

ADVANCED REVIEW

Political economies of climate change

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Political economy approaches across the social sciences provide powerful explanations for important dynamics within the global response to climate change. This article discusses in particular how they provide explanations of the social origins of greenhouse gas emissions, the dominant policy and governance responses to climate change, recurrent political conflicts over these responses, and the patterns of bargaining between states, businesses, and other actors. Underlying these dynamics are a set of contradictions or tensions between the character of capitalism as a social system and the demands of decarbonizing the global economy, specifically: between the imperative for growth that constrains and shapes responses; concerning the power of large transnational businesses and other incumbent interests to block responses; and over the embeddedness of carbon emissions in daily life. The article explores the implications of these contradictions as well as some of the important theoretical debates about the limits of political economy approaches.

This article is categorized under:

Policy and Governance > Multilevel and Transnational Climate Change Governance
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1 | INTRODUCTION

Political economy is a term that is used in various different ways. Here, we use it in two specific ways, reflecting how these uses dominate the literature on climate change from political economy perspectives. The first, with roots in classical political economy (but considerable evolution from the original ideas of Smith, Ricardo et al.), is public choice theory. This is an approach that might be termed “economic theories of politics”—approaches that emerged in the 1970s that treated political and policy processes through the lens of seeing all actors—politicians, voters, bureaucrats, as well as “economic” actors such as firms and consumers—as instrumental utility-maximizing agents (Buchanan, 1990). Public choice theory thus extends the basic assumptions of economics by applying its premises within political science (Buchanan & Tollison, 1972, 1984; Mueller, 1993, 2003). However, given that political processes are not structurally the same as abstract “perfect” markets, the processes that result are ones of bargaining, rent-seeking, and patronage, as market actors seek to strategically capture the resources that states dispose of in a monopolistic fashion (Krueger, 1974), and phenomena such as information asymmetry, power imbalances, and political business cycles (where governments manage the economy to maximize their chances of re-election, with perverse economic outcomes) become central to the analysis (Black, 1948; Niskanen, 1971; Tullock, 1989). This sort of analysis has become what is referred to as political economy within economics—if you ask an economist what they mean by “political economy,” this is what they tend to respond. But the approach has become widespread elsewhere—in much of political science and International Relations, notably (especially in the United States).

The second focuses on the overall structure of the global political economy. Capitalism is the central concept here, a term rarely used in public choice theory. These approaches, that we will call collectively critical political economy (CPE), have

their roots in the writings of Marx and some strands of Marxist thought (notably Gramsci, regulation theory, and world systems analysis). Ecological economics provides occasional insights also useful for this account. Central here is the idea that capitalism is an integrated system that has specific historical conditions of existence and specific organizing logics and tendencies. In the Marxist account, integral to capitalism are dynamics of class conflict and other persistent economic inequalities, the imperative of capital accumulation, the extraordinary economic and technological dynamism, geographical expansion across the globe, the importance of the State in providing the conditions for accumulation, and persistent tendencies towards economic crisis. These sorts of approaches are what are more likely to be understood when the term “political economy” is used in development studies, geography, sociology, and in political science outside the United States.

In what follows we elaborate how these ideas have been used to understand various aspects of social, economic, and political responses to climate change. There is considerably more material from and emphasis on the CPE approaches; this reflects perhaps our own understanding of how each enables us to address important questions regarding climate change, but also simply the literature we found using a systematic database search for articles published explicitly referring to “political economy” and “climate change.” We illustrate the considerable value of these different approaches in highlighting key dynamics in climate change politics and policy. We organize our discussion around: the origins of climate change, the key contradictions between capitalism and climate change, the dynamics of responses to climate change, and the anticapitalist character of much climate change activism. Across these sections, we highlight the contribution of political economy approaches to persistent North–South conflicts in climate politics, the dominance of debates about economic growth across all states, the complex politics arising from the embedding of capitalist reproduction in daily life, the effects of the particular and the power of corporate actors in shaping responses to climate change, and the drivers of whether or not the global economy can be “decarbonized.” After these sections, we consider critiques of and extensions of political economy approaches, notably from Actor Network Theory and governmentality approaches.

2 | POLITICAL ECONOMY AND THE ORIGINS OF CLIMATE CHANGE

For public choice theorists and orthodox economics, the origins of climate change are in the problem of externalities. When there are costs that are not incorporated in the price of the good or service, those costs are likely to be overused, according to the logic of the well-known “tragedy of the commons” (Hardin, 1968) that arises when resources are rival but nonexcludable as is the case regarding the climate. For some, climate change is the quintessential commons problem (Stavins et al., 2014). In this situation, the standard response is to internalize these externalities using taxes (Pigou, 1920) or the market (Coase, 1960), although Elinor Ostrom in particular has argued widely that such commons problems can be resolved via community control of resources (Ostrom, 1990). In that perspective thinking about climate change starts from the logic of collective action (Hardin, 1968; Olson, 1965; Ostrom, 1990).

However, while this approach has a certain formal analytical appeal, it has distinct limits in terms of understanding *historically* why the emissions that cause climate change have grown. A core claim in CPE is that specific dynamics integral to capitalism are at the heart of the origins of climate change (Koch, 2011; Muzio, 2015; Newell & Paterson, 2010; Sapinski, 2016). If in the immediate sense climate change is the result of the acceleration in the burning of coal, oil, and gas from the late 18th century onwards, then the growing deployment of these resources can be seen as both cause and consequence of the emergence of capitalism itself from the 17th century onwards. Capitalism is, in Lewis Mumford’s (1934) term, “carboniferous,” reliant on the use of the energy contained in the coal in carboniferous rock seams (Sapinski, 2016).

The term “metabolic rift,” used by Marx, has become commonplace to account for this historical shift, and thus the centrality of fossil energy to the history of capitalism (Clark & York, 2005; Foster, 1999; Moore, 2011). It refers to the transition from renewable sources of energy (and other things, but energy is central for the present purposes), with cyclical flows, to linear flows of nonrenewable sources. The shift to fossil fuels enabled the increasingly global mobilization of resources and the concentration of energy in ways not previously possible. In part, this is simply because of the Energy Return on Energy Input—meaning the amount of energy needed in order to extract or generate a given amount of usable energy from the source—is so high for fossil fuels (Altvater, 2009). The era of unlimited economic growth became imaginable, and thus the metabolic rift constitutes a fundamental contradiction between capitalist dynamics and the ecological conditions of social reproduction. The question of “externalities” should be understood in this context: capital fought hard to make sure costs like air pollution (and now greenhouse gas (GHG) emissions) remains external to market prices for their products.

In the 19th century, coal powered the central economic sectors and drove political change. As Andreas Malm shows, the shift to coal in industry was as much about controlling labor as about increases in the efficiency of production (Malm, 2016), but by the end of the century, the control that workers came to have over this central resource enabled trade unions in those

sectors to lead the campaigns for the universal male suffrage and thus the emergence of democracies across the Western world (Mitchell, 2013). And the experience of coal drove a number of understandings of capitalism by economists, notably in the Jevons Paradox familiar to environmental economists (Jevons, 1865), which focused on the paradox that increasing the efficiency of coal use increased rather than decrease the use of coal, because of the dynamic effects on prices, technology, and consumption. By the end of the century, oil started to work alongside coal to help power the rapid expansion of electricity but more importantly the emergence of the automobile, which becomes central to 20th-century capitalism (Aglietta, 1979; Paterson, 2007).

Throughout capitalism's history, fossil fuel use (and therefore GHG emissions) and economic growth have had a more or less linear relationship (Lane, 2015). They remain tightly coupled at the global level (Peters, Marland, Le Quéré, Boden, Canadell, & Raupach, 2012), with any national-level decoupling being accounted for largely by changing international divisions of labor (Givens & Jorgenson, 2016).

Because capitalist social relations (the combination of wage labor and competitive markets) simultaneously produce extraordinary dynamism, recurrent economic crises and continual class conflict, the State becomes crucial in managing and shaping the patterns of growth and conflict to pursue the smooth reproduction of capital accumulation (Jessop, 1990). Given the centrality of energy to economic growth, 20th-century states have thus become intimately involved in managing, controlling, and accelerating the use of fossil energy sources. Much of it is to make sure that there are sufficient stable sources of energy to power economic growth—by controlling labor unions (Mitchell, 2013), by providing infrastructure that the market would not itself provide, and through imperialist ventures to control access to and profits from oil resources. Producing climate change has thus been an integral effect of, if an unintended consequence of, what states have seen as their core business.

There is however significant variety within capitalism across time and space. The key concept in a tradition of political economy known as regulation theory (Boyer, 1986) is the notion of a “regime of accumulation”—that in particular places and times, capital and the state generally seek to articulate labor regimes, production technologies, and consumption patterns in ways that generate a coherent and relatively smooth pattern of growth. Variations in how accumulation is pursued structure the carbon intensity of their economies (Koch, 2011; Lachapelle & Paterson, 2013).

Fordism is the classic regime of accumulation in this literature (Aglietta, 1979). The Fordist era, as its name suggests, was the highpoint of state activism in economic management, focused on Keynesian demand management, full employment, and corporatist relations between states, business and labor, and premised on Taylorist assembly line production and mass consumption. It was centered on the twin institutions of mass housing/suburban development and the automobile industry (Aglietta, 1979) and generally entailed, for Western countries at least a high rate of both economic growth and GHG emissions growth. Scholars developing the notion of the Anthropocene call this period the “great acceleration” in GHG emissions growth (Steffen, Broadgate, Deutsch, Gaffney, & Ludwig, 2015), which needs to be seen as the effect of this particular way of organizing capitalist development.

Political economists commonly argue that there was a shift from “fordist” to “neoliberal” organization of the economy from the late 1970s onwards (Harvey, 1990; Lash & Urry, 1987), with significant effects on climate change (Klein, 2014; Koch, 2011; Newell & Paterson, 2010; Parr, 2014). The Fordist-Keynesian era came under sustained attack in the late 1970s and 1980s, and the economy became organized around different principles—leaving more to the market, reducing the power of trade unions, focusing on inflation control rather than full employment in macroeconomic policy, and privatizing state-owned industries, notably. Starting in the United States and the United Kingdom, this became globalized via the IMF and World Bank with the “Washington Consensus” (Williamson, 2000) and structural adjustment programs. The onset of neoliberalism was associated with a decline in average economic growth rates, at least in advanced capitalist economies, and thus (more modestly) a decline in GHG emissions growth, but had significant effects also on the global division of labor and thus on the patterns of where emissions came from. Large parts of the industrialized world experienced significant deindustrialization during the 1980s as manufacturing (and with it energy use and GHG emissions) shifted to developing countries (Roberts & Parks, 2007). At the same time, finance was deregulated, unleashing important shifts in the relative power of finance both in relation to states and other economic actors (Harvey, 2007; Helleiner, 1994). States became significantly constrained in their policymaking, with effects on climate policy, by the threat of “capital strikes” and the general increase in dependence on transnational financial flows for investment and growth. While neoliberalism did not produce a major departure from the fossil fuel dependence of Fordist development (Koch, 2011; Newell & Paterson, 2010), the geographical shift in emissions that results becomes highly important for how states come to respond to climate change (see below).

3 | CAPITAL'S PRINCIPAL CLIMATE CONTRADICTIONS

If capitalist development is the historical cause of climate change, conceptually, CPE understands this relationship through the concept of contradiction (Ervine, 2012; Wright & Nyberg, 2015). That is, the logic of climate change and the logic of

capitalism are in constant tension with each other, and the resolution of these tensions cannot be guaranteed. The strongest claim regarding these is to claim that fossil energy dependence is inherent to capitalism per se and thus no capitalist solution to climate change is possible (Altvater, 2009). Many CPE scholars are sympathetic to this conclusion, but whether or not they reach a conclusion this strong; they highlight at least four principal contradictions between the character of capitalism and climate change.

First is to distil the fairly obvious observation from the previous section: capitalism's growth dynamic and the fossil energy-economic growth relation is the direct cause of GHG emissions growth and thus of climate change (Newell & Paterson, 2010; Wright & Nyberg, 2015). The pursuit of economic growth continues to pose a significant challenge to dealing with climate change. In simple numeric terms, if the global economy needs to decarbonize in absolute terms by say 3% per year to stay within 2°C limits, as is roughly the case, the relative rate of decarbonization needs to be around 5%, given about 2% per year global economic growth. By contrast, the historical rate of relative decarbonization is around 1% (Peters et al., 2012).

But even if numerically it is possible to imagine the decarbonization of the global economy within the constraints posed by the logic of growth, this points importantly to the character of the challenge: to identify the sectors, products, services that are key to keeping growth going while decarbonizing the economy, and the policy and political processes by which those processes might be favored. The various discourses of sustainable development, ecological modernization, green growth (Dale, Mathai, & Puppim De Oliveira, 2016; Moe, 2012), "green transformation" (Scoones, Leach, & Newell, 2015) and all the variants on a "low-carbon" economy (Lovell, 2015a; Urban & Nordensvärd, 2013; Viola & Lessa, 2012), are in effect attempts to articulate how such a transformation might occur within the constraints and logics of capitalism (Anshelm & Hultman, 2014).

The second contradiction is that the history of "carboniferous capitalism" has created powerful entrenched interests that resist change. This is both in terms of the specific industries involved in extracting and using fossil energy (Newell & Paterson, 1998) and, at the international level, specific countries that depend heavily on energy exports for economic growth and exports and thus have resisted progress in international negotiations. This is most prominently the case for oil exporters (Depledge, 2008; Kassler & Paterson, 1997) but has also been important for some coal exporters, notably Australia (Bulkeley, 2001; Christoff, 2005).

However, beyond this specific feature of the international negotiations, fossil fuel corporations have resisted action on climate change widely. This was particularly the case during the 1990s, through the Global Climate Coalition (Levy & Egan, 2003; Newell, 2000; Newell & Paterson, 1998), but continued in other ways after that. U.S.-based corporations have been particularly vocal in their opposition to action on climate change (Jones & Levy, 2007; Kolk & Pinkse, 2007), and have engaged in various strategies to undermine action (Oreskes & Conway, 2011). Much of this resistance is created by, as Malm points out, the need to protect investments that need to be amortized over long periods of time (Malm, 2016), and which thus lock in high emissions for decades. Within the energy economy, incumbent interests have particular power to oppose change, with established connections to politicians, parties, and strong connections to state bureaucracies. Energy ministries are routinely understood to be subject to processes of regulatory capture, where government officials understand their interests as synonymous with those of the industry itself (Baumgartner & Midttun, 1987), meaning that particularly strong external shocks are needed to promote alternatives. Scholars in the low-carbon transitions literature are beginning to recognize this political-economy dimension to pursuing such transitions (Geels, 2014).

Third, these incumbent interests are aided by the broad social embeddedness of energy. Energy provision and use entail myriad daily practices amongst all social actors. These practices—driving, flying, cooking, heating, cooling, and many more—are in effect the social or cultural life of GHG emissions (Shove & Spurling, 2013). They are simultaneously the way that the economy is lived in daily life and thus given meaning for individuals (Lederer, 2012), and central to the generation of GHG emissions. The political economy of energy and therefore climate change needs to be understood in part in cultural terms (Bulkeley, Paterson, & Strippel, 2016)—through the meanings of the objects we use in daily life, and the way those meanings act, alongside corporate lobbying (and often strategically used by corporations) as a constraint on action on climate change. Capitalism has thus been able to entrench its production of climate change in daily life and everyday practices (Huber, 2013; Paterson, 2007; Pelling, Manuel-Navarrete, & Redclift, 2012; Szeman & the Petrocultures Research Group, 2016), and thus in individual subjectivities reinforcing the power of entrenched corporate interests in climate politics and policy (Kolk, Levy, & Pinkse, 2008; Wright & Nyberg, 2015).

Fourth, the particular global character of capitalist development has produced significant constraints on action. CPE traditions understand this through the notion of combined but uneven development, which argues that through a variety of mechanisms (formal imperialism, unequal exchange, commodity dependence), hierarchical and unequal relations are reproduced over time between "core" and "periphery" in the global economy (Wallerstein, 1974, 1979). These core-periphery relations have been largely maintained despite the industrialization of parts of the global South, although the changing geography of industrial activity has important effects on the global distribution of emissions and thus on political dynamics (see below) (O'Hara, 2009; Parks & Roberts, 2010).

4 | POLITICAL ECONOMY OF RESPONSES TO CLIMATE CHANGE

Political economy approaches provide a number of insights into the dynamics of responses to climate change. We focus here on: the design of international agreements; North–South dynamics; the politics of carbon markets and neoliberalism in climate policy; corporate responses to climate change; varieties of capitalism; and the search for a decarbonizing “regime of accumulation.”

4.1 | The design of international agreements

Public choice theorists have focused in particular on the question of international cooperation over climate change, where the key problem is to work out how to get all states to cooperate, given that they may have powerful incentives to free-ride (Brennan, 2009). The central argument in this literature is that the design of international climate agreements needs to focus on the question of the incentives that states have to comply with the terms of an agreement (Aldy & Stavins, 2007). A commonplace argument is that the Kyoto Protocol (KP) failed because it provided insufficient incentives for states to join or comply (Victor, 2011).

This debate on international climate cooperation tends to frame it as a question of “top down” versus “bottom-up” approaches (Andresen, 2015; Green, Sterner, & Wagner, 2014; Hare, Stockwell, Flachsland, & Oberthür, 2010; Michaelowa, 2015; Rayner, 2010; Stavins et al., 2014). It is generally accepted that a “top down” global agreement would be optimal in both environmental and economic senses (Gollier & Tirole, 2015; Stern, Bowen, & Whalley, 2014), but there are various reasons to do with the incentives states face that mean this cannot be achieved especially in the face of the urgency of meeting a 2°C target, prompting policymakers and economists to look more towards the bottom-up approach (Chung, 2013; Sabel & Victor, 2017). This approach could be less effective but lead to better cooperation (Keohane & Victor, 2016). A bottom-up approach also allows for more regionalization of the global response, as argued by various studies of specific countries or regions (Chaudhary, Narain, Krishna, & Sagar, 2014; Francesch-Huidobro, 2016; Jones & Carabine, 2013; Käkönen, Lebel, Karhunmaa, Dany, & Try, 2014; Kim, 2016; López-Vallejo, 2016; Nagoda, 2015; Tanner, Mensah, Lawson, Gordon, Godfrey-Wood, & Cannon, 2014; Waterbury, 2013).

This literature also offers an explanation for why climate change governance has become increasingly complex over time. Many agreements, outside the United Nations Framework on Climate Change (UNFCCC), have emerged, involving cities, regions, businesses, NGOs, and smaller groupings of states (Bäckstrand & Lövbrand, 2015; Bulkeley et al., 2014). Keohane and Victor (2011) term this a regime complex. In the public choice view, this is because of the varied interests and incentives these actors face. A number of them display the attempt to secure what public choice theorists term “club goods”—goods where the members of the club can secure exclusive benefits (e.g., exclusive access to a particular technology)—which means that the incentives to cooperate and comply are much stronger than for pure public goods or commons problems (Andonova, 2009; Keohane & Victor, 2011; Potoski, 2017). But while public choice theory sees potential in these “climate clubs,” the rise of multiple agreements means that international coordination across different agreements becomes a more important issue (Finus, Kotsogiannis, & McCorriston, 2013; Hv, 2014). The risk is that global climate governance becomes yet more fragmented and even that different initiatives and agreements undermine each other (Gupta, 2014; Hickmann, 2015; Hv, 2014).

4.2 | North–South dynamics

The North–South dynamics of UNFCCC negotiations are well known. They have been one of the most important structural conflicts in the international negotiations, with conflicts over: principles (such as “common but differentiated responsibilities,” or CBDR) and their practical consequences; over which countries should undertake action to reduce emissions; over the inequalities produced by market mechanisms; over questions of finance and technology transfer; and over adaptation to climate change (Okereke, 2008; Roberts & Parks, 2007).

CPE enables us to understand these conflicts in terms of the historically evolving structures of the global division of labor. Both the background inequalities in per capita emissions levels and the ways these have evolved since negotiations began in early 1991 are driven largely by the core-periphery structure in the global economy and the changes in the global income structure since then (Ciplet, Roberts, & Khan, 2015; Roberts & Parks, 2007). The background inequalities drove the initial conflicts over the framing of the UNFCCC, with the principles of CBDR (Vanderheiden, 2015) reflecting the bargaining strategy of Southern states (Paterson, 1996), and they influenced strongly the form of the KP, notably the CDM, driven by a Northern desire both to include emissions reductions action in Southern states and a Southern desire for access to investment (Linnér & Jacob, 2005; Newell & Paterson, 2010). The changes in the geographical distribution of emissions have driven the shift from a North–South model toward a more complex pattern of negotiations since Copenhagen where the

large, rapidly growing developing countries, and especially China, have bargained as “great power” states, albeit with the North–South rhetoric still playing a significant role in their strategy (Banerjee, 2012; Hallding, Jürisoo, Carson, & Atteridge, 2013). But this is complicated by the accompanying intensified problem of the production-based accounting methodology for national carbon emissions (Lovell, 2015a). The migration of industries in effect is a migration of emissions from the North to rapidly industrializing countries, raising questions of where the emissions should be accounted for. CPE scholars understand this via the concept of “ecologically unequal exchange,” (Roberts & Parks, 2009) and thus this question of consumption versus production-based accounting for national emissions has global political economy dynamics at its core.

CPE helps us situate the global negotiations within a broader context of struggles over the pursuit of decarbonization and struggles over climate justice. While individual states may be seen to pursue their “national interests,” these interests are themselves produced by struggles within and between corporations and between them and social movements. Much CPE work, therefore, understands the UNFCCC in terms of corporate capture—the use of the KP to promote climate commodification being the classic instance of this (Brunnengraber, 2009). Much of the value of CPE in this context is in this basic recognition—that climate change is best understood as a global struggle between fossil fuel interests and the states that support them, and the rest of humanity, over the future trajectory of capitalist development and/or the shift away from capitalism as a social system. This point is strengthened by the focus, as much CPE work does (Bulkeley et al., 2014), on global climate governance beyond the FCCC—the recognition that that struggle is going on in cities, between corporations and social movements, at myriad scales and in varied forms.

4.3 | Carbon markets: Bargaining, rent-seeking, and neoliberalism

A good deal of political economy work has focused on the development of carbon markets in climate policy. Public choice theorists working on this have focused on processes of bargaining and rent-seeking in national policymaking processes. Most public choice theorists accept the standard arguments of economists in favor of market mechanisms, based on the logic of externalities going back to Coase (Coase, 1960) and Pigou (Pigou, 1920; Weitzman, 2016), but focus on the political dynamics when they are introduced, including explicitly the question of the political acceptability of carbon pricing systems (Rozenberg, Vogt-Schilb, & Hallegatte, 2013). There are market and political failures such as information asymmetry and inefficient allocation of resources that prevent achieving an optimal balance between private and public interests (Helm, 2010; Sovacool, 2015). As a result, carbon markets in practice are highly prone to capture by market actors. This is most obvious in circumstances like the emissions trading system (ETS) in China, given that country’s authoritarian system (Engels, Qin, & Sternfeld, 2014; Lo, 2013; Lo & Howes, 2013), but it is also the case in the EU ETS (Okereke & McDaniels, 2012; Patnaik, 2014) and the CDM (Newell, 2015). This is also the case in nonmarket approaches, such as regulatory policies to promote renewables (Helm, 2010). Current research, therefore, attempts to overcome these problems by reducing rent-seeking from public policies (Kuntsi-Reunanen, 2010; Meng, 2013).

CPE approaches agree with this critique of carbon market politics but extend it further. They argue that carbon markets (about which there is a huge literature in CPE (Baldwin, 2008; Böhm & Dabhi, 2009; Böhm, Misoczky, & Moog, 2012; Böhm, Murtola, & Spoelstra, 2012; Descheneau & Paterson, 2011; Ervine, 2013; Lohmann, 2005, 2006, 2013; Lovell, 2010; MacKenzie, 2009; Meckling, 2011; Newell, 2012; Newell & Bumpus, 2012; Newell & Paterson, 2010; Paterson, 2010, 2012; Reyes, 2011; Spash, 2010; Stephan & Lane, 2015)), should be understood as the central example of the way that neoliberalism has shaped climate policy.

Carbon taxes and carbon markets share the idea that climate policy should work via setting general incentives via prices, rather than directly imposing particular limits or technologies. This fits generally with the neoliberalism’s arguments regarding the appropriate role of the state (Clarke & Newman, 1997; Prasad, 2006). But carbon markets, in particular, articulate this more effectively with the need to find new sectors and processes of growth and accumulation (Paterson, 2010, 2012). Carbon markets create a new set of commodities to be traded in financial markets and around which derivatives can be created (Lane & Stephan, 2015; MacKenzie, 2009), which operate as assets for those that hold allowances in ETS or can create credits to sell from offset projects (Lovell, 2010), and thus they create a host of lines of business for lawyers, accountants, and consultants. In other words, the problems of bargaining and rent-seeking that are the object of criticism by public choice theorists and others are precisely the reason that carbon markets have taken off, from a CPE perspective: they enable the capture of rents by powerful industries and conversely enable policymakers to bring those industries into the realm of carbon regulation.

Work in CPE is mostly critical of carbon markets. Most argue that carbon markets are inimical to decarbonizing the global economy (Böhm & Dabhi, 2009; Spash, 2010), and some more strongly that carbon markets were developed and promoted by industry and some governments precisely as a strategy to avoid serious action to reduce emissions (Lohmann, 2006; Reyes, 2011). Others argue that carbon markets have a messier set of origins and consequences, that while they produce all sorts of problematic consequences, they nevertheless shift the balance of political forces within businesses away

from fossil fuel interests, enabling other strategies to decarbonize the economy to emerge (Meckling, 2011; Newell & Paterson, 2010).

Beyond the phenomenon of carbon markets, the neoliberal organization of contemporary capitalism has played an important role in the types of responses that have emerged. It is usually argued by political economists that neoliberalism has heavily constrained the ambition of responses (Parr, 2014). In the most recent financial crisis, this is likely to have been accentuated by the shift to austerity as a dominant policy since around 2011 (Burns & Tobin, 2016). The enhanced structural power of financial actors has made governments worry about the responses of such actors and markets to proposed climate policy. The policy discourse has been dominated by questions of impacts on GDP growth (Anderson & M'Gonigle, 2012; Stern, 2009; Stern & Treasury, 2007). Corporations have been able to use their mobility to threaten to relocate if states introduce climate policy unilaterally, creating the discourse of "carbon leakage" (where if one state regulates carbon, industry may simply migrate to other countries with no regulations, meaning that there is no effect on overall carbon emissions) (Juergens, Barreiro-Hurlé, & Vasa, 2013; Kama, 2014; Michalek & Schwarze, 2015; Zhou & Sheng, 2015), reinforcing the reluctance of states to regulate corporations.

4.4 | Corporate power in climate politics

The dominance of finance under neoliberalism has also empowered financial actors to seek other ways of shaping climate policy in their interests (Lohmann, 2012). While financial actors worry about the impacts of climate policy on corporate profits, they have more complex interests in relation to climate change than energy companies or heavy energy-using sectors. This is notably the case for insurance companies who are particularly exposed to risks from climate change impacts. They were amongst the first companies to start to play a more constructive role in climate politics (Paterson, 2001). Over time, these activities have led to a significant amount of private governance activity by financiers, predominantly in the area of carbon disclosure. Organizations like the Carbon Disclosure Project or the Investor Network on Climate Risk have emerged to get companies to disclose their GHG emissions, strategies for limiting them and exposure to risks either from climate change impacts or government regulations to limit emissions (Harmes, 2011; Kolk et al., 2008; MacLeod, 2010; MacLeod & Park, 2011; Newell & Paterson, 2010). Closely associated have been initiatives of accountants to develop means of accounting for carbon at project, installation and company levels (Lovell, 2015b; Lovell & MacKenzie, 2011; Thistlethwaite, 2011; Thistlethwaite & Paterson, 2015). This investor-led governance has become an integral part in the emergence of transnational climate change governance, governance that reflects in part the shift to neoliberalism which decenters the sovereign state in global governance (Bulkeley et al., 2014).

But corporate power in climate politics is not only about finance. The immediate causes of climate change can be identified in the activities of around 90 private corporations and state enterprises that extract, sell, or use fossil energy resources (Heede, 2013). While corporate lobbying has often been focused on stalling action, a common frame in CPE literature is that much of business has moved from seeing climate change as a threat to climate change as an opportunity (Newell & Paterson, 2010; Pinkse & Kolk, 2009; Wright & Nyberg, 2015). The CPE contribution to the business and climate change literature is twofold.

First, it enables us to understand the politics of building coalitions to promote climate policy, especially transformational policies toward decarbonization. CPE understands this in terms of the neo-Gramscian notion of hegemony—that capital seeks to rule by consent (where possible) and to do this involves both the construction of coalitions of forces, incorporating subordinate forces (labor and other social movements), using specific ideologies to do so. Given, however, that capital does not have homogenous interests in the case of climate change, hegemony also involves a struggle amongst different groups to identify their specific interests as the general interests of capital and society (Newell & Paterson, 1998). This allows us to understand both the struggles within business between (crudely) fossil fuel interests and corporate interests more favorable to climate action, as well as the struggles between business actors and social movements favoring more aggressive action on climate change and opposing specific procapital interventions like carbon markets (P-Laberge, n.d.).

Second, CPE helps us to understand the internal struggles within business, caught between logics of accumulation and their historically constituted ways of pursuing that, and logics of legitimation, as they seek to respond to claims by consumers, governments and their own employees, about the need to respond to climate change (Paterson, 2010). Much of this latter tension can be seen in the increasing focus on the emotional management of climate change by firms (Wright & Nyberg, 2015) as well as the competing narratives of climate change adopted both within and across firms (Levy & Spicer, 2013). Some of this production of narratives can be understood as greenwashing (Böhm, Brei, & Dabhi, 2015; Ferguson, Sales de Aguiar, & Fearfull, 2016), but they often have more complex dynamics, with narratives playing important roles reconstituting the identity of firms (Wright & Nyberg, 2015).

4.5 | Varieties of capitalism

As stated above, capitalism takes varied forms across time and place, and as a consequence, neoliberalism does not determine the entirety of responses to climate change. There is significant variety in the political-economic discourses through which

climate policy is articulated, and indeed, climate change has arguably become part of a broader questioning of neoliberal norms.

The ideas of sustainable development and ecological modernization articulate the idea that economic growth and sustainability can be made consistent with each other, at a general level, but climate change was a key part of the emergence of these discourses. More recently, ideas such as green growth and climate Keynesianism (Anshelm & Hultman, 2014; Newell & Paterson, 2010) make climate change even more central to the attempt to think about sustainability. In the case of climate Keynesianism (and more radical approaches of ecosocialism (Löwy, 2002, 2005) and no-growth steady state (Anderson & M'Gonigle, 2012; Barry, 2012)), there is a clear challenge to neoliberalism itself, and an argument that dealing with climate change involves a much more central role for state planning, public deliberation, and re-regulation of the private sector (Klein, 2014; Newell & Paterson, 2010). At the same time, we have had important shifts in the understanding of climate change as an economic problem, from emissions reductions to decarbonization to more recently the “end of the fossil fuel era” (Princen, Manno, & Martin, 2015; Rubin, 2012, 2015). These latter frames focus attention away from the management of an existing status quo to a transformative agenda focused on eliminating fossil fuels from the global economy.

Responses to climate change also vary geographically according to the location of a state in the global economy and its particular institutional forms of state economic intervention, as well as across different scales of political organization. The North–South split is becoming less useful over time as a way to understand this variation, with some southern states now taking leading roles in pursuing emissions reductions, renewable energy, and the development of low carbon technologies (Held, Roger, & Nag, 2014; Mathews, 2014; Urban, 2014). This is not only in the obvious way of providing low-cost manufacturing for renewable energy (especially solar pV as in the case of China) but considerable numbers of new patents for clean energy is coming out of developing countries like China and South Korea (Lachapelle, MacNeil, & Paterson, 2017; Hahn, Lee, & Yoon, 2012; Moe & Midford, 2014; Wang, 2013).

In comparative political economy, a commonplace distinction is between liberal market economies (LMEs), coordinated market economies (CMEs), and developmental states. There are significant variations across these types of state in terms of climate policy (Harrison & Mikler, 2014; Mikler, 2009; Mikler & Harrison, 2012). Broadly, CMEs have had significantly lower growth in emissions (or in some cases declines in emissions) compared to LMEs or developmental states, even controlling for other standard determinants of emissions levels (Lachapelle & Paterson, 2013). In terms of specific policy instruments, some of this variation is counter-intuitive, however,—CMEs are for example notably more likely to have developed ETSs than LMEs, at least at national levels (Lachapelle & Paterson, 2013). It is also useful to think about the interactions between different types of state and how they enable or constrain the development of climate policy. For example, we can see interactions between the strong capacity for R&D policy in the United States, the low-cost manufacturing strategy of China, and the strong regulatory capacity of CME states like Germany or Denmark to promote renewable installations, as an integrated dynamic favoring in this instance renewables development (Lachapelle et al., 2017).

This geographic variation is also in terms of spatial scales (Bulkeley & Betsill, 2013). Cities have become increasingly important to climate change politics (Bulkeley, 2013; Hodson & Marvin, 2010) and in part this is because the political economy appears very different at urban scales to national ones (Flint & Raco, 2012). Cities have multiple reasons to address questions of urban energy demand and supply, transportation problems, urban sprawl, and so on, in ways where climate change appears as an opportunity to attract investment and build new sorts of growth coalition (Rice, 2014). Cities also have distinct interests in climate change adaptation, with strong political economy dynamics (Whitehead, 2013). At city level, climate change has the potential to be a new “spatial fix.” Transnational city networks such as C40 have emerged in part to mobilize this new potential and attract further attention to the urban political economy that determines large swathes of global GHG emissions (Bouteligier, 2012; Gordon, 2013; Lee, 2014).

4.6 | Regimes of accumulation

In order to understand these various responses in a more integrated way, but also the conditions under which decarbonization might occur within capitalist conditions, the concept of a regime of accumulation is particularly useful. This concept refers, at the most general level, to the way in which a process of accumulation is organized institutionally, given that capitalist accumulation contains a variety of internal contradictions that could cause it to fall apart. This organization entails coordination across labor markets, state economic and fiscal policy, corporate organization and strategy, and so on (Aglietta, 1979).

The varied responses sketched above, structured by different traditions of political-economic organization, can be understood, especially as they get more ambitious, as attempts to create a set of cycles of investment, consumption, and growth within specific sectors, which could become self-sustaining over time. Often, these cycles start in highly localized places as “spatial fixes” (McCarthy, 2015). To the extent that they do so in a reasonably stable manner, they could become a decarbonizing regime of accumulation. But while specific aspects, notably carbon markets (Paterson, 2010; Sapinski, 2016), in which in some sense nature itself becomes the source of new types of accumulation (Smith, 2009) can be seen as such

smaller cycles of growth, creating a fully-fledged regime entails much more sustained strategic action by states to coordinate investment patterns and enable the consumption of the products thus produced. Historically, this also entails redistributive activity to ensure effective demand for things being produced.

Schumpeter's notion of "gales of creative destruction" is at times explicitly invoked in climate policy to understand how the process of generating new forms and regimes of growth works: that capitalism renews itself periodically via massive destruction of productive capital and investment in a new cycle of growth centered on novel technologies (Schumpeter, 2013). Some within CPE traditions see this inbuilt technological dynamism within capitalism as a potential source for decarbonizing transitions within capitalist logics (Buck, 2007). This helps understand why innovation and technology are at the center of various aspects of climate politics, from the assertion of the need for radically new technologies and extensive innovation (Harrison & Mikler, 2014), through to proposals for international climate agreements based on technology promotion (Coninck, 2011).

The concept of regimes of accumulation was developed to understand national growth processes, where successful growth regimes have depended on the ability of national governments to coordinate the relationship between investment, production, consumption, and wealth distribution to favor growth (Bridge & Perreault, 2009). Such conditions are much less apparent given economic globalization and the decarbonization of the global economy implies a globally coordinated approach. Nevertheless, we can see the elements in place in a more complex manner: a UNFCCC process focused on setting long-term decarbonization targets, within which national states set their own; some states promoting R&D in low-carbon technologies; agreements (in principle, unlikely to be realized fully) for climate finance flows to spread technologies and investment globally (Michaelowa, 2012); multilevel actions by cities and regions to promote investment in specific low-carbon trajectories over transport and buildings; private financiers generating systems of managing investments in a low-carbon direction. None of these individually is adequate, but all might be seen from a CPE perspective as potentially evolving into a more coherent growth regime that favors decarbonization.

Regimes of accumulation need political support, and the Gramscian notion of hegemony is important to understanding this (Cox, 1983). It entails the construction of a coalition of forces—a "historic bloc" in Gramscian terms (Banerjee, 2012)—that can sustain politically the drive to decarbonization. This involves identifying how to articulate particular interests and promote them so they will sustain the decarbonization project. This has to be understood as expressly in opposition to the fossil fuel bloc of interests that can be expected to continue to resist what has to be their medium-term demise (Levy & Egan, 2003). Hegemony also contains an ideational dimension, which provides the ideological "glue" to hold these coalitions together, and discourses such as green growth are evidence of the recognition of the need for such ideological work. The concept of hegemony can explain the global acceptance of market-based approaches (Matt & Okereke, 2015).

4.7 | Climate change and anticapitalism

If the concept of hegemony helps us understand dominant responses to climate change, then it has its counterpart in counter-hegemony. An important (if far from dominant, and many climate activists work directly with corporations) strand within social movements mobilizing over climate change invoke anticapitalist arguments, and even those who do not at times operate in counter-hegemonic ways, notably critiquing and opposing fossil fuel corporations. Arguably, anticapitalism in climate change movements increased from around the time of the Copenhagen COP in the UNFCCC (Fisher, 2010; Hadden, 2014, 2015), but it has a longer history. Anticapitalist discourse and action in climate movements coalesce around two interconnected themes: opposition to commodification of climate in the form of carbon markets (Lohmann, 2008a; Page, 2012) and opposition to the inequalities and injustices produced by climate governance (Derman, 2014; Kovel, 2008) (including but not limited to those produced by carbon markets) encapsulated by the term "climate justice" (Athanasίου & Baer, 2011; Lohmann, 2008b; Mathur, Afionis, Paavola, Dougill, & Stringer, 2014).

Opposition to the commodification of the climate goes back to the early days of climate politics in the early 1990s, when ETS were first proposed (Corfee-Morlot, 1992; Grubb, 1989; UNCTAD, 1992) and most international NGOs quickly opposed them as generating "licences to pollute" (the exception were a number of US NGOs that aggressively pushed for such markets, causing splits in the Climate Action Network) (Bedall, 2013; Lohmann, 2006). Opposition to carbon markets crystallized in the run-up to the KP and in the development of the operational rules for the KP's "flexibility mechanisms." NGOs won a number of battles, most notably in the almost complete exclusion of forests from the clean development mechanism (CDM) (Bäckstrand & Lövbrand, 2006). During the 1990s, anticarbon market politics became more explicitly anticapitalist, articulating the push for carbon markets with neoliberalism (Gilbertson & Reyes, 2009; Lohmann, 2009, 2012), a new form of colonialism (Bachram, 2004; Lohmann, 2008b), the increase of inequality (Böhm et al., 2012), and the power of finance more generally (Lohmann, 2006, 2008a, 2010).

What became known as the climate justice movement emerged out of this anticarbon market movement and broadened the frame of reference for contesting climate governance and understanding it in political economy terms (Böhm, 2009;

Methmann, Rothe, & Stephan, 2013). Out of it has emerged movements against oil pipelines and the divestment movement (Bratman, Brunette, Shelly, & Nicholson, 2016; Rowe, Dempsey, & Gibbs, 2016). The climate justice movement understands the response to climate change as explicitly a project to reassert democratic control over the economy, govern climate via participatory practices rather than the technocratic ones that suit corporate interests, and recognize both the radical challenge that decarbonization poses to traditional assumptions about political economy and the deep injustices produced both by climate change itself and responses to it (Klein, 2014).

4.8 | Critical questions

Over the past 30 years or so, there has been a sustained set of debates between CPE perspectives and poststructuralist ones across the social sciences. The way these approaches have been used to analyze climate change raise important questions regarding political economy accounts of climate change, principally around two specific themes.

The first of these concerns questions of technology and governance. A number of writers coming from Science and Technology Studies (STS) have focused on the very specific sorts of technologies that are used in assembling responses to climate change. In carbon markets, for example, a number of specific, innovative tools have been developed that act as “market devices,” with specific effects (Blok, 2014; Callon, 2009; (Lovell, 2015a; MacKenzie, 2009; Paterson & Strippel, 2012). These include the device of the tCO₂e, the Global Warming Potential, the methodologies for carbon offset projects, and specific carbon accounting tools. Collectively they show that a core process in climate governance is the means by which climate change and carbon become measurable, calculable, and commensurable (Eden, 2014; Lohmann, 2009; Lovell, 2014; MacKenzie, 2009). These devices create the possibility of trading carbon, but they do so in particular ways, with particular effects. The challenge for the CPE approach sketched above is that this focus on the “assemblage” of carbon markets, or any specific climate policy instrument, draws our attention to the limits of explaining climate policy by reference to the general features of “capitalism.” If specific markets are assembled in specific ways, then are there any generic features of markets *per se*? If the technologies by which markets are constructed generate their own effects, then how does this connect to the concept of class and capital as the principal social forces, central to most analyses in CPE?

The second theme is that of culture and subjectivity. As alluded to above, high carbon practices (driving, flying, etc.) are not only integral to the production of GHG emissions, they can be seen as integral to the reproduction of capitalist development. As a consequence, resistance to decarbonization operates as much at this cultural level of the meanings people attach to these practices in daily life, as in the politics of big corporations resisting emissions reduction policies and shaping climate policy in their interests (Bulkeley et al., 2016). Wright and Nyberg (2015) explore the emotional politics that plays important roles in how corporate managers deal with climate change. Norgaard shows this emotional politics at play in a small town in Norway (Norgaard, 2011). A number of the technologies of government discussed in the previous paragraph focus on trying to shape specific types of cultural subjectivity, such as via carbon offsetting, carbon counting, and so on (Paterson & Strippel, 2010). Gramsci is the central theorist of culture in the Marxist tradition, but scholars using Gramsci to understand climate politics have for the most part not deployed his accounts of culture (but see Levy and Spicer (2013)). There are, however, very broad literatures deploying such accounts of the social practices through which climate change is produced—see for example on automobility (Paterson, 2007) or oil (Huber, 2013)—but these have only alluded to climate change rather than made the connection explicitly. And there are arguably many insights from poststructuralists accounts of culture and climate politics that exceed the logic of Gramscian or other political economy accounts (Bulkeley et al., 2016). A key question for CPE perspectives is therefore the extent to which it can capture the complexity of these cultural identities as they evolved.

Foucault's concept of governmentality, which argues that government occurs principally through the governing of mentalities, or the “conduct of conduct” (Foucault, 2004), has been used widely to analyze climate change (Methmann, 2011; Oels, 2005; Paterson & Strippel, 2014; Strippel & Bulkeley, 2014), and brings these themes of subjectivity/culture and technology/assemblage in a particular way. Carbon governance often entails a specific set of techniques that aim to produce particular changes in practice and identity in individuals (Paterson & Strippel, 2010). But this raises a similar challenge to that above, that of whether or not such practices of governing can be understood adequately by reducing them to effects of some general account of “capitalism,” and certainly the intent of most working within Foucauldian or Actor Network Theory traditions is to eschew the idea of social totality that underpins both CPE (capitalism) and public choice (rational choice, methodological individualism) analyses of climate change.

5 | CONCLUSIONS

Building on these two themes, we can ask whether the insistence in CPE approaches on the idea of capitalism as a “totality,” a system with identifiable logics that play out inexorably, and within which particular projects and attempts at the agency

must be situated, is adequate to understanding the challenge of climate change, or if there is much greater heterogeneity and contingency in how economies address climate change.

This is of great importance to the pursuit of decarbonization. If capitalism has hard logics, and its growth dynamics and politics mean that eliminating fossil fuels from the global economy is impossible within capitalist conditions, notably, then it is pretty clear one that a decarbonized economy must be a postcapitalist one. Many draw this conclusion (Klein, 2014; Koch, 2011; Pelling et al., 2012). But if capitalist economies are constantly being remade, if markets have particular qualities depending on how they are put together, then there is a lot more potential for reconstructing capitalism in ways that favor the rapid transition to a fossil fuel-free future that is necessary.

Whichever position we adopt in this debate, however, it remains the case that political economy approaches enable us to understand the drivers of projects to pursue decarbonization, in ways missed by other approaches to climate change politics, policy and governance. We have emphasized a number of these in this article, both regarding how responses to climate change have been structured to date, but also regarding what will determine the possibility of transforming the world by decarbonize it. We do not offer definitive answers here, but there are clear hints from political economy about this.

We can be confident thus that the question of economic growth will continue to dominate climate policy. We do know that pursuing decarbonization is not simply a question of technology but will entail the combination of an economic strategy for (rapid) investment and growth in sectors that benefit from decarbonization, combined with a political strategy of building a coalition out of those sectors as well as civil society actors that favor decarbonization. We do know from the experience of carbon markets that these strategies are likely to be plagued by persistent legitimacy problems, both from critics of capitalism but also from incumbent interests resistant to change. We also know that states with strong traditions of state economic coordination, will be better able than others to reduce emissions, but also that other sorts of state economic management have institutional features that can enable them to play some sort of role in global decarbonization. Whether or not these insights from political economy can help those engaging strategically to promote decarbonization remains, of course, to be seen.

CONFLICT OF INTEREST

The authors have declared no conflicts of interest for this article.

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