting the seriousness of contemporary ecological challenges makes 'innovation' seem unarguably both necessary and urgent, and the figure of the entrepreneur is heralded accordingly, as society's savior.

These trends come together in a discursive shift, away from markets and towards innovation as a central organizing and justificatory concept (see e.g. Economist, 2015). The overwhelming appeal and strategic enablement of this move, however, is that the latter does not negate, but actually has the

power to re-situate and re-legitimize, the former. The entrepreneurial state is thus envisioned as an innovator, and the definition of innovation as venture capital-led private sector entrepreneurship remains hegemonic and unqualified. It is both in support of this capacity to innovate – thus defined – and upon the condition that the state *itself* is opened up and subjected to renewal by way of the superior stewardship of entrepreneurial change-agents that ‘bringing the state back in’ attains its new justificatory significance.

Building on a CPERI approach, we would argue that for neoliberalism “nothing proves that the market economy is intrinsically defective since everything attributed to it as defect and as the effect of its defectiveness should really be attributed to the state” (Foucault, 2008, p.116). Hence the market serves as a neoliberal fantasy or apotheosis that sutures the gap between real and symbolic orders (Dean, 2008), providing a non-falsifiable (political) argument. And the flipside is to scapegoat the (implicitly Keynesian, planning) state as the source of all imperfections and a permanent fetter upon realizing the ideal form of a market-based society.

With the entrepreneurial state, by contrast, we see a new ideology emerging that scapegoats ‘dirty’, corrupt, corporate capital and industrial polluters, along with the parasitic and unproductive financiers and the ‘Big Government’ (to whom they are connected by fast-revolving doors) supporting them. The entrepreneurial state instead empowers clean, productive, entrepreneurial innovators (who are still capitalists), enabling this new group of industrial (now high-technological) actors by entrusting them with the unique powers of the state.

Of course, the idea of ‘Silicon Valley’, and its implicit contrast with ‘Wall Street’, – which we understand through this CPERI lens to be simultaneously locations, networks, and political-economic imaginaries (Jasanoff, 2004) – is crucial to this picture, and not just in the US. Silicon Valley’s message is enticing, and strikingly resonant with the message of Green Keynesianism. In this sense, entrepreneurs are framed as the social actors who can innovate a way out of the problems incubated by Wall Street, so long as the state funds and empowers their efforts. For an example of this hubris, see Goldstein (2013).

In other words, the entrepreneurial state - or really the venture capital state - becomes a seemingly radical alternative to the Wall Street-backed, status quo neoliberal state. Instead of “the market can’t be wrong” and a political project of market fundamentalism we have “Technology can’t be wrong” as part of a broad project of technological salvation, or ‘disruption’ (Morozov, 2014; Keen, 2015). Furthermore, instead of the state as political whipping boy, we have the new unconscionable

vice of neo-Luddism, accused of objections to, calls for regulation of, or caution regarding any and all ‘disruptive’ technologies.¹ This explains the Breakthrough Institute’s admonishment of left environmentalism, which has, in their assessment, taken on precisely this sort of anti-technological, and therefore politically moribund, position (Shellenberger & Nordhaus, 2004).

Technology has and will continue to play a central defining role in the production and reproduction of global societies, and questions of technology will always be essential to climate politics. However, the use of the term ‘technology’ is problematic in Green Keynesianism. It allows them to slip into an uncritical and wholesale endorsement of a very specific, venture capital- (and military-) funded understanding of technology and the innovation agenda underwriting it. And it thus avoids political questions about what is considered to be desirable technological innovation in the first place. Any inkling of a return to debates around appropriate technologies – more often today understood through concepts such as degrowth, just transitions, diverse economies or *buen vivir* – are dismissed for not providing wholesale endorsement of the specific technological agenda currently promoted by venture capital-funded entrepreneurs, the self-anointed masters of innovation.²

By contrast, CPERI highlights that this is but one specific and situated model of innovation. Instead of showing technology and innovation to be an ethical, political and historically complex terrain of social creativity, their far narrower discussion of green technology reflects the current trajectories of commercial viability and its focus on alternative energy production; as opposed, for instance, to challenging unequal and unsustainable patterns of energy use. An unquestioned notion of market sovereignty comes to be embedded within a naturalized conception of what technology is and what innovation can, and cannot, become. As such, this entrepreneurial techno-politics squanders the opportunity to acknowledge, as many STS scholars have convincingly shown, that the process and trajectory of innovation itself, and not just its funding, is an essential terrain of political and ecological struggle (Tyfield et al, 2017).

Returning to Bina’s typology, the notion of the entrepreneurial state is different from proposed policy frameworks that can actively shape investment and innovation in the green economy, and which take a Polanyian perspective that seeks to re-embed the economy within an invigorated social and

¹For a graphic illustration of the current political purchase and work being done by the concept of ‘innovation’ in the EU, for example, see the attempted propagation by several trans-national chemicals corporations of a so-called ‘Innovation Principle’, designed to rival the ‘Precautionary Principle’ as a newly established maxim of EU governance where the goal is to protect the ‘innovation environment’ – i.e. of minimal regulatory interference in innovation (EPSC 2016, ERF N.D.).

² This pro-technology perspective is also voiced by the accelerationists (Srniczek and Williams 2015), who castigate positions such as degrowth, *buen vivir* and diverse economies as ‘folk politics’, which operate on too small of a scale to actually make an impact.

political sphere (Bina, 2013). With the entrepreneurial state, revitalized state direction is primarily set in collaboration with venture capital. Innovation trajectories therefore become focused on the needs of the market (i.e. financial corporations) as much – if not more – than any public or environmental needs that Green Keynesians might be hoping the state would address.

If the Keynesian state is imagined to have done its de-risking of industrial development for the people, this entrepreneurial state will instead do its de-risking for Silicon Valley, as supposed agents of Green Keynesian innovation. Furthermore, in the process it enables this privileged network to shape the institutions of the state to their enduring strategic and financial advantage (Morozov, 2015). Crucially, therefore, the entrepreneurial state is primarily a project of *redefining* the state, while taking innovation as given, as opposed to revitalizing, redirecting and redefining innovation through a publicly-interested state agenda.

Perhaps the reason for this is that neither Mazzucato nor the Breakthrough Institute’s thinkers consider the interaction between processes of innovation and the state as a set of power relationships, unlike CPERI (Tyfield, 2012). They have a vision of what the state could become economically, but there is no real analysis of what the state already is politically. The same is true with their treatment of technology, precluding any possibility that a necessary and just transition may and likely will require a radical revisiting of what innovation means, how it is developed, who is empowered to innovate, and, reciprocally, who is empowered or disadvantaged by these innovations.

With this example we can see how an actually-emerging Green Keynesianism can thus be marshalled (more-or-less unwittingly) to support ongoing neoliberal-framed efforts to steer the economy in relatively unchanged ways. When underpinned by frameworks like the entrepreneurial state, as we will now explore, Green Keynesianism can inadvertently provide justificatory cover for neoliberal projects by offering a superficial, populist idealism that flattens out the contours of history and pines for a return to simpler and more august days, regulated days, days when finance was kept in check and the ‘real’ economy could therefore flourish (e.g. Perez, 2009). The veneer of these golden days glistens brighter as the distance between historical fact and present day fantasy widens.

Some Problems with Green Keynesianism

If, as Geoff Mann (2015) argues, Keynes was primarily concerned with saving civilization from the destabilizing effects of capitalism, then Green Keynesian efforts to ‘save the planet’ may actually be the most faithfully Keynesian aspect of GND politics. Yet herein lies the crux of the problem: what civilization is it that will be saved when so much of the social, environmental and technological

infrastructure of *this* civilized life is deeply embedded in the capitalist world-ecology (Moore 2015) that we need saving *from*? A richer account of Green Keynesianism that addresses the historic relations amongst political economy, political ecology and socio-technical change in the actual history of Keynesianism can, as we now explore, offer us guidance.

Many Green Keynesian proposals overlook how actually-existing Keynesianism was socio-ecologically and historically situated and unrepeatable (Mann, 2015). It was comprised of a constellation of sociopolitical forces including regimes of accumulation, spatio-temporal fixes, political-cultural settlements and hegemonic common-senses. Together these constituted the Keynesian National Welfare State (Jessop, 2002) that dominated the post-war period in the re-established ‘core’ of the global North, and in an age before global environmental challenges were acknowledged. Furthermore, and perhaps most importantly, this Keynesian miracle was inseparable from a massive influx of petroleum into the global economy – fueling what Schnaiberg and Gould (1994) termed the treadmill of production (*Cf* Cato, 2013).

Most invocations of this Keynesian period focus on state-supported public works and the institutional infrastructure of social welfare provisioning. But military and Cold War spending was an equally, if not more, central (and certainly larger in terms of total expenditures) aspect of the 20th century growth model (Pivetti, 1989). Militarism not only led directly to economic activity and significant innovation (in the military-industrial complex). It was also a necessary means of securing global access to the material and financial resources upon which first world prosperity was built (e.g. Mitchell, 2011; Yergin, 2009).

The Cold War provided a social and cultural politics of legitimization for unprecedentedly generous state funding in the United States, which could be cast as a defense of the ‘free world’ and even more specifically, a defense of a distinctly American way of life predicated upon mass consumption. And yet, the intense dependence of the Keynesian settlement, including its public provision of science and technology (Mirowski & Sent, 2008), on Cold War military spending is all-too-easily passed over with allusions to a new Keynesianism that eliminates its dependence on warfare, or assumes it can be deployed instead as a civilian “war on climate change” (Rao, 2015). Such hopes ignore the actual geopolitical militarization and securitization already underway, *including* of climate change, not least in the US where government officials have explicitly framed climate change as a national security threat (see Bonds, 2015; Jackson, 2015).

At the point of production, the New Deal’s labor-capital accord was a means of ensuring that the working class majority forwent labor militancy in exchange for relatively high wages and decent workplace protections (Bowles et al., 1986). However, a broader picture needs to consider the ways in

which a new form of social reproduction was central to this bargain. Despotism in the workplace was met with individuated suburban freedoms in home life, at least for those making good white male wages.

As Matthew Huber (2013) argues, the Keynesian labor-capital accord was a means of using public resources to create a landscape of privatized and fossil-fueled wealth. Direct state support for mass suburbanization, the production of an interstate highway system, and the rise of consumer credit all helped lay the ground – financially, socially and concretely – for the rise of a neoliberal subjectivity, where entrepreneurial competition as opposed to market exchange could be seen as the foundational pillar of society. This compromise was very much about insuring a petrol-regime over production and consumption – cheap oil fueling mass industrial production, and therefore also mass consumer life (Urry, 2013; Mitchell, 2011).

Petroleum-based products and infrastructure became a ubiquitous, unquestioned dimension of everyday life, as oil – the central and defining commodity of the 20th century – flowed through almost everything (Urry, 2014). Huber argues that this mode of social reproduction –or what Stephanie LeMenager (2014) calls petromodernity and Timothy Mitchell (2011) conceptualized as ‘carbon democracy’ – is so thoroughly tethered to the petroleum-based economy that any substantive proposals for decarbonization will appear farcical at best, and, at worst, aggressively anti-American affronts to the freedoms of mass-consumer life.

Simply put, the American way of life was not – nor is it now – up for debate. It must be preserved (or even made ‘great again’) at all costs. This becomes starkly clear in the U.S. based, ecomodernist proposals for GND politics discussed above, which justify their focus on technological innovation in light of the recalcitrance (and unquestionable desirability) of mass consumer lifestyles and desires. It will be easier to create green cars, for instance, than to wean people off of their use (Mowery et al. 2010).

More broadly, however, what we see happening with the invocation of Green Keynesianism is a split history. On the one hand, the 20th century Keynesian miracle is seen as a product of state intervention – whether through warfare or welfare – and Green Keynesians want to see a return to this sort of central authority to steer the economy. But on the other hand, there is an inseparable history of accelerating climate change over this same period, marked by many of the specific sociotechnical assemblages (automobiles, airplanes, suburbia, disposability, etc.) that were being engrained into modern industrial life by this very same regime (Huber, 2013; Urry, 2014). To a large extent, this Keynesian miracle put in place the sociotechnical conditions for an utterly toxic and unsustainable way of life – an infrastructure of waste-making at a planetary scale (Schnaiberg and Gould, 1994).

To the extent that problems with historic Keynesian initiatives and policies are acknowledged by many of the more high-profile and influential proponents of a Green New Deal on whom we have focused above, they are simply assumed to be analytically distinct and unfortunate side-effects that can be rectified by greater care and attention rather than constitutive and deepening systemic dynamics. For example, UNEP's (2009) proposal for a GND does not limit itself to Roosevelt's New Deal policies as its model, but also looks to the Green Revolution, where new agricultural technologies were disseminated across the Global South. "Notwithstanding its environmental and social drawbacks," they explain, these technologies spread "from the hands of a few hundred scientists to millions of poor farmers... at a breathtaking speed and scale" (pp.15-6). However, instead of rapidly increasing agricultural yields in environmentally and socially devastating ways (Thompson & Thompson, 2005), they argue that their GND will instead rapidly increase renewable energy yields – in environmentally and socially harmonious ways.

Ultimately, the idealism and pragmatic political appeal of Green Keynesian proposals such as this depend upon maintaining the analytically implausible split between two 20th centuries. In one, a strong and virtuous state creates the conditions for the relative affluence of a broad-based (white) middle class and its global development agenda; and in another one, a treadmill of production (and destruction and warfare) enables this affluence through (post-)colonial dispossessions and the accelerated destabilization of world-ecology. In order for Green Keynesianism to remain logically coherent and politically compelling, the state (abstractly understood) and its potential to act in *securing* the public interest (socially and now ecologically as well) must be insulated from the realities of its sociotechnical infrastructure. How that public interest is defined becomes, therefore, a critical question to unpack.

The 'Public Interest' Redefined

Perhaps the most alluring aspect of a return to Keynesianism is the idea that the state will be able to function primarily in the public interest, in contrast to an incumbent, globally-dominant and environment-destroying neoliberalism. This contrast is crucial to the political appeal of Green Keynesianism, as the most important and ready-to-hand foil against which neoliberalism can (supposedly) be understood and countered. However, the supposed self-evidence – and achievability – of this familiar sense of the public interest ignores the complex conceptual constellation of public and private interests in the Keynesian period, rather than their simple opposition (Mann, 2015). As a renewal of liberal capitalism in the wake of two world wars, the defeat of fascism and the continuing

threat of socialism, the Keynesian public was mainly prioritized to the extent that it enabled growth of private life: a large social sphere incorporating private enterprise, work contracts and the rights to a private domestic life that supposedly characterized the 'Free World' (Aglietta, 2000).

The return to this publicly-minded statecraft is also belied by the unique conjunction of socio-technical, political economic and cultural conditions that gave the actually-existing Keynesian 'public' both its specific sense and its broad political purchase. Of particular importance was the dominance of industrial (as opposed to financial) capital, built around new horizons of accumulation from the expansion of mass consumerism and petrol- and plastic-based innovation (Huber, 2013). Furthermore, it was built on a strong working class in the Global North that served as bedrock and guard of the social welfare settlement, themselves empowered by the threat of more radical anti-capitalist politics sponsored by actually-existing socialism (Jessop, 2002). The way in which Green Keynesian arguments simplify and even fetishize what the Keynesian state was and therefore could become, however, crucially depends upon being pitted against an equally simplified, straw man version of the neoliberal state that ignores the dynamism and ongoing coordinating capacities of this more recent social formation. Here again a CPERI perspective is helpful for understanding neoliberalism as complex dynamic system.

Conceptually, it is the gravest mistake to misread neoliberalism as a radical preference for the market *as against* the state in the organization and coordination of political economic relations. Rather, as an epistemic market fundamentalism, in which the market is conceived as the best of all possible decision-makers (Mirowski, 2013), neoliberalism is systematically agnostic regarding the state *per se*. This is exemplified in the Hayekian debate about the 'esoteric' and 'exoteric' relations of state and citizenry. Indeed, the monopoly of legitimate coercion in the hands of the state is a crucial political tool for neoliberalism in the (often heatedly rejected) marketization of all things (Mirowski, 2013).

More generally, state power is needed for multiple political projects of entrepreneurial and/or financialized profit-seeking and for the oversight and regulation of markets. Furthermore, the state itself and its functions of public support can be increasingly subjected to forms of (quasi-) market discipline. Even in the archetype of the US, the state has never stopped (and indeed has massively increased) its support for R&D of commercial technologies (Block, 2008). Yet, this has been conducted as a 'stealth' industrial policy because the discourse of 'market vs. state' has proven a powerful means of delegitimizing the incumbent Keynesian consensus from which it emerged (Mirowski & Plehwe, 2009).

The supposed return to the public (vs. private) is no different in this respect, especially when it is itself cast in terms of state vs. market. Neoliberal governance has not abandoned the 'public', even as

it systematically denigrates it in political discourse and demolishes the social welfare institutions embodying the Keynesian sense of the public interest (Smart, 2003). Instead, neoliberalism has effected a profound transvaluation, in which government's role in defense of the public is to secure (perhaps literally, via accumulation by dispossession) the conditions for unencumbered pursuit of the interest of a 'public' consisting of shareholders, property owners, (debt-based) consumers and competitive entrepreneurs (Crouch, 2011).

To counter that this is just not what public really means belies a refusal to admit that one's (perhaps quite legitimate) normative preferences do not trump, in and of themselves, the prevailing operative understanding of one's society and the system of power-knowledge relations through which it is constituted. To be clear: we do not deny or underestimate the profound (and in early 2017, manifest) political appetite for an alternative to the neoliberal status quo and its impoverished, economically uneven conception of the public interest. However, when such criticism falls back upon a simplified conception of Keynesianism as the paradigmatic form of not-neoliberalism, it fails to register the crucial political and ideological continuity between the two and therefore fails to offer any meaningful, strategic and potentially transformative alternative.

Sticking to surface dualisms – Keynesianism vs. neoliberalism, public vs. private, state vs. market – conditions a largely superficial analysis that envisions discrete regulatory regimes that can simply be exchanged at will, as interchangeable and replaceable skins to sheath the state in its management and superintendence of the capitalist economy. In contrast, the CPERI approach we use herein provides a means to examine actually-existing social formations and socio-technical models which have irrevocably and thoroughly reshaped the social, economic, political and of course environmental landscape, not to mention the very nature of what states themselves are and can become. We caution against approaches to Green Keynesianism that effectively fetishize the potentially developmental state (*Cf* Song 2013), as the forebear of a virtuous, collectively rational guardian of the public interest that temporarily and regrettably lost out to neoliberal greed, but to which deepening environmental, economic and political crises will force a return, by way of our collective reason.

Conclusion: Towards an Eco-Politics of Innovation and the State

Many GND proposals offer compelling and what seem to be politically realistic visions of a greener world. Against the continuing torpor of meaningful global action, they also seem quite radically ambitious, and we do not doubt that massive state projects of this kind could be greatly preferable to the status quo and even necessary (Jessop, 2012). Yet it remains important to see how

these supposedly straightforward calls to ‘bring the state back in’ to stimulate (or re-orient) innovation are built upon analytically inadequate and strategically problematic conceptions of the state, innovation and their (developing) inter-relations.

In this paper, we have used a CPERI approach that sees the state and innovation as co-produced social, political, economic and technical phenomena (Jasanoff 2004). We first presented a critical analysis of the Green New Deal, in some of its dominant manifestations. These Green Keynesian approaches presume that if existing processes and models of innovation were to receive stronger support from a newly nimble state and to focus on ecological sustainability, these latter issues could be resolved. Amongst the Green New Deal discourses achieving greatest political purchase are those that champion the concept of the entrepreneurial state, while failing to problematize their understanding of innovation and the public good, as implied by the terms ‘entrepreneurial’ and ‘state’ respectively. Innovation is thus accepted to mean high-technology innovation driven by venture capital investment, while it is taken for granted that (greater) state direction of innovation will serve a just and democratic public interest, almost by definition. This, we have argued, also affords a wholly uncritical disavowal of the actual record of 20th century Keynesianism, not least regarding the central issue of its ecological impact.

In all these respects, however, a CPERI analysis – exploring the co-production of actual trajectories of socio-technical change and innovation policy in parallel with changing power relations and dominant imaginaries and common-senses – directly opens up these blindspots. Placing these political narratives of innovation policy atop the existing political economic regime, we can see how, counter to much of the well-intentioned sentiment built into Green Keynesian proposals, incumbent power relations are not supportive of (and actively hostile to) a reversion to both the social democracy that accompanied mid-20th century Keynesianism along with any social democratic framing of innovation. To the contrary, the resulting conceptions of a GND can lend credence to agendas that actually reinforce and revive the neoliberal growth machine (rising levels of resource consumption accompanying rising inequality), just in new, greener and more ‘innovative’ forms.

Indeed, as seismic political events during the review process of this article have clearly demonstrated, this inimical twisting of Green Keynesianism is arguably one of the *better* possibilities today. In many ways, the election of Trump and the vote for Brexit confirm the foregoing argument. First, both signal a formidable populist resistance to any revived social democratic Keynesianism and *its* entrepreneurial state, making the grand visions of Green New Deal advocates seem more remote than ever.

Yet, secondly, and somewhat ironically, these events signal a nostalgic thirst for a return to

(innovation and investment in the model of) the ‘good old days’ of Keynesian industrialism and the allure of full and life-long employment (for the white, male working class) – viz. ‘Make America Great Again’ or, indeed, ‘We want our country back’ for Brexit. It is just that this vision is precisely *not* Keynesianism of a ‘green’ or low-carbon innovation, but rather one determined to rebuild the original, *high*-carbon variety, that caters to an industrial working class that feels as though it has been left behind (Chen, 2015). The (geo)politics required to preserve the financially and environmentally unsustainable ‘carbon bubble’ (Steffen 2016) are apparently now being actively pursued (including now, Trump taking the US out of the global Paris Agreement on climate change), and are being bolstered by an attempt to destroy and censor all federal capacity to document the counter-narrative of worsening anthropogenic climate change. As always, this is also being played out through the crucial arena of innovation policy and government support for socio-technical systems; in this case, of fossil fueled industrialism, not green innovation. In this respect, then, the election of Trump may come to present a warped revival of ‘Keynesianism’ that is more politically and environmentally faithful to its historical referent than many of the idealistic and aspirational visions of Green Keynesianism.

But Trump potentially represents even more of a challenge to Green Keynesianism, stealing not just their old, familiar clothes (an industrial, militarized state) but also their new ones, regarding the entrepreneurial state. For Silicon Valley not only remains a pre-eminent power center in determining the common-sense meaning of ‘innovation’ - as in fact self-styled ‘disruptive’ *rentiership* (Birch 2017) - but its tech scions have already shown themselves willing to work with the Trump administration (Coren 2016).

Given that they are clearly opposed to Trump on some major issues (e.g. immigration), this suggests Big Tech spots clear opportunities in this populist, ‘entrepreneurial’, free-market and ill-prepared administration to ‘disrupt Washington’ in a durable reframing of the state, further sedimenting their power to shape national innovation policy (Taplin 2017). Completing the disrobing of Green Keynesianism’s express intentions, therefore, the Trump presidency threatens to effect a Keynesian revival that achieves precisely the opposite: a regressive, high-carbon, chauvinistic new New Deal in parallel with an ‘entrepreneurial state’ that manifests an even-more-radical dismantling of the state by handing it over to quintessentially neoliberal, Randian ‘innovators’ (Cf Micklethwaite & Woolridge, 2014).

This dark prospect places a grave responsibility on STS to raise key issues of contemporary politics, in which the politics of *innovation* (in co-production with constantly evolving power relations) are so pivotal. As STS scholars have made abundantly clear, technologies are not neutral, nor is the ‘innovation’ that includes, but is not exhausted by, the introduction of new technologies. Which

innovations are produced, which technologies are maintained, and how, all matter deeply, and increasingly so in an age of proliferating socio-technical novelty, risk and uncertainty (Tyfield, 2015).

One cannot just assume that technologies coming out of any given innovation ecosystem, let alone one dominated by Silicon Valley-funded ventures, are the ‘green’ or ‘clean’ or ‘smart’ technologies that will best serve the public interest, just as one cannot assume that greater state involvement in innovation necessarily ‘tames’ the private interests of capital in shaping sociotechnical trajectories. In other words, and to reframe this in environmental terms, we need to be asking: *which* ‘green’ innovation will shape our cities, our transit, our energy supplies, and our food system, and *which public* will this serve and co-produce (Viitanen and Kingston, 2014; Tyfield et al., 2015)?

We do not intend to inveigh here on the specifics of these debates, but wish merely to flag the necessity of having them, and of having them with as broadly relevant a ‘public’ as possible. Setting a socially-determined innovation agenda is central to defining what ‘progress’ can and should mean, who or what that progress will serve, and what sort of governing institutions can support these ends. As such, this is an agenda – for politics, research and their conjunction – that remains attentive to the constitutive relationality of innovation and state/politics, and how the latter is irreducibly shaped by the former.

It may be that neither ‘reform’ nor ‘revolution’ offers a way forward, and that this framing itself may need to be rethought. Along these lines, we might ask: what would it look like to engage (existing) states without capitulating to them – to build the capacity to make collective decisions – to plan as states plan – while transforming the mechanisms of decision-making at every scale imaginable? Furthermore, what forms of ongoing socio-technical responses can and should be supported by these re-imagined political institutions, with what uneven effects upon a diverse, already-scarred socio-ecological world? Ultimately, only an egalitarian and ecological politics of innovation, explicitly targeted at both concrete issues of socio-technical change and the longer-term co-produced parallel remodeling of political communities and institutions – including, crucially, the *state* –, has any strategic hope of actively and self-consciously building better states, better technologies and with them, brighter futures.

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