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The central bank lacuna in green state transformation

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ABSTRACT
The scholarship on green state transformation has harnessed debates on the empirical and ideal transformations of the state in the Anthropocene, but central banks have thus far been elided from analysis. In this article, we draw into focus central banks as pronounced, if ill-considered, features of green state transformations in both theory and practice. Central banks exemplify the intractability, incrementalism and limitations of actually existing green state transformations. Yet simultaneously, these institutions of economic governance are, at least theoretically, vital constituents of fully fledged green states. In addressing the central bank lacuna in the analysis of green state transformation, we propose a research agenda at the intersection of environmental and monetary politics that centres on (i) the institutional variation and convergence of central banks across the global economy, (ii) the political-economic and institutional constraints on green institutional transformation, and (iii) the theoretical constituents and operations of a truly 'green' central bank.

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Introduction

In the study of the ecological crisis and the governance of an economic transformation that meets environmental targets, academic attention has increasingly been dedicated to 'bringing the state back in' (Eckersley 2004, Bäckstrand and Kronsell 2015, Duit 2016, Craig 2020a, Hammond and Hausknost 2020). This reflects the unrivalled power, capacity and legitimacy states possess in coordinating path-shaping transitions in the global economy. Whilst any transition to sustainability on the scale required must involve top-down and bottom-up economic changes catalysed by a plurality of societal actors

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(Scoones *et al.* 2015), it is difficult to imagine rapid systemic changes occurring without the actions of at least some agencies of the state (Eckersley 2004, 2021, Barry and Eckersley 2005, Bäckstrand and Kronsell 2015).

The Green State concept has been developed to gain analytical purchase on the empirical and normatively desirable relationship between the state and the natural world. Some have used the concept to instigate fruitful and salient theoretical debates on the forms of institutional transformations within the state necessary to orchestrate a sustainability transition (Eckersley 2004, Christoff 2005, Bailey 2020). Others have used the term to analyse the institutional developments of actually existing states in which vested interests subvert and shape political action on ecological degradation (Dryzek *et al.* 2003, Bäckstrand and Kronsell 2015, Hysing 2015, Death 2016, Bailey 2024), in ways which overlap with the Environmental State concept in terms of its *a priori* ontological assumptions of the state's objectives and limitations (Duit 2016, Mol 2016, Craig 2020b, Hausknost and Hammond 2020, Babić and Dixon 2022).

The debates on the Green State and Environmental State concepts, however, have historically elided the role of central banks and monetary policy, limiting the analytical and theoretical scope of green state transformation to the fiscal and regulatory functions of governments and the objectives and strategies that animate their usage. Implicit within these debates is the tacit acceptance of Central Banks own disingenuous and strategic discourse that as institutions they carry out a peripheral, technocratic and perhaps even apolitical role in economic governance (Tucker 2018, Van't Klooster and Fontan 2019, van't Klooster 2022). The 'fiscal-centric' accounts of green state transformation provide only a partial understanding of the state's potential capacity to enact the economic transformation required to avoid climate breakdown, the institutional changes taking place within the state as a result of the ecological crisis, and the plurality of ways that state change is being constrained by political-economic and institutional conditions.

As has become increasingly evident since the 2008 financial crisis, central banks are powerful actors which formulate policies with significant distributional and ecological consequences (El-Erian 2016, Tucker 2018, Van't Klooster and Fontan 2019, Reisenbichler 2020, Gabor 2021, Wansleben 2023, Bailey 2023). As investment continues to be channelled toward the fossil fuel industry and other unsustainable economic activities (Banktrack 2022), and these investment patterns have only been fortified by the 'market neutral' monetary allocations of central banks (Matikainen *et al.* 2017, Volz 2017, Dafermos *et al.* 2018, Campiglio *et al.* 2018, Reclaim Finance 2021, Bailey 2023), the financial sector has emerged as one of *the* most pronounced obstacles to meeting environmental targets. In this context, the importance of central banks as a key state agency in the governance of economic transformation has never been more acute.

This article lays the foundations for a new research agenda by drawing attention to the existing lacuna in the analysis of green state transformations. It locates the rising power of Central Banks in the environmental politics of facilitating or inhibiting financial and macroeconomic change and seeks to advance the scholarship through proposing three future research directions (RDs). These centre on (RD1) the institutional variation and convergence of central banks across the global economy on the governance of the instability resulting from the ecological crisis and economic transitions, (RD2) the political-economic and institutional constraints on green institutional transformation, and (RD3) the theoretical constituents and operations of an ideal-type 'green' central bank that upholds 'green' normative principles and values.

We will begin by reviewing the Green State scholarship and its neglect of the central banks and monetary policy in 'green' economic governance. Then, we shall demonstrate the powerful role played by Central Banks since the 2008 financial crash and the environmental consequences of its governance. Thereafter, we shall outline a research agenda based on these reflections, which we hope will theoretically, conceptually and empirically expand the analytical horizons of this field of study.

Eliding central banks in the analysis of green state transformations

Debates over the role and capacity of the state to respond to ecological degradation have generated a myriad of analytical concepts which seek to make sense of the ideal and empirical transformation of capitalist states in the ecological crisis. The concept of the Green State has harnessed discussion of the form, functions and objectives of the theoretical state with ecological protection enshrined at the core as an imperative (Eckersley 2004, Christoff 2005, Christoff and Eckersley 2011, Death and Tobin 2017, Hildingsson *et al.* 2018, Bailey 2020). The Environmental State concept, meanwhile, has served as a lodestone for empirical discussion on the constrained and stunted evolution of actually existing capitalist states in the midst of structurally contradictory ecological and economic objectives (Meadowcroft 2012, Hysing 2015, Paterson 2016, Eckersley 2021, Babić and Dixon 2022), albeit the Green State concept has also occasionally been utilised to analyse empirical transformation as well (see Dryzek *et al.* 2003, Bäckstrand and Kronsell 2015, Death 2016, Martus 2023, Bailey 2024). The analyses of green state transformation within this field of study has centred on the ways in which state capacity and governance practices could be (or have been) subverted for environmental purposes (Eckersley 2004, Christoff 2005, Barry and

Eckersley 2005, Hildingsson *et al.* 2018), but also how the state's institutional capacities have been shaped and distorted by capital interests that inhibit systematic transformation (Duit 2016, Paterson 2016, Koch 2020, Hausknost and Hammond 2020, Hausknost 2020).

Numerous scholars have documented how the state is developing environmental protection functions in response to growing societal and democratic pressures to tackle the environmental crisis (Dryzek *et al.* 2003, Christoff 2005, Meadowcroft 2008, 2012, Bäckstrand and Kronsell 2015, Death 2016, Gough 2016, Hausknost 2020). Although no states are considered truly 'green' at present, and the forms of state change have differed significantly between countries, some states are widely considered to be greener than others and have been categorised as such, with scholars seeking to discern leaders from laggards (Dryzek *et al.* 2003, Christoff 2005, Christoff and Eckersley 2011, Bäckstrand and Kronsell 2015, Duit 2016, Sommerer and Lim 2016, Tobin 2017).

Meanwhile, the institutional design of the ideal Green State has been subject to debate, with contestation over its degree of *dirigiste* interventionism to orchestrate structural economic changes, the de-prioritisation of GDP growth as an objective of governance, the expansion and re-casting of democracy, the role of welfare institutions, and the governing of industrial relations through sustainability transitions (Eckersley 2004, Christoff 2005, Barry and Eckersley 2005, Death 2016, Hildingsson *et al.* 2018, Bailey 2020).

These constructs have largely overlooked a powerful actor of economic governance in their analyses – central banks. This constitutes a tacit acceptance of Central Banks' own discourse that they are apolitical and technocratic agencies of economic governance (Langley and Morris, 2020). Central Banks are mentioned only as an adjunct of governance in the scholarship analysing state responses to the ecological crisis and evaluating the extent of green state transformation.

Central Banks are elided from the pioneering theoretical work of Eckersley (2004), as well as in the typology of green states developed by Christoff (2005). It is also absent from the assessment of state greening advanced by Dryzek *et al.* (2003), the identification of complex challenges facing green states in the governance of sustainable development by Hysing (2015), and in the extension of the concept to African economies by Death (2016). Mol (2016) does cite the role of central banks in 2008 but only to demonstrate the fallacy of the 'hollowed out' hypothesis.

The central bank lacuna can also be identified in the parallel analyses that primarily deploy the Environmental State concept. In both of the two *Environmental Politics* special issues on the environmental state in recent years (see Duit 2016, Hausknost and Hammond 2020), Central Banks are overlooked. Duit (2016) outlines four faces of the environmental state – regulation, redistribution, organisation, and knowledge generation – but neither the Central Bank nor monetary policy is explicitly mentioned. Hatzisavvidou (2020) argues that neoliberalism is a constituent of the glass ceiling facing the green transformation of the state and that monetarism is one of its defining characteristics, but the role of Central Banks or monetary policy is not explicitly mentioned. Sommerer and Lim (2016) investigate 25 policies across 37 countries but again focus on other areas of governance. Whilst Craig's (2020b) focus in a *New Political Economy* special issue is fixed on fiscal policy.

Åsa Knaggård and Håkan Pihl comparatively analyse climate policy and monetary policy in Sweden in Bäckstrand and Bäckstrand and Kronsell's (2015) edited collection to make the case that a sustained green transformation of the state must transcend short-term targets and accomplish constitutional redesign. Here though, the analysis is not on the place of the Central Bank in a Green State but instead what Green State scholars can learn from analogous political experiences of institutionalising policy trajectories.

The most extensive analysis thus far is on the role of central bank in ensuring the state's fiscal capacity beyond growth (Bailey 2020). This analysis, following Eckersley (2021), 'opened an important new front of inquiry in research on the green state. An examination of the relationship between monetary policy, debt and the fiscal crisis of the state has thus far been largely neglected' (Eckersley 2021). This analysis urged Green State scholars to challenge and transcend the capitalist conventions of state financing that render fiscal capacity dependent on current or future tax income in order to mitigate the contradictions between green dirigisme and moving beyond economic growth (Bailey 2020).

This, however, is the extent of the analysis of the Central Bank in the existing scholarship on green state transformation. As such, the call to reform 'both the practice of governance by states (i.e. policy and law making) and the structures of governance (the institutional framework in which policy and law are made and implemented) in ways that are more ecologically responsible' (Christoff and Eckersley 2013: 195) has thus far largely precluded Central Banks and monetary policy.

The role of central banks in actually existing green states

The financial sector continues to channel investment toward unsustainable industrial operations and activities (Carney 2019, Banktrack 2022), and thus represents a formidable barrier to transitioning the economy towards sustainability (Network for Greening the Financial System [NGFS] 2019, Gabor *et al.* 2019, Shrivastava *et al.* 2019). The state agencies tasked with the governance of the financial sector are Central Banks.

Central Banks have always possessed latent far-reaching powers in economic governance, which have shaped economic structures generating ecological degradation. Central banks have powers related to the execution of monetary policy, the management of their own balance sheet of assets and liabilities and regulatory responsibilities (including setting interest rates). These powers have been continually depoliticised by Central Bank actors in order to safeguard a technocratic independent status in some countries (Ingham 1984, Sørensen and Torving 2017, Best 2018). The power of Central Banks expanded and became increasingly visible in the years following the 2008 financial crisis, which demanded unconventional measures to accomplish its mandate of ensuring financial stability, and was thereafter entrenched by the COVID-19 pandemic (Bowman *et al.* 2012, Gabor and Ban 2016, Tucker 2018, Papadia and Välimäki 2018, Gabor 2021, Wansleben 2023). The nature of central bank operations renders it difficult to quantify its effects on capitalist development, but the centrality of central banks to financialised forms of economic growth in several leading national economies means that, following Langley and Morris (2020), 'it would now seem appropriate to speak of "central-bank-led capitalism"'.

Epitomising the growing power of Central Banks is the succession of Quantitative Easing (QE) schemes, which denote the purchasing of financial assets by central banks. As is increasingly recognised by scholars and state actors alike, Central Banks play a direct role in either bolstering or subverting the financial patterns underpinning economic trajectories at times of crisis (Matikainen *et al.* 2017, Campiglio *et al.* 2018, Van't Klooster and Fontan 2019). Due to these crisis management interventions, 'much of the global capitalist economy has moved onto the balance sheets of the major central banks' in recent years (Langley and Morris 2022). QE has also served to bolster the fiscal capacity of the state during periods of economic instability. This has blurred the boundaries of fiscal and monetary policy to the extent that some have argued that QE represents a form of 'monetary financing' of state spending (Van't Klooster 2022, Bateman and Van't Klooster 2023), whilst others have accused central banks of becoming 'quasi-fiscal' institutions (Bateman 2020). This represents a 'revolution without revolutionaries', according to Gabor (2021), and has led to conventional notions of independence becoming contentious (Tucker 2018, Van't Klooster and Fontan 2019, Redwood 2021, Binder and Spindel 2018).

Since 2008, the Bank of England, the Bank of Japan, the European Central Bank (ECB) and Federal Reserve have collectively amassed an asset portfolio of $24.5 trillion (Smith 2021) which underlines the scale of these central bank interventions into the global economy. Not only has the power of Central Banks become increasingly visible, however, these policies have had significant deleterious ecological effects via the 'locking in' of existing economic growth models (Reisenbichler 2020, Van Doorslaer and Vermeiren 2021). The impacts of QE on national economies had adverse repercussions for decarbonisation through economic transformation due to the 'carbon bias' resulting from the principle of 'market neutrality' underpinning the purchasing of corporate bonds (Matikainen *et al.* 2017, Volz 2017, Dafermos *et al.* 2018, Campiglio *et al.* 2018, Reclaim Finance 2021, Bailey 2023). Market neutrality refers to the tendency to match the investment preferences of the capital markets when acquiring corporate bonds in order to minimise the impact of the purchases on the relative prices of financial assets. The effect of this structural bias towards industry incumbents in the acquisition of corporate bonds – more notable in those cases where corporate bond-buying was a larger constituent of QE such as the UK and Eurozone – has been to reinforce the pre-existing economic trajectory and, consequentially, the global economy's ecological footprint (Matikainen *et al.* 2017, Campiglio *et al.* 2018, Dafermos *et al.* 2018, Svartzman and Althouse 2022, Bailey 2023). This has been compounded by the limited macroprudential and financial regulations of numerous central banks which have done little to deter commercial and investment banks from lending to the fossil fuel industry, a figure now larger than it was before the Paris Agreement was signed (Banktrack 2022).

The impacts of government bond purchases as part of QE schemes could potentially have supported green public investment (Bailey 2020), but the additional fiscal space created has been utilised to fortify economic trajectories associated with ecological degradation (Bailey 2023). As such, crisis management measures deployed by Central Banks in the form of QE asset purchases on corporate and Treasury bonds have helped 'lock in' ecologically deleterious economic models. The growing power of Central Banks, and the ecological implications of its economic governance, has rendered these state agencies pivotal actors in either promoting or inhibiting sustainability transitions.

Simultaneously, it should be noted, Central Banks have increasingly engaged with the topic of climate change, at least insofar as it poses risks to financial stability. Climate-related financial risks present foreseeable and seismic threats to the stability that central banks are tasked with preserving (Bolton *et al.* 2020). According to Quorning (2023), the engagement of central bankers with the concept of climate risk is in no small part due to 'field arbitrageurs', those outside of the central banking community but with expertise in climate science as well as financial sector careers, that strategically advanced a risk-based frame and the notion of a 'carbon bubble'. This was advanced via civil servants in order to speak directly to the objectives of central bank actors.

As a result of this increasing concern about climate-related financial risks, and its salience for the core institutional purpose of central banks, there are ongoing debates within central banks on the measurement of complex systemic climate risks and what implications the available evidence carries for the existing expertise and practice of central bank actors

(Bolton *et al.* 2020, European Central Bank [ECB] 2021, Lagarde 2021, Best 2022, Van 't Klooster and de Boer 2022, Deyris 2023, Jackson and Bailey 2023, DiLeo 2023). These actors remain reticent and divided on how to adapt to climate risks (Deyris 2023, Jackson and Bailey 2023, Best *et al.* 2024), but the engagement with the issue has led to a range of institutional changes and internal debates in the last decade (Siderius 2023, Quorning 2023, Deyris 2023). There are discussions and experiments regarding the analysis of climate risks (DiLeo 2023, Jackson and Bailey 2023), the merits of excluding carbon assets from future rounds of QE and actively pursuing 'green QE' (Network for Greening the Financial System [NGFS] 2018, Gabor *et al.* 2019, Deyris 2023), climate stress testing (Deyris 2023), making green bonds eligible for collateral (Macaire and Naef 2022), and differing interest rates for loans that aid a low-carbon transition (Harding 2021, Larsen 2022). These experiments are far from commonplace but could be indicative of emerging forms of governance that could contribute to the state's response to the ecological crisis.

As climate-related financial risks escalate in the decades to come, and indeed as these risks are accompanied by other threats to financial stability resulting from ecological breakdown (Kedward *et al.* 2023), central bank actors will be under increasing pressure to 'green' both financial supervisory frameworks and monetary policy frameworks. Internal debates on appropriate have been, and will be, fuelled further by the introduction of sustainability or transition-related mandates (Dikau and Volz 2021a, Jackson and Bailey 2023).

The power of Central Banks has not yet lent itself to any economic transformation, but there are expectations that these institutions of economic governance could be used much more aggressively in future years. That some central banks are going beyond prudential risk management approaches and towards measures promoting path-shaping economic transition suggests that a shift towards a more developmental approach to central banking than we have seen since the 1970s (Bezemer *et al.* 2018). This, however, is a profound moment of indeterminacy in central banking, shaped by the intersecting crises of COVID, inflation, and the Russian invasion of Ukraine, which has served to destabilise emerging forms of climate governance and raise further questions of conventional practice (Best *et al.* 2024).

As such, central banking can no longer be ignored in the theoretical or empirical investigation of green state transformation. These institutions have become increasingly powerful actors in economic governance, which have experienced varying degrees of green institutional change, but have nonetheless been complicit in 'locking in' economic trajectories that generate ecological degradation at moments of critical juncture. Its reform in the Anthropocene is a necessity, both to counteract these tendencies and to harness the instrumental and strategic potential, but will subject to strategic dilemmas between economic objectives.

The greening of central banks: a research agenda

The rising power of Central Banks in economic governance and its impacts on the ecological footprint of the global economy raises empirical questions of the varied institutional developments of Central Banks in the context of the stability risks related to the Anthropocene and the 'layering' of new environmental mandates on top of pre-existing objectives, rules and practices. Equally, as the Green State scholarship has partly sought to theorise ideal political institutions with ecological protection as a core imperative, it raises normative questions of the design and function of a truly green Central Bank. These delineate a research agenda that links 'politics, policy, and polity' (Bäckstrand and Kronsell 2015, Duit *et al.* 2016), bringing together political theory of green state transformation and the political economy of institutional developments that present trade-offs between conflicting institutional imperatives at a time of escalating ecological and economic contradictions.

In developing such a research agenda, it seems particularly important to establish a more systematic understanding of (i) the institutional variation and convergence of central banks across the global economy in the Anthropocene, (ii) the theoretical constituents and operations of a truly 'green' central bank, and (iii) the role of a central bank in the institutional complex of a Green State. This represents the three proposed 'research directions' (RDs) for the scholarship.

(RD1) The institutional variation and convergence of central banks across the global economy

Central Banks possess a range of varied functions that could be re-purposed or modified for the purposes of ecological protection, as has been acknowledged by Central Bank actors (Network for Greening the Financial System [NGFS] 2019, Carney 2021, Lagarde 2022). A selection of Central Banks has begun experimenting with their varied operations, following the formalisation of environmental targets and mandates (Dikau and Volz 2021a), the measurement and escalation of climate risks (Network for Greening the Financial System [NGFS] 2019), and the establishment of the 'Network for Greening the Financial System' and the 'Taskforce for Climate-Related Financial Disclosures' (Van't Klooster and Fontan 2019, Baer *et al.* 2021, Van 't Klooster and de Boer 2022, Macaire and Naef 2022, Deyris 2023, Quorning 2023). This has included a range of policy instruments – from 'informational' attempts to enhance analysis of climate-related financial risks, monetary incentives to facilitate a low-carbon transition, and direct controls on credit allocation – wielded by policy-makers motivated by either ‘prudential’ tendencies to ensure the stability of the financial system in the face of climate-related challenges or ‘promotional’ attempts to influence the allocation of the financial sector (Baer *et al.* 2021).

Institutional variations across Central Banks on evolving mandates, remits, motives and policy instruments have been identified (Dikau and Volz 2021a, Baer *et al.* 2021). A small number of individual studies suggest that the People’s Bank of China, the ECB, De Nederlandsche Bank and the Banque de France have been adjudged to have made the greatest strides in greening monetary policy operations so far (Dikau and Volz 2021a, Siderius 2023, Van’t Klooster 2022, Larsen 2022), whilst the US Federal Reserve is the most prominent central bank to declare that they are not a ‘climate policy-maker’ and plan to eschew any regulatory model to counteract climate risks (Smialek 2023). Yet we are far from having a systematic and clear view of the evolution of central banks across the global economy (particularly in countries beyond the OECD), the clustering of central banks around particular strategies of governance (i.e. the varieties of central bank green transformation), and a methodology for conceptualising and comparing the ‘leaders and laggards’ of environmental performance within central banking (albeit Positive Money has developed a ‘scoreboard’, see Barmes and Livingstone 2021).

Organising knowledge and developing a systematic understanding of continuity and change in the environmental governance of states through typologies, classifications and comparative measurement are long-standing leitmotifs of the field (Christoff 2005, Fiorino 2011, Meadowcroft 2014, Bäckstrand and Kronsell 2015, Duit 2016). Extending this work to address this lacuna in the scholarship will develop our understanding of green state transformation in two ways. First, it will enable a clearer understanding of central banks as latent but constrained agents of environmental protection. Secondly, it will inform efforts to develop classifications of green state transformation more broadly, in which the role of central banks is recognised alongside the role played by other state agencies.

(RD2) The political-economic and institutional constraints on the green transformation of central banks

Not only would more systematic analysis across the global economy enable a clearer understanding of the cross-national variation and convergence of central banks in the Anthropocene, it would also deepen our theoretical understanding of the structural and institutional factors that cause divergence and convergence amongst states on environmental protection. It would demonstrate the political, economic and institutional constraints on state actors that shape their perception of new environmental mandates, the integration of new remits within the broader operations of the institution, and the scope to act on mitigating CRFRs and low-carbon transitions.

The focus on the 'layering' of imperatives on top of pre-existing governance arrangement in ways which create tensions with more deeply embedded imperatives, rules and practices has been a long-standing feature of analyses of green state transformation and explaining variation and convergence (Scruggs 2003, Meadowcroft 2014, Bäckstrand and Kronsell 2015, Hysing 2015, Duit *et al.* 2016, Mol 2016, Death 2016, Kronsell *et al.* 2019, Hausknost 2020, Hausknost and Hammond 2020, Martus 2023). Central banks have been elided from this analysis but can be seen as exemplars of state agencies inexorably mired in the strategic dilemmas between conflicting economic and ecological goals whilst seeking to ensure political legitimation. The institutional integration of environmental targets – whether as primary or secondary objectives – alongside the specific economic objectives of central banks is producing a unique form of layering (Van 't Klooster and de Boer 2022, Jackson and Bailey 2023), which is ripe for analysis by those studying green state transformation.

The politics of this layering is itself shaped by the broader economic and geopolitical landscape in which all state agencies are embedded. This includes the nationally specific and swiftly evolving projections of physical climate risks to economic stability and the risks to national economic stability of a green transition, which relate to idiosyncratic national economies and present a series of intensifying structural contradictions and trade-offs for central bank actors (Campiglio *et al.* 2018, Jackson and Bailey 2023). It also includes the escalating geopolitical competition between the US and China and the war in Ukraine, which affects the strategies and operations of central banks as well as the coordination between them. This has direct impacts on climate governance, as well as counteracting inflationary pressures, as Christine Lagarde (2023) has noted.

In addition, there are a range of institutional factors which condition the greening of central banks which require further analytical attention. One of the most notable, at least in certain countries, is the notion of central bank independence – the supposed removal of monetary policy from the conventional area of democratic politics – the rationale of which was to adopt a narrow technocratic focus on ensuring price and financial stability and to be operationally autonomous of politicians (Best 2018, 2022). Central Banks have been the exemplars of 'strategic depoliticisation' since the economic and ideological fallout of 1970s stagflation, and now typically (although disingenuously) claim 'neutrality' in determining political and economic outcomes beyond the technocratic mission of ensuring macroeconomic stability (Dafermos *et al.* 2018, Van't Klooster and Fontan 2019) and embrace 'apolitical scientific discourses' to reinforce this image (Thiemann *et al.* 2022). The cherished notion of central bank independence has served to constrain green institutional transformation and actions to facilitate transition. This is currently being tested by escalating climate risks to financial stability and the re-politicising effects of stabilising unsustainable forms of economic activity, which is generating various internal strategic conflicts and trade-offs that further undermine the illusion of apolitical technocratic governance. Yet the desire to protect operational independence has, thus far, constrained green institutional transformation in many countries and created significant variegations of central bank governance across the global economy.

Accordingly, there is not only a need to develop a systematic empirical picture of institutional variation and convergence across the global economy but also to make sense of the structural and institutional causes of this variation between states. Analysing the green transformation of these state institutions would yield further empirical insight into the structural contradictions and institutional pressures generated by 'layering' which characterise green state transformation, highlight the political and economic limits of monetary policy in the governance of transition, and offer clues as to where institutional greening is most likely within central banking (Eckersley 2020).

(RD3) The theoretical constituents and operations of a fully fledged 'green' central bank

Interrogating the theoretical design and operations of state institutions with ecological protection as a core imperative is a central purpose of the Green State scholarship (Eckersley 2004, Christoff 2005, Bailey 2020). The historical neglect of central banks has limited theoretical and normative discussion of ideal types within the scholarship, but the power of central banks in 'locking in' economic trajectories associated with ecological degradation and the contemporary debates amongst central bank actors on the power that should be wielded in the Anthropocene makes this an urgent task.

A fully fledged Green Central Bank with environmental protection as a core imperative would presumably seek to transcend 'prudential' concerns of managing risks to the economy and instead active promote rapid transformations of the economy through utilising macroprudential and monetary powers in radical ways. Existing debates amongst central bank experts indicate that Central Banks can play a pivotal role in realigning global finance with environmental targets through monetary policy and regulatory frameworks and in so doing prompt systemic change and industrial decarbonisation within the global economy (Gabor *et al.* 2019, Schoenmaker 2021, Robins *et al.* 2021, Boneva *et al.* 2022, Kedward *et al.* 2022, Macaire and Naef 2022, McConnell *et al.* 2022). This could include differentiated interest rate setting for carbon-intensive assets compared to low-carbon alternatives

(Larsen 2022, Boneva *et al.* 2022), differential capital or liquidity requirements based on green investment taxonomies (Campiglio *et al.* 2018, Villhauer and Villhauer 2023), modifying central bank collateral frameworks for the purposes of incentivising and disincentivising investment (McConnell *et al.* 2022, Macaire and Naef 2022), tilting the Banks' own asset portfolios towards low-carbon assets (Schoenmaker 2021), and safeguarding the state's capacity to orchestrate green economic transformation through the purchasing of government bonds (Bailey 2020, Bateman and Van't Klooster 2023). This would likely require significant institutional transformations of the objectives, remits and strategies of central banks; in some respects harking back to a bygone era of central banking when strategic credit guidance policies were a common feature of Central Bank operations (Bezemer *et al.* 2018, Sener 2019) but allied with objectives which institutionalise a cognisance of planetary boundaries.

Theorising the form and functions of a Green State must be analytically sensitised to context. The institutional transformations and actions taken by central banks will depend on the conditions in each case, three aspects of which are worth highlighting here.

The first concerns the temporality of green monetary policy, as various environmental issues are raised and intensified by capitalist development. Currently, the primary focus is on climate change but in future decades the focus may instead be on biodiversity loss or zoonotic diseases. So, the understanding of what is 'green' may evolve over time. In future years, contemporaneous ecological issues emerging from capitalist development may prompt further institutional evolution of central banks in terms of objectives, policies and role. This problematises a clear theorisation of a Green Central Bank.

The second condition relates to the broader configuration of state institutions in which the central bank is located (which differs dramatically between countries) and the interactions between them. Given that the consensus in the literature in that a sustainability transition will be led by other state agencies within the Green State, the facilitatory role of Central Banks will be conditional on the objectives and strategies of those institutions. The role of a Central Bank may vary depending on the fiscal expansiveness of a government, the objectives of the government (e.g. the extent to which GDP is deprioritised and the institutionalisation of a broader dashboard of indicators), the existence of a sovereign wealth fund or national development bank, etc. The idiosyncratic nature of these state configurations also problematises a clear theorisation of a Green Central Bank.

Thirdly, the precise role of each Central Bank will be dependent on the broader political economy in which it is situated and its specific fragilities, contradictions and crisis tendencies. National economies will not converge into homogeneity as states undergo green transformations, and this means continued contestation and conflict over how central banks meet economic and ecological objectives. Monetary policy will still need to be tailored to suit the particular circumstances of the national economy and government. For example, it may well be that a national economy has a greater or less proportion of speculative finance relative to patient capital, which would shape monetary policy decisions. A further salient example concerns the inflationary pressures within an economy which, as in the current conjuncture, could signal the limits of monetary financing government expenditure (Bailey 2020). More speculatively, if the green transformation of states results in fundamental challenges to ingrained capitalist concepts such as the primacy of GDP growth, this will have even more profound impacts that determine the character and prominence of a Green Central Bank. Save for a post-growth transformation that so profoundly destabilises the foundational concepts of capitalist society that a Central Bank is rendered redundant and the Green State itself an oxymoron, a green central bank offers vital flanking mechanisms for the transformation of national economies.

The importance of context undermines the notion of a universalisable theoretical template of a central bank within a fully fledged green state. Instead, there will need to be a pluralistic, contextualised and reflexive understanding of a role shaped by the political, economic, social and ecological conditions in which it is operating. Yet it remains imperative to conceive of the operations of an ideal central bank in order to conceive of the ambitions required within central banks in order to accomplish an orderly transition to sustainability.

Conclusion

Given the state's potential role in the governance of a sustainability transition, the academic attention dedicated to the prospects and opportunities for 'greening' state institutions is vitally important (Meadowcroft 2012, Hausknost 2020, Eckersley 2021). The omission of central banking in the Green State scholarship is glaring given the growing power of central banks in the governance of the global economy and its relevance to the transformative potential, capacity and limitations of the state in environmental politics.

It remains to be seen how central banking will evolve in the Anthropocene. There are already noteworthy changes to mandates within these institutions, which have promoted internal strategic debates (Dikau and Volz 2021a, Van 't Klooster and de Boer 2022, Jackson and Bailey 2023). Certainly, ecological crises will present challenges for the pre-existing objectives of central banks, but these objectives will also serve to condition and constrain the radicalism of institutional transformation.

The evolution of central banks could be a key component of green state transformation. The research agenda outlined here can help formulate a greater understanding of the ideal and empirical developments of 'green central banking'. This dovetails with the call by Eckersley to develop a more rigorous understanding of the politics of sustainability transitions and the opportunities for transforming state agencies through infusing them with new green purpose (Eckersley 2020, 2021). As Eckersley notes, 'Greener states, if they are to emerge, are most likely to be built piece by piece, as the result of political struggles' (Eckersley 2020, p. 49). This entails a critical reflection and reform of political structures, such as central banks, that promote ecological degradation.

The research agenda outlined here can, we hope, contribute to this endeavour. We have proposed three future research directions which promise to develop a more comprehensive understanding of monetary governance in the green transformation of the state. Through establishing the institutional variation and convergence exhibited by central banks across the global economy, the political-economic and institutional constraints that shape institutional transformations, and the operations of a central bank that upholds 'green' normative principles or values, this agenda challenges existing the analytical boundaries of existing research and deepens our understanding of the complexities and limitations of 'greening the state'.

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