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The political economy of national climate policy: Architectures of constraint and a typology of countries

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ABSTRACT

In the wake of the Paris Agreement, countries have yet to embark on deep decarbonisation pathways. This article explores the reasons for this limited response, taking a comparative political economy lens to identify national constraints that actively hinder climate policy progress. We discuss different metrics of climate policy progress, including emissions trends, climate legislation adoption, policy adoption, policy stringency, and policy outcomes. We then review literatures that explain varying national outcomes along these dimensions. Identified constraints include (but are not limited to) exposure to fossil fuel extraction activities, supply-side coal dependency, a lack of democratic norms, exposure to corruption, a lack of public climate awareness, and low levels of social trust. Correlation and principal component analysis of these variables demonstrates strong co-dependencies, including a North-South divide in institutional quality, trust and climate awareness that limits full participation in climate legislation and the removal of fossil subsidies. Recent trends indicate stability in corruption across the whole sample, and the continued durability of autocratic and extractivist states. We identify common constraints for five distinct country groups using cluster analysis: 'oil & gas states', 'fragile states', 'coal-dependent development', 'fractured democracies' and 'wealthy OECD'. We highlight the need to scrutinise architectures of constraint – combinations of political economic factors that are mutually reinforcing and highly resistant to intervention.

1. Introduction

It is widely acknowledged that countries are not on track to meet the climate mitigation goals of the Paris Agreement. Assessments of current emissions pathways and those projected under the Nationally Determined Contributions (NDCs) suggest that the global cumulative emissions budget of 1.5 °C may already be exhausted by 2030 – with the 2 °C budget soon to follow [1,2]. A majority of countries have put into place climate targets and legislative measures [3,4], but the implementation of effective and stringent policies is still lacking [5]. Fossil fuels remain a mainstay of the global economy and global emissions continue to rise [6].

Why has there been such a lack of action? One prominent explanation is that a top-down global agreement on burden sharing, technological transfers and climate finance is needed [7]. Since Paris produced only a bottom-up voluntary pledge system with no recourse for sanctions, nations currently have few incentives to initiate strong mitigation. Instead they will minimise costs, avoid strong commitments, and freeride on the actions of others.

Another common line of explanation puts the blame on intrinsic human characteristics. It is argued that humans are uniquely unsuited to perceiving the proximity and severity of climate change, and consequently taking actions [8]. Furthermore, we struggle with ethical and socio-temporal aspects of climate change mitigation, such as the need to shoulder the costs of mitigation on behalf of distant victims and future generations [9]. A 'perfect moral storm' locks society and its institutions into inaction.

A third avenue focuses on social and infrastructural sources of carbon 'lock-in'. It is argued that energy systems and other human infrastructures have built-in sources of inertia that severely constrain the speed and ambition of transitions. This includes the long lifetimes and sunk costs of fossil emitting infrastructures, or socially embedded patterns of energy use that are 'normal' and resistant to change [10–14].

A fourth explanation centres on the political economy of energy

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transitions. In this view, shifts away from fossil fuels and energy-intensive activities are seen through a lens of power and conflict between interest groups [15–20]. Fossil fuel interests are central to the analysis: strong climate policy poses an existential threat to their standard operating practices, and they will mobilise vast financial and political resources to prevent it. This may involve political lobbying, shaping public discourses against climate action, or 'capturing' the very government bodies that are tasked with their regulation. Incumbent interests are also situated within a history and trajectory of political institutions and societal norms, often passively reinforcing and entrenching their articulation of power. For political economists, carbon lock-in and moral failures are not accidents of modern society – they are design features of the fossil economy.

There are many strands of political economic literature on climate change mitigation. From different theoretical perspectives, authors have explored the conditions and contexts that support (or hinder) energy and climate transitions [15,20,21]. Within these, institutions are argued to have a central role in mediating the power of interest groups and locking-in technology systems through rules and other organisational arrangements [17,22]. There has been much attention on the appropriate design of policies to overcome political constraints, for instance by compensating interest groups, or bringing social and health co-benefits to the forefront of the climate agenda [23–25].

The question we address in this article is - *what are national political economic constraints to climate policy, and which countries are exposed to them?* This question is situated in the tradition of comparative political economy research, which seeks explanations for the stark variation one can observe in national environmental ambitions, policies and performance. Notable contributions are Eckersley's [26] study of 'Green States', which explores the multi-layered elements that constitute good environmental governance, and Gough's [21] later comparison of environmental and welfare states. Volumes by Steinberg and VanDeveer [27] and Bailey and Compston [28] lay further groundwork, exploring the national social and institutional conditions that shape environmental politics, the latter with a specific climate focus in rapidly industrialising states. Most relevant for our article, Christoff and Eckersley [29] compare the emissions and climate policies of 20 states, offering a series of political explanations for their diverging performance.

We aim to address three key gaps in this emerging literature. First, there has been little attention on the conceptual and methodological challenges of conducting comparative climate policy analysis [30]. What political economy elements should be investigated? And what is the appropriate dependent variable for comparing national climate policy performance? We address these topics in Section 2 of the paper. Second, a comprehensive synthesis of the existing empirical literature is missing. What can we learn from comparative cross-national research on legislation adoption, policy adoption and policy stringency? We address this question in Section 3. Finally, few studies have conducted a simple descriptive analysis of international political economic constraints. How are constraints distributed across countries? Are they changing over time? Which countries are exposed to similar constraints? We explore these questions in Section 4.

We adopt the language of 'constraints' to describe social, political and institutional contexts that appear to actively hinder climate policy progress. In doing so we consciously avoid the more passive and prevalent formulations of climate policy 'determinants' or 'enabling conditions'. Since many policies are either inexpensive (fossil subsidy reform), socially desirable (low-emissions zones, retrofit programs), or both (revenue neutral carbon pricing), active hindrance ought to be the semantic assumption.

The focus of this article is on identifying broad political structures and international trends such as democratic norms, corruption, climate awareness, and so forth. It therefore lends itself to quantitative analysis, but remains at a relatively high level of abstraction compared to the case studies and mid-range theories that often inform political economic research. Nonetheless, as we will argue in the conclusion (Section 5), one can observe systematic differences between countries in terms of their prevailing contexts and rates of climate policy progress. This basic observation has been largely unappreciated in the climate mitigation and scenario literature so far, calling for a clear-eyed assessment of the challenge and new thinking to find viable entry points to strong international climate policy.

2. Background and theoretical setting

2.1. A framework of interests, institutions and ideas

The established framework by Hall [31] of interests, ideas, and institutions provides a simple basis to explore political economic constraints and structure for our analysis. Here we briefly introduce these different domains, before turning to the different dependent variables that can inform comparative research on climate policy constraints.

Interest-based analysis recognises that societal changes have material consequences for different actors, such as workers, capitalists, and political agents. These groups actively participate in social and political change, often forming coalitions to lobby and push for common agendas. Industry and energy interests associated with particular technology domains (e.g. oil and gas) are of particular relevance for climate policy. These incumbents engage in political struggles, aiming to prevent new players from entering the marketplace (e.g. renewable energy interests), or to hinder the advancement of regulation [32,33].

Institution-based analysis usually focuses on the organisation and functions of the nation state. In most political economy traditions, the state is seen to have a central role in setting the boundary conditions for social, political and economic activities, while also facilitating markets and capital accumulation [34]. Both the quality of the institutions that carry out these tasks (i.e. their bureaucratic capability) and their different organisational forms (e.g. exposure to veto players or political cycles) are highly consequential for understanding the constraints to structural change [17,18].

Idea-based analysis argues that the underlying worldviews and ideologies of different actors matter. Certain worldviews can undermine political consensus on important points of policy, such as a pre-disposition towards rationalising the status quo [35], or an increasing distrust of 'elites' such as scientists and politicians [36]. Beyond the voting public, the ideas of particularly influential actors (e.g. business leaders and politicians) are argued to be highly consequential for social and political change.

Political economists often argue that ideas, institutions and interests interact in a complex manner, potentially fusing into 'regimes' that are internally consistent and self-reinforcing [20]. The dominance of private car transport in many countries is one example, itself the result of decades of sunk investment in infrastructure (roads, refineries, factories), facilitating institutions (transportation ministries, automobile associations), cultural conditioning (cars as symbols of freedom and status), and manufacturing industries that support a wide array of actors (capitalists, workers, unions, regional economies) [37]. The 'ways of doing things' that are established by regimes may be so embedded in daily life as to appear a natural social phenomenon, with alternatives rarely discussed or simply deemed 'infeasible' [38]. Together this explains the difficulty of initiating wide-reaching energy transitions – and the need for analysis that identifies architectures of constraints, rather than individual and separable issues.

To the traditional framework put forward by Hall [31], one should also add 'international influences' [21]. These comprise the economic, political and strategic relations between countries. The structure of global trade, for instance, is a key driver of (and is driven by) the fossil economy [39,40]. International political norms are a key design element of the Paris Agreement and can strengthen domestic actions [41]. Ideas can also be propagated internationally. This has been widely documented in the case of the post-1980s neoliberal turn in global

governance and its far-reaching social, economic and political consequences [42,43]. For reasons of scope, we are not able to address this category of constraint in our review and analysis. However, we return to it as a key element in the forthcoming discussion (Section 5).

2.2. Defining the dependent variable

To judge the influence of constraints, one needs a comparative measure of success (or failure) in national climate policy-making. An obvious approach is to examine trends in national carbon emissions. This is taken by a large volume of well-reviewed studies that aim to uncover the 'human drivers of carbon emissions', including political economy determinants [44–47]. An advantage is the long and consistent time series of emissions accounts available [6], facilitating quantitative assessments into the influence of various factors. A disadvantage is that current emissions are often the outcome of path dependencies that significantly pre-date contemporary climate concerns, such as early decisions that shape the fuel content of national energy systems [29,48]. For these reasons, recent trends in emissions are an incomplete guide to progress in climate policy making.

A second option is to examine the adoption of climate targets, legislation and international agreements [30]. These 'intentions to mitigate' might include the Nationally Determined Contributions (NDCs), compilations of national targets and legislative measures [3,4], or the commitments of countries to UNFCCC protocols [49]. The large variation in country commitments and different types of strategies adopted (e.g. legislation vs. executive targets) attests to the interesting nature of these data. Yet, a clear disadvantage is that intentions often do not reflect outcomes. Ambitious target setting can be a form of 'symbolic meta-policy' that satisfies short-term political demands, but does not manifest in concrete instruments and actions that lead to long-term emissions reductions [50].[1] This is increasingly clear from countries with ambitious targets, such as Germany, but a poor track record of making progress towards them [22].

A third approach is to examine the adoption of climate policies, particularly 'flagship' policies such as carbon taxes, subsidies, renewable energy tariffs, or moratoria on new fossil fuel infrastructure [30,56,57]. These instruments move beyond targets to directly penalising fossil fuel use, encouraging lower energy demand, or supporting renewable energy. This seems to be a promising approach, and yet the variety of climate policy instruments clearly hampers comparative research: some countries and jurisdictions favour economic instruments (a carbon price), others tend towards direct regulation, and many countries have no formal instruments whatsoever.

A fourth approach is to examine the stringency of adopted policies, such as the price level of a carbon tax, or the 'gap' between current fossil prices and an effective rate [52]. Alternatively, one could track explicit policy support and subsidies for fossil fuels (i.e. the negative carbon price). The International Energy Agency [53] tracks fossil subsidies across 41 countries at present (totalling 300bn US$ in 2017), while researchers at the International Monetary Fund have assessed pre- and post-tax subsidy rates across all countries [54,58].

A final approach is to examine policy outcomes. This likely to be the optimal, but most challenging approach, as it requires estimating a counterfactual (e.g. the business as usual case). So far, assessments have been rather straightforward, for example by combining measures of policy adoption with recent trends and levels of GHG emissions, energy use and renewable energy penetration [55]. Such assessments are highly dependent on data availability – with only 60 countries tracked in the latest iteration of the CCPI – and are likely too premature to provide a good comparative picture.

Evidently, the cross-country comparison of climate policy performance is challenging. Single indicators (such as emissions trends) appear to be insufficient, and pragmatic concerns (data availability) will drastically narrow down the option space. Nonetheless, very comprehensive databases have been established, such as the Climate Change Laws of the World database [4], and measures of global fossil subsidies [54]. In the next section, we turn to the studies employing such measures to explore and identify constraints.

3. International assessments of climate policy constraints

What climate policy constraints have been examined to date? In this section we structure the international comparative literature into the three broad areas already introduced: the role of interests, institutions and ideas [31]. We derive the relevant literature from a search in the Web of Science and Scopus, followed by manually tracking citations in Google Scholar.[2] Studies examining only emissions outcomes are rejected. Our focus instead is on those that examine determinants of legislation adoption, policy adoption, policy stringency and outcomes. We complement this discussion with relevant case studies, surveys and qualitative research, particularly from literatures on public policy making and public perceptions of climate change.

3.1. Interests

Stringent climate policy will threaten the standard operating practices of some of the most capitalised international companies in existence (e.g. Shell, BP, ExxonMobil, Sinopec, Saudi Aramco and others). For many other industries, such as car manufacturers, electric utilities, mining and smelting firms, chemical and heavy manufacturing industries, compliance costs in the short and medium term are likely to be non-negligible. How do these interests influence climate policy?

There is mixed cross-national evidence that fossil interests influence the adoption of climate legislation, but more support for the claim that they oppose climate policy adoption and stringency. Steves and Teytelboym [59] find that high shares of industry in GDP reduce climate legislation adoption rates. Lachapelle and Paterson [60] and Fankhauser et al. [61] examine the impact of fossil fuel exports in GDP on legislation adoption, finding a negative correlation, but not a significant relationship. But when it comes to climate policies, Dolphin et al. [62] show that carbon tax adoption is strongly limited by high industry shares of GDP, as well as fossil fuel shares of electricity generation (coal and oil, but not gas). Carbon tax stringency, in turn, is hampered by high shares of coal in the energy generation mix [62,63].

Fossil interests may take different approaches in minimising their exposure to regulation, explaining these divergent effects. Direct opposition to climate policy adoption (or the roll-back of existing policies) has been well documented in case studies, such as the carbon tax repeal in Australia [64], heavy lobbying against coal regulation in South Africa [65], and the more recent and widely commented-on failure of a carbon price ballot in Washington State, US [66]. Yet, when high political demand for climate policy is perceived, affected interests may also take a hedging strategy: support the adoption of policy, but push for exemptions or a particular instrument in order to minimise compliance costs [67].

Besides fossil fuel interests, other groups have a stake in climate policy processes. Environmental NGOs are vocal proponents and support or participate in a wide array of climate governance activities [68]. Indeed, there is cross-national evidence that their absence hinders the adoption of climate legislation [61,69]. Similarly, low-carbon industries (e.g. renewable energy producers) are an interest group that would materially benefit from climate policy. There is emerging evidence from the case study literature that they indeed support and can be decisive

[1] We thank Giulio Mattioli for this insight

[2] TS = (("political econom*" OR "constraint*" OR "driver" OR "determinant*") AND ("climate" OR "fossil") AND ("polic*" OR "subsid*" OR "legislation" OR "tax")) NOT TS = ("adaptation" OR "agriculture" OR "land use")

for the adoption of climate policies, but require nurturing through a 'sequence' of technology policies in order to gain an initial foothold [70,71]. Workers and unions are another important constituency, often vocal in opposition to reforms that result in job losses. International studies are limited, but small-n comparative research has documented heavy resistance from coal industry workers in particular, who are often well unionised and geographically concentrated, and hence can be politically influential [24].

On the consumption side, constituencies that face higher living costs under climate policy can be intransigent opponents of reform. For instance, fossil subsidy reform in many countries of the global South would primarily affect middle and upper classes (e.g. the minority of households that drive cars) [72–74]. Van Beers and Strand [75] show that oil exporting countries in particular fail to limit fossil fuel subsidies. Many have therefore suggested that fuel subsidies are intentionally distributed to 'buy' the support of politically influential constituencies, particularly in autocratic countries – or that they may be the simplest form of welfare payments in the absence of capable institutions [75–78].

3.2. Institutions

Institutions and governance arrangements have important procedural roles in the adoption and implementation of climate policies. Institutions include formal democratic systems such as elected parliaments and the distribution of powers between different ministries, as well as less formal methods of exchange and governance between public and private actors, e.g. through consultations, lobbying and so forth. Public institutions are also the primary vehicles for monitoring private sector activities and enforcing regulations, and hence have a central role in public policy implementation.

To date there has been much attention on the role of democratic forms of governance, which (contra autocratic regimes) are argued to have particular features that favour the adoption of climate policy: inclusivity, a tolerance for diverse and free press, greater transparency and oversight. Together these enable citizens and NGOs to formulate environmental values and attempt to manifest these in policies and governance [69].

Democratic governments also have stronger built-in incentives to provision public goods (i.e. goods that benefit everyone, such as climate protection), since their legitimacy and support is drawn from a wide electorate. By contrast, in regimes of restricted electoral competition, political power tends to be arbitrated by a small elite (e.g. industrial oligarchs, or the military). Incumbents recognise that political survival depends on funnelling government expenditures towards this elite, not towards a larger majority [69,79]. In this manner, discussions of institutions and environmental policy often draw from an extensive literature on the role of democracy in facilitating (and being mutually strengthened by) the provision of public goods [47,79,80].

These hypotheses are strongly supported by cross-national evidence. Higher indexes of democracy and democratic inclusiveness (e.g. strength of civil society, participation and political freedom) correlate with the adoption of climate legislation [60,69,81], the adoption of carbon prices [62,63], and the absence of fossil fuel subsidies [75]. Time-averaged analysis also confirms that the long-term accumulation of democratic norms and institutional apparatus is needed to support climate legislation adoption [75,82]. In other words, even short periods of autocratic rule has a lasting and limiting effect on climate policy.

Of course, there are large differences between democracies and their institutions. A prominent claim is that the concentration of political power in centralised and parliamentary systems presents fewer frictions to climate policy adoption than federalist and presidential systems, which allocate power among a wider range of actors [17]. In the latter case, a profusion of 'veto-points' could limit the passage of strong climate policy – for instance when regional legislatures dependent on coal mining unilaterally block national measures. There is indeed cross-national evidence that parliamentary systems are more likely to adopt climate policies [60], however they do not reduce emissions faster [60]. Nor do more concentrated political systems with parliamentary majorities implement more stringent carbon prices [63]. Hence, there is no clear perspective on which types of democratic system are more promising.

State institutions also vary in terms of quality and exposure to corruption. In wealthier countries, bureaucracies can mobilise greater financial and human resources to formulate and implement policies. In poorer countries, states often fail to carry out even basic functions, such as effective taxation. It has therefore been suggested that the implementation of more sophisticated climate policies (such as feed-in-tariffs) are a foregone conclusion in the context of poor state capacities [83]. Indeed, there are strong positive correlations between weighted carbon prices levels and subjective scores of "government effectiveness" and "regulatory quality" [see 84], even after controlling for GDP [63] .[3] Poor control of corruption is associated with a failure to reform fossil subsidies [75] and carbon tax stringency [63]. In the extensive development literature, poor state capacity is linked to a wide range of public provisioning failures, such as underinvestment in health services, poor economic performance (i.e. GDP), low environmental quality (air pollution, carbon emissions), and poor human well-being outcomes [85–88].

3.3. Ideas

Climate policy has long been a battle of ideas, with much contestation centred on the perceived existence, severity and human-driven nature of climate change. Many have reasoned that if the public remains in doubt regarding the causes and impacts of climate change, then legislators will be unwilling to push for climate policy adoption [89,90]. Indeed, public belief in climate change to a large extent explains willingness-to-pay for climate policies in a US survey [91].

There is an extensive literature examining the underlying drivers of climate change perceptions. Much attention is paid to left- versus right-leaning political orientations, which appear to correlate with positive and negative attitudes, respectively, on climate change belief, concern, and preference for policies [90,92]. However, it could be that the phenomenon of conservative climate scepticism is unique to Anglo-Saxon countries (US, UK, Canada and Australia), all of which are highly exposed to organised networks of climate scepticism and misinformation [93–96]. Again, this underlines the manifold channels by which interests can intentionally hinder climate policy [97].

In broader cross-national studies, education emerges as the most significant predictor of climate change awareness and risk perception [89,94], followed by media freedom [59]. Accordingly, countries with poor education provisioning and media landscapes that fail to prioritise climate reporting can have majority populations that are simply unaware of climate change, as is the case in India, Bangladesh, Egypt, Nigeria and others [89] (see Fig. 1). Climate change awareness is in turn a significant determinant in cross-national regressions of weighted carbon prices [63] and climate legislation adoption [59]. Of course, here there is a particularly strong case for reverse causality, insofar as climate policy formulation is likely to increase public awareness of the problem. In short, public opinion on climate change (awareness, belief, risk perception) matters for policy making, and it can be bolstered by education and media, or weakened by propaganda [see 98] for a general review].

Trust is another key ideational element that shapes national climate policy support. It is the notion that other individuals, institutions, scientists, or politicians share common social norms and act in a mutually

[3] Dophin et al. [62] do not find a significant effect of these indicators on carbon price adoption or stringency. However, their study is based on a smaller sample of mostly wealthier states with strong institutions.

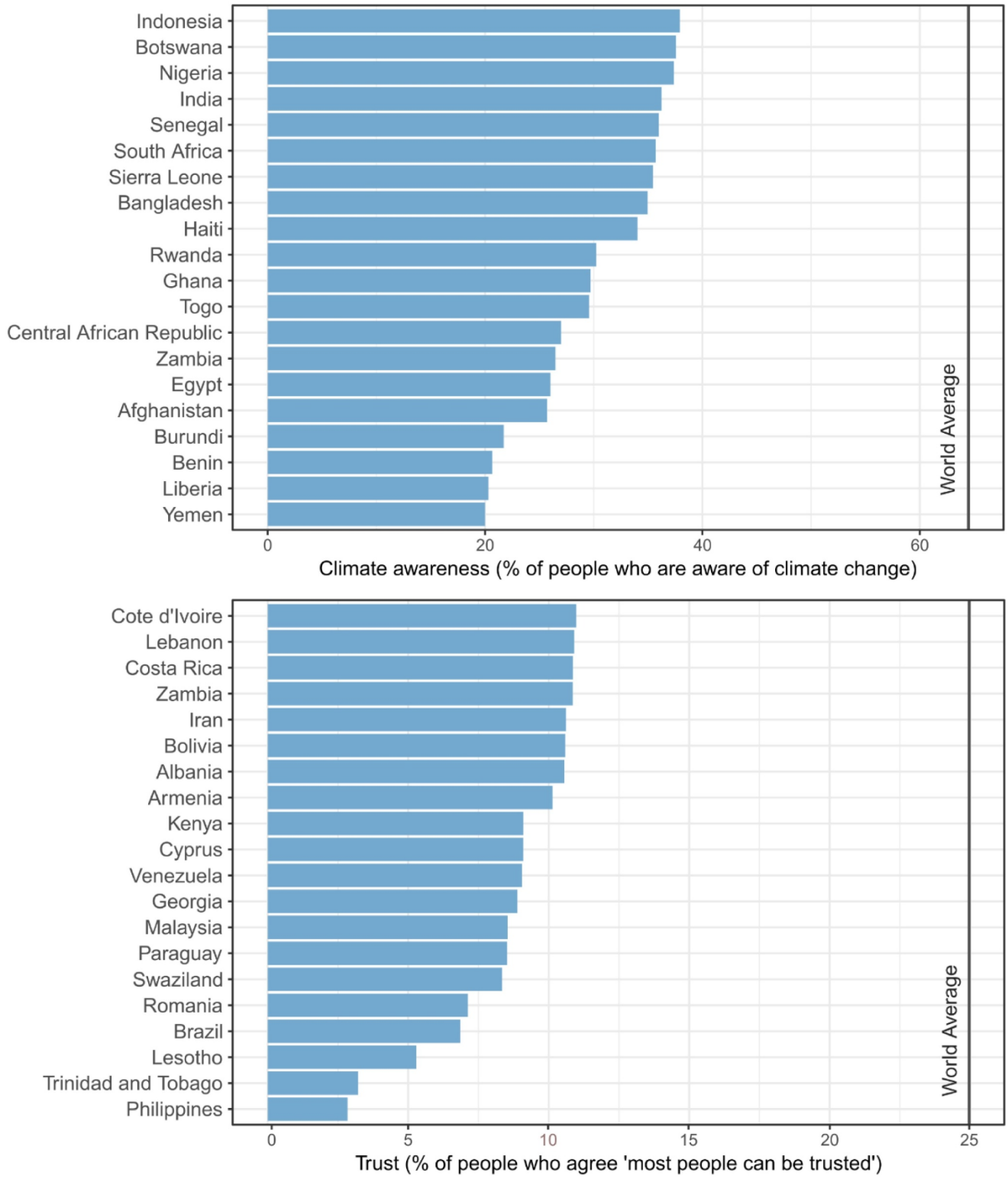

Fig. 1. 20 countries with the lowest levels of climate awareness and social trust. Data are based on representative surveys, see Section 4 for sources.

beneficial way [90,99]. A lack of trust in institutions implies limited confidence that public policies and environmental measures will be effective [100]. A lack of social trust (e.g. in others generally) undermines collective action, since few will have the confidence that others are 'doing their part'. In a small-n comparative study, Smith and Mayer [99] find that individuals with high levels of social and institutional trust are far more willing to support costly climate policies. Hammar and Jagers [101] find a similar result for trust in politicians in Norway, while Fairbrother [102] extends the analysis to an international survey, showing a consistent and positive pattern of trust in explaining environmental policy support. Against a backdrop of low or progressively eroding trust in social and political institutions (see Fig. 1), and the emergence populist parties and agendas that dismiss climate concerns [36], this is a problem that has likely not received the attention it deserves [103].

3.4. Towards architectures of constraints

We identify various national constraints in this review: exposure to fossil fuel extraction activities, supply-side coal dependency, the countervailing absence of climate policy constituencies, a lack of democratic norms, exposure to corruption, a lack of public climate awareness, and low levels of social trust. How are these conditions interlinked?

The cross-national studies we review tend not to focus on interdependencies, but rather report individual effects. This is perhaps problematic when considering interventions to overcome and systematically dismantle constraints. It is not uncommon to find generic policy advice building upon such work, such as the call for "establishing an enabling environment" or "building technical and institutional capacity" [5]. But if constraints occur simultaneously within countries, and have strong interlinking causal mechanisms, then the task of overcoming them becomes more difficult. How can institutions be reformed, when the necessary conditions for doing so – technocratic skill, or sheer political will – are absent and or even endogenous to their failure [87]? Arguably, one would then need to deal with *architectures of constraints* that are deliberate in nature, enduring over time, and actively defended by interest groups [104].

The literature on the 'resource curse' is enlightening in this regard. It follows the empirical phenomenon that states with considerable natural resource endowments tend to experience wide-ranging detrimental effects on their societies and institutions [105,106]. There is strong evidence in particular that an abundance of oil increases the durability of authoritarian rule and heightens levels of corruption. That is, a distinct architecture can be seen in countries at the upper end of the spectrum of oil production (e.g. Algeria, Iran, Saudi Arabia, Qatar and others), of which not a single has successfully become democratic since 1960 (Ross, 2015). Oil revenues can be used to reduce taxes, increase patronage, and fund a military/security apparatus – all effective means for incumbent rulers to buy off challengers and suppress dissent. With regime stability resting upon these systems of corruption, one should not be naïve about the prospects for reform [104].

Failed and fragile states are another problematic architecture for climate policy adoption. Clearly, countries in the midst of civil wars (Syria, Iraq, Libya, Yemen) or major domestic instability (Venezuela) cannot progress energy and climate policies [107]. Such events also spill over into neighbouring countries through mass migration and conflicts. These might be considered one-off 'exogenous shocks' sparked by specific events, and yet underlying structural conditions often provide the tinder. Failing state institutions, the under-provisioning of basic needs, and latent ethnic or political tensions can all be leveraged to realise political or economic gains by interest groups [87,108]. Such conditions can be mutually dependent [109] and often have strong historical origins (e.g. colonialism) [110]. Again, this renders generic advice to increase competencies and build an 'enabling environment' rather hollow. As of 2019, 38 countries and territories can be found on the World Bank list of fragile situations.[4]

Even in countries that do not face such drastic circumstances, the preconditions for environmental policymaking are non-trivial. According to Eckersley [26], they encompass "knowledge (ecological, technological, vernacular, and administrative), legal and material resources, effective policy-making institutions, innovative industry, and political participation, underpinned by an active civil society and critical public spheres, including green public spheres." In the next section, we aim to further explore the interrelations between these multifaceted conditions, and their potential to coalesce into common architectures in different countries across the world.

4. Stylized facts of political economic constraints

Which of the discussed constraints are interrelated? In which countries do they cluster? And what are their trends over time? Here we assemble a dataset of indicators representing different constraint dimensions, then develop some basic stylized facts regarding their interrelations and distribution across different countries of the world.

4.1. Materials and methods

4.1.1. Data

We structure the data around four categories: dependent variables of climate policy progress, and constraints related to interests, institutions and ideas (Table 4). Our indicator selection largely follows the studies reviewed in Section 3, but is moderated by the quality and availability of data for a relatively complete set of countries.

In the first instance, we select three measures of climate policy progress: climate legislation adoption [4], the on-going prevalence of fossil fuel subsidies [calculated by 54], and territorial carbon dioxide emissions [6]. For legislation adoption, we remove adaptation-only laws due to our mitigation focus. For fossil fuel subsidies, we use the pre-tax subsidy level, which estimates the difference between fuel supply costs and consumer prices. This is a relatively narrow measure that does not reflect the full external costs of fossil fuel use, such as those from air pollution and climate damages [58]. These indicators are chosen for their balance between legislative and policy aspects of climate mitigation – while also recognising that a different selection of dependent variables (e.g. carbon prices) would drastically reduce the scope of countries. We also include CO_2 emissions despite our earlier critique (Section 2.2), since it provides important context and reveals wide differences in the mitigation challenges of countries (a factor of 15–20 in some cases).[5]

Following the discussion in Section 3, we select two measures of interest-based constraints. First, the fraction of coal in the energy generation mix is clearly relevant – we construct this indicator from IEA data [112]. We also see the presence of oil and gas extraction as a key constraint, due to the documented tendency of this industry to dominate national economies, limit state capabilities and directly oppose stringent climate policy. We represent this by summing the World Bank [111] indicators for oil and gas resource rents – i.e. national net earnings from these industries as a fraction of GDP.

Institutional variables are well documented and widely available. Given considerable evidence pointing to the importance of broad democratic processes, as well as the specific issue of controlling corruption, we employ respective indexes on these dimensions from the V-Dem [113] and World Governance Indicator [84] databases.

Finally, for idea-based constraints we centre on climate change awareness and social trust as the foundations for long-term climate policy making. The former we obtain from the Gallup survey of 2008 [115], averaged with data reported in a more recent publication [89]. The latter was obtained by aggregating the World Values Survey [114] with regional value surveys from Europe, Latin America and Africa.

4.1.2. Correlations, PCA, cluster and trend analysis

Our exploratory analysis consists of 4 stages. First, we calculate (Spearman) correlations between variables, to derive a general sense of the dominant relationships at hand. Second, we perform a principal component analysis (PCA) to synthesize the dataset into a smaller set of dimensions. Since we expect strong correlations between certain variables (for instance, democracy and corruption), PCA reduces the raw data into vectors (components) that combine these effects, each orthogonal to the other, capturing decreasing amounts of variance. This

[4] http://www.worldbank.org/en/topic/fragilityconflictviolence/brief/harmonized-list-of-fragile-situations

[5] It is also important to note that we account for only territorial carbon emissions and not the consumption of emissions embodied in trade.

Table 1
A basic categorisation of political economy constraints on climate policy.

	Analytical focus	Potential influence on climate policy
Interests	Power and motives of collective actors, such as industrial associations, political parties, social classes, NGOs	Powerful interests can determine – within an institutional setting – the priority order for policies, or shape the possibility space for reform by deploying veto powers
Institutions	Organisation, functions and capabilities of public policy making bodies, e.g. the nation state	Institutions mediate the distribution of power resources among interests, the channels for promoting ideas (e.g. via media and education), and the quality of policy implementation
Ideas	Content claims and narratives embedded in social, political and cultural discourses	Ideas with a wide reach shape the underlying worldviews of key interests and the public, regarding the need for (and possibility of achieving) reform

Table 2
Dependent variables for comparing climate policy progress.

Dependent variable	description	example data sources
Emissions & energy trends	Recent or long-term changes in CO_2 emissions, the fuel content of energy systems, or the carbon efficiency of national economies	Global carbon budget [6]
Climate legislation adoption	The ratification of climate treaties (e.g. the Kyoto Protocol, Paris Agreement); setting of climate targets (e.g. NDCs); adoption of legislation and laws (e.g. UK Climate Change Act 2008); creation of responsible ministries	Climate Change Laws of the World [4]; Climate change mitigation legislation, strategy, and targets [3]
Climate policy adoption	The adoption of regulations, standards and instruments that support energy demand reduction and renewable energy technologies, or penalise fossil fuel use (feed-in-tariffs, carbon tax, emissions trading schemes, coal moratoria, energy subsidy reforms)	Carbon Pricing Dashboard [51]; Effective carbon rates [52]
Climate policy stringency	The scope and strength of policies adopted (e.g. the emissions covered by a carbon tax, and the price level of the tax). The level of continued subsidy support for fossil fuel use.	World Energy Outlook [53]; Global Fossil Subsidies [54]
Climate policy outcomes	Composite indicators of climate policy adoption, emissions trends and renewable energy technology adoption	CCPI [55]

aids interpretation, by removing noise, and creates more stable data for conducting cluster analysis [116]. Third, we assess general trends over time by country. We are only able to do this for indicators with consistent time series: the electoral democracy index, control of corruption, oil and gas rents, and the coal share of the electricity mix. We calculate mean values for each indicator in the period 1990–2000, and then plot these against mean values for the available data post-2010.

Fourth, we perform cluster analysis to addresses the question - *which countries are exposed to similar political economic constraints?* To do so, we cluster countries based on their underlying constraints, using a k-means algorithm on the principal components that account for greater than 85% of the cumulative data variance. This method avoids common regional groupings (e.g. the UN categorisation) and potentially subjective choices in setting thresholds for an income categorisation. The number of clusters is subjectively chosen: we calculated n clusters from 4 to 8, and noted that beyond 5 we obtain only marginal differentiation between groups of wealthier northern states. The 5 clusters of countries are then descriptively analysed and named.

Overall, our analysis focuses on interrelations between constraints, their distribution across countries, and their trends over time. We do not estimate the strength of constraint effects, which will vary between indicator and context. Due to high data requirements, we use the latest available years for each variable (see Table 4). However, for some countries there simply is no data on key variables, particularly in the case of climate awareness, trust and coal use. We are therefore only able to capture 99 countries in the final cluster analysis, representing 88% of global population and 92% of global CO_2 emissions. We provide the full data and country clusters in a supplementary file to this article.

4.2. Results

4.2.1. Interrelations between constraints

Fig. 2 shows a striking (but not unexpected) picture: indicators representing control of corruption, electoral democracy, and awareness of climate change have a strong and negative correlation with fossil fuel subsidies. A similar trend is clear for climate legislation: weaker institutions and low climate awareness limits the adoption of climate laws. This series of indicators is captured in the first principal component, which we interpret as a latent 'development' variable pointing to a general North-South divide in the quality of public institutions, which has knock-on impacts on the social sphere (with poor education being associated with low awareness of climate change). Conversely, countries with stronger institutions tend to adopt more climate laws and remove fossil fuel subsidies.

Are territorial CO_2 emissions also associated with these constraints? These correlations suggest that nations with stronger institutions and higher levels of trust and climate awareness do tend to have higher emissions. Yet in the second principal component, CO_2 emissions is a dominant variable, associating primarily with oil & gas rents and social trust. This suggests there is a well-differentiated subset of fossil-extractive nations in which emissions are very high. Such emissions may arise from extraction processes themselves (which tend to be energy-intensive), or from poor incentives to pursue efficiency and fuel switching measures, i.e. a 'fossil-resource curse' [117]. Again, in such contexts, the adoption of climate legislation is less likely.

The influence of coal is interesting: it moderately correlates with the institutional variables and legislation adoption, but negatively with fossil subsidies. This suggests that a high coal share is not a significant barrier at the legislative level. Yet the low strength of these relationships, and the third principal component (which is primarily driven by this measure), indicates that the coal share of primary energy is orthogonal to other constraints: cutting across different types of countries, and in certain contexts associating negatively with the measure of electoral democracy.

We find no direct evidence that levels of social trust are linked to climate legislation adoption and the removal of fossil subsidies. However, trust correlates with both climate awareness and corruption, and is represented in the first and second principal components, which explain aspects of development and extractivism, respectively. Overall, the low variance captured by each component suggests that political economic constraints are rather heterogeneous. They are captured in a few general tendencies that we have described – in particular, the broad divide in institutional quality – but the remaining components describe more context-specific combinations of factors.

4.2.2. Trends in constraints

How have political economic constraints developed over the past decades? Fig. 3 depicts these trends where data is available. Most

Table 3
Cross-national studies of political economic constraints to climate policy.

study	Dependent	Identified constraints and their reported effects on the adoption and stringency of climate legislation and policy(+ higher value increases adoption/stringency | - decreases adoption/stringency | 0 no effect)		
		Interests	Institutions	Ideas
[63]	**Climate policy stringency** [Weighted carbon price level across 191 jurisdictions]	- Share of industry in GDP (+) - Share of coal in elec. generation (-) - Share of oil in elec. generation (0)	- Democracy index score (+) - Government effectiveness (+) - Control of corruption (+) - Multilevel governance (e.g. EU) (+) - Development level (GDP) (+) - Political concentration (veto points) (0) - Majoritarian voting system (0)	- High public belief in human-made climate change (+)
[62]	**Climate policy adoption** [Carbon price adoption in 136 countries + 63 subnational jurisdictions]	- Share of industry in GDP (-) - Share of coal in elec. generation (-) - Share of oil in elec. generation (-) - Share of gas in elec. generation (0) - Share of trade in GDP (+)	- Development level (GDP) (+) - EU membership (+) - Democracy index score (+) - Institutional capacity (Government effectiveness, Regulatory Quality) (0)	- Left/right political ideology (0)
	Climate policy stringency [Carbon price level across 37 countries + 24 subnational jurisdictions]	- Share of industry in GDP (-) - Share of coal in elec. generation (-) - Share of oil in elec. generation (0) - Share of gas in elec. generation (0) - Share of trade in GDP (0)	- Development level (GDP) (+) - EU membership (+) - Institutional capacity (Government effectiveness, Regulatory Quality) (0)	- Left/right political ideology (0)
[61]	**Climate legislation adoption** [Targets and policies within a given year across 63 national jurisdictions]	- Pro-green lobby (IUCN members) (+) - Share of fossil/mining exports in GDP (0)	- Existing legislation and path dependency (e.g. presence of flagship laws) (+) - Electoral cycles (strong democracies) (-) - Electoral cycles (weak democracies) (0) - Concentration of political power (seat shares of ruling party in all legislatures) (+)	- Right-political ideology (Anglo-Saxon countries (-) - Left/right political ideology (all countries) (0)
[69]	**Climate legislation adoption** [UNFCCC protocols + emissions across 149 national jurisdictions]	- Pro-green lobby (IUCN members) (+)	- Political participation (freedom of speech, assembly, association) (+) - Political freedoms (suffrage, elections, women's political rights) (+)	
[60]	**Climate policy adoption** [Adoption of regulations, incentives, carbon price, voluntary agreements, R&D across 19 countries]	- Fossil fuel exports (-)	- Democratic Polity score (+) - Parliamentary system (+) - Variety of capitalism affects instrument choice (0) - Proportional representation (0)	
[82]	**Climate legislation adoption** [CLIMI Index for 87 countries]		- Years of democracy, with depreciation during autocracy (+) - Constraints on the executive (e.g. independent judiciary) (+) - Political competition (free and fair elections) (0)	
[81]	**Climate legislation adoption** [CLIMI Index for 94 countries]	- CO_2 per capita (-)	- Democracy index score (+)	- Social cognitive capital (IQ) (+)
[59]	**Climate legislation adoption** [CLIMI Index for 73 countries)	- CO_2 per GDP (-) - CO_2 per capita (-) - Share of industry, mining, utilities in GDP (-)	- Democracy Polity score (0 controlling for public knowledge, CO_2 per capita and Kyoto commitments) - Government effectiveness & regulatory quality (0 controlling for public knowledge, CO_2 per capita and Kyoto commitments) - EU membership (+) - Post communist (0)	- Public knowledge of climate change (+)

(*continued on next page*)

Table 3 (*continued*)

study	Dependent	Identified constraints and their reported effects on the adoption and stringency of climate legislation and policy(+ higher value increases adoption/stringency | - decreases adoption/stringency | 0 no effect)		
		Interests	Institutions	Ideas
[75]	**Climate policy adoption (fossil fuel subsidy reform)** [Petrol and diesel prices for 201 countries]	- Oil export surplus (-)	- Development level (GDP) (+) - Control of corruption (+) - Years of democracy (+) - Shift to democracy (- then +) - Presidential system (-) - Proportional representation (+) - Concentration of political power (seat shares of ruling party) (-)	

Note: in some cases we do not report variables outside the interest/institution/ideas typology. Often these are control variables such as the share of trade in GDP [69].

striking is the level of stability in perceived corruption since the 1990s, with few countries able to make substantive improvements. In fact, for a large portion of the sample we see evidence of marginal declines, even among relatively wealthy countries, such as the USA, UK and Italy. Democratic institutions have fared somewhat better, particularly in the centre of the distribution. Nigeria, Indonesia and Peru are among those who have rapidly (but not fully) improved democratic institutions since the 1990s. However, in other countries, democratic norms, or the lack thereof, have remained highly stable. This is the case in China, and the majority of oil & gas states such as Saudi Arabia and Iran. In some circumstances, democratic quality has substantially declined (Russia, Venezuela).

Oil and gas rents have noticeably increased among countries with high levels of production over the past two decades. There have only been isolated and exceptional instances of countries reducing their reliance on these resources (e.g. Yemen). The relative increases have also been very large: Saudi Arabia shifted from a 32% share of oil and gas rents as a fraction of GDP in the 1990s, to 45% in the 2010s; Iran from 20% to 25%; Algeria from 17% to 28%. The share of coal in primary energy supply shows a double pattern: increasing across a number of large and developing or middle-income countries, such India, China, and Vietnam while decreasing in turn within wealthier countries like the United Kingdom and the USA.

We are unable to report in a similar fashion for the other indicators (which are based on recent data or incomplete time series). However, some additional points are relevant here. The available climate legislation data shows a rapid and sustained global increase over the past decade, reaching a peak of over 100 laws passed per year from 2009–2013. This subsequently slowed to 40 laws in 2016 [4]. Climate awareness and concern is also an area that may change very quickly, potentially increasing alongside legislative activity, or with the recent emergence of global social movements. Unfortunately, there are no recent global surveys to shed light on this. Finally, in the area of fossil subsidies, relative stability in the total level of global subsidies has been shown, despite a pledge to phase these out already over a decade ago at the G20 meeting in 2009 [54,58].

4.2.3. Clusters of countries

Where do similar types of constraint manifest? We estimate 5 groups of countries in the cluster analysis, ordered from the highest to lowest levels of apparent constraint (Fig. 4). We first observe a group of states strongly dependent on oil & gas resource extraction. Of the entire sample, these tend to have the lowest levels of legislation adoption, the highest fossil subsidies, as well as the most serious deficiencies in controlling corruption and advancing democratic norms. In short, they appear to face fundamental political economic barriers to advancing climate policy. The states include countries such as Saudi Arabia, Iran, Algeria and Venezuela.[6] They comprise 6% of global emissions (territorial) and 5% of global population.

The second cluster we name 'fragile states'. These countries tend to lack democratic norms, have poor levels of corruption control and limited social trust. They have made only marginal progress in climate legislation adoption and fossil subsidy removal, but generally have low levels of per capita carbon emissions. The fragile states group includes many low-income countries in Africa, Latin America and Asia such as Nigeria, Mexico, Pakistan, Bangladesh and Kenya. They make up 3% of global CO_2 emissions and 11% of global population.

The third cluster is distinguished by a heavy reliance on coal in the primary energy supply. We refer to this group as 'coal dependent development', since it captures fast emerging economies such as China, India, Turkey, South Africa, Russia, as well as other countries from the former Soviet Union and Eastern Block. This group tends to occupy the

[6] One country with no oil & gas rents is included in this cluster – Zimbabwe – due to its extremely low scores on the institutional variables.

Table 4
Data and variables.

Variable	Name	Unit	Latest year	Source
Dependents				
Climate legislation adoption	Climate laws	No. laws per country	2017	[4]
Fossil fuel subsidies	Fossil subsidies	Pre-tax subsidy as% of GDP	2017	[54]
CO_2 emissions (territorial)	CO_2 emissions	tonnes of CO_2 per capita	2017	[6]
Interests				
Oil & gas rents	Oil & gas rents	Rents as% of GDP	2015	[111]
Coal in elec. mix	Coal share	% of coal in total primary energy supply	2014	[112]
Institutions				
Electoral democracy index	Democracy	0 – 1.0 (normalised scale)	2015	[113]
Control of corruption	Corruption	−2.0 – 2.0 (normalised scale)	2017	[84]
Ideas				
Social trust	Trust	% of population who trust others	2017	[114]
Climate awareness	Climate awareness	% of population aware of climate change	2010	[89,115]

Table 5
Principal component (PC) analysis of constraints.

	PC1	PC2	PC3	PC4	PC5
Standard deviation (SD)	1.85	1.29	1.02	0.88	0.85
Proportion of variance	0.38	0.18	0.12	0.09	0.08
Cumulative variance	0.38	0.56	0.68	0.77	0.85
Climate laws	**0.27**	**0.27**	**0.28**	**−0.73**	**−0.28**
Fossil subsidies	**−0.35**	−0.20	0.14	**−0.27**	**−0.45**
CO_2 emissions	0.22	**−0.60**	0.06	−0.17	**0.37**
Oil & gas rents	−0.24	**−0.58**	−0.12	**−0.27**	0.09
Coal share	0.17	−0.02	**0.87**	0.19	**0.27**
Democracy	**0.42**	0.19	**−0.29**	−0.01	0.16
Corruption	**0.48**	−0.12	−0.15	0.15	−0.16
Trust	**0.30**	**−0.35**	0.11	**0.37**	**−0.67**
Climate awareness	**0.42**	−0.14	−0.11	**−0.32**	0.06

middle-ground of political economic constraints: moderate legislation adoption and CO_2 emissions, some remaining fossil subsidies, but institutions that are fragile and exposed to corruption. However, there is diversity and a large spread of values across different dimensions, from autocratic regimes to competitive electoral democracies, as well as low and high levels of trust and awareness. This group makes up the largest share of global CO_2 emissions (47%) and population (48%).

The fourth cluster of countries has the highest average rates of climate legislation adoption; they also have relatively low CO_2 emissions and very limited fossil subsidies. We call this group 'fractured democracies' since they have formal electoral systems, but remain hampered by low levels of trust and a failure to eradicate corruption. It is a group of middle and upper-middle income countries in Latin America and Eastern Europe, among which the awareness of climate change is typically high. Countries such as Brazil, Argentina, Chile, Portugal, Greece and Hungary are present in this cluster. It comprises 4% of global CO_2 emissions and 6% of the global population.

The final cluster is dominated by wealthy OECD nations, where CO_2 emissions are high and direct fossil subsidies are practically eliminated. These countries have moderate (but not high) levels of trust, a good awareness of climate change, and strong democratic institutions largely free from corruption. With the lowest apparent levels of constraints, they ought to be leading in climate policy ambition, and yet legislation adoption is spread across a large range, averaging lower than the fourth cluster. In this sense, the group is severely lagging in its potential response to climate change. It is responsible for 30% of global CO_2 emissions and 13% of global population.

5. Discussion

There is no single constraint to climate policy progress, but various conditions that converge in different architectures. The stylized facts focus on the strong linkages between institutional, interest and ideational-based factors. We find a lack of democratic norms, exposure to corruption and fossil fuel subsidies go hand in hand. As do autocratic regimes, oil and gas extraction, and limited progress on climate legislation. Yet varied combinations of factors pervade these general trends. Coal-dependent countries, for instance, span a range of democratic conditions, and have high and low levels of trust and climate awareness. Even the least constrained group of countries, the wealthy OECD, can vary widely in their climate policy outcomes. As shown in several other studies, the complexity of comparative climate policy analysis should not be understated [26,28,29].

How are climate policy risks differentiated across different architectures and the groups of countries we identify? In the oil and gas states, recent history presents little evidence that a transition is occurring, either away from extractive economies, or towards democratic and inclusive governance [113]. Oil and gas extraction rents provide regime stability, but they can mask deep social ruptures and a strong latent demand for democracy [118]. A global transition towards net zero emissions, which directly threatens the production of these rents [119], could result in severe political upheaval and is likely to be strenuously opposed [120].

Fragile states face rather different challenges. They are rapidly urbanising and hence establishing basic transportation, energy and urban infrastructures. These infrastructures will shape emissions in the coming decades, for a significant fraction of the global population [14,121]. There are also non-trivial oil and gas reserves across this group, especially in Mexico and Nigeria. Hence, while current emissions are low, the potential is large. As these countries face intransigent institutional and social issues embedded in histories of exploitation, much will depend on them receiving international support and being able to appropriately design policies that expand development possibilities while limiting fossil fuel lock-in [122,123].

The coal-dependent development states are at a crossroads. Many are initiating a new wave of coal power plants: China, India, Turkey, Vietnam and Indonesia currently top the list of countries with an announced and approved pipeline of coal power plants [124]. If all currently planned power plants were built, the carbon budget for staying within 2 °C would be almost depleted [13,125]. But despite this, a large number of projects are being shelved, and China is initiating direct regulatory measures to limit coal use [126]. Reaching sufficient scale in such measures and initiating them in all such countries is far from certain. From the perspective of territorial emissions, these are some of the most consequential countries in the global mitigation regime [28].

The fractured democracies account for a small portion of global emissions. But they also represent large land areas (e.g. Brazil, Argentina) where tropical deforestation and intensive livestock production have been the focus of recent international attention (important issues not addressed in this article). A severe risk is the fragile nature of these democracies. Brazil, for example, has the fourth lowest level of social trust in the world (at 7%) and increasing levels of perceived

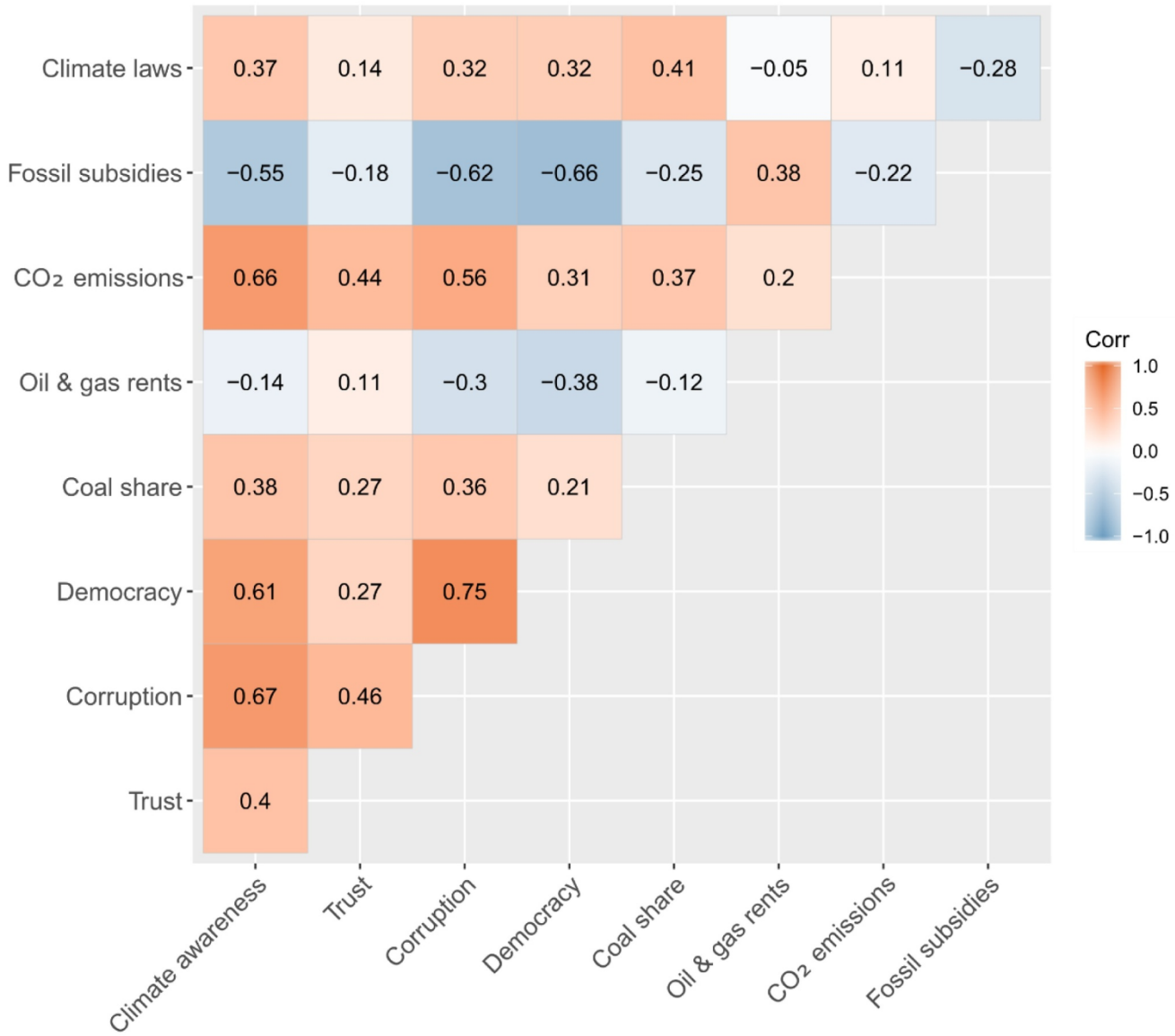

Fig. 2. Spearman correlations.

corruption since the 1990s (currently standing at −0.05 on the World Governance Indicator scale) [84,114]. Populist movements that exploit these conditions for political gain are generally hostile towards environmental protections, especially those premised on international norms and cooperation [103]; although this problem is by no means unique to this group of countries.

In the wealthy OECD, the identified constraints are not as severe. Indeed, this group contains several declared climate 'leaders' such as the UK, Germany and Denmark; countries that have successfully reduced emissions over the past decade (even when accounting for trade), or have been committed players in UNFCCC negotiations [29,127]. Nonetheless, there are obvious examples of failed or stalled progress, most clearly in the cases of the United States (withdrawal from the Paris Agreement) and Australia (repeal of the carbon tax). This raises two key issues that limit our exploration of architectures of constraint: first, the challenges of deepening comparative political economy analysis to more nuanced and conditional constraints that capture the failures we observe here; and second, the need to explore the role of international influences in shaping climate policy prospects.

To the first issue, the international scope of this analysis presents key limitations. As we have discussed in this paper, there are few adequate cross-national measures of climate policy performance. At best, the number of climate laws implemented in a country gives a suggestion of policy engagement, but does not describe policy stringency or outcomes. The inclusion of fossil subsidies gives a more rounded picture, but one that is still lacking. It tends not to differentiate between wealthy countries, which have largely (but not entirely) eliminated subsidies. Quantifying interest-based opposition to climate policy is also challenging. Oil & gas rents and shares of coal are supply-side issues; they may not capture interest groups spanning transportation, agriculture or energy demand sectors. Nor can they describe the full scope of possible lobbying and obstruction activities that are available to interest groups, which often operate through sophisticated and hidden networks [66,104]. One needs small-*n* or case study analysis to uncover these factors; methods that are indeed complementary to the broader scope of work and typology building that we conduct here [128,129].

Second, our analysis and literature review shies away from fully explicating international constraints. This is a key area to address. In her case study of Honduras, Chayes [104] points to the manifold international enabling conditions that strengthen the durability of a kleptocratic, environmentally destructive regime: U.S. military

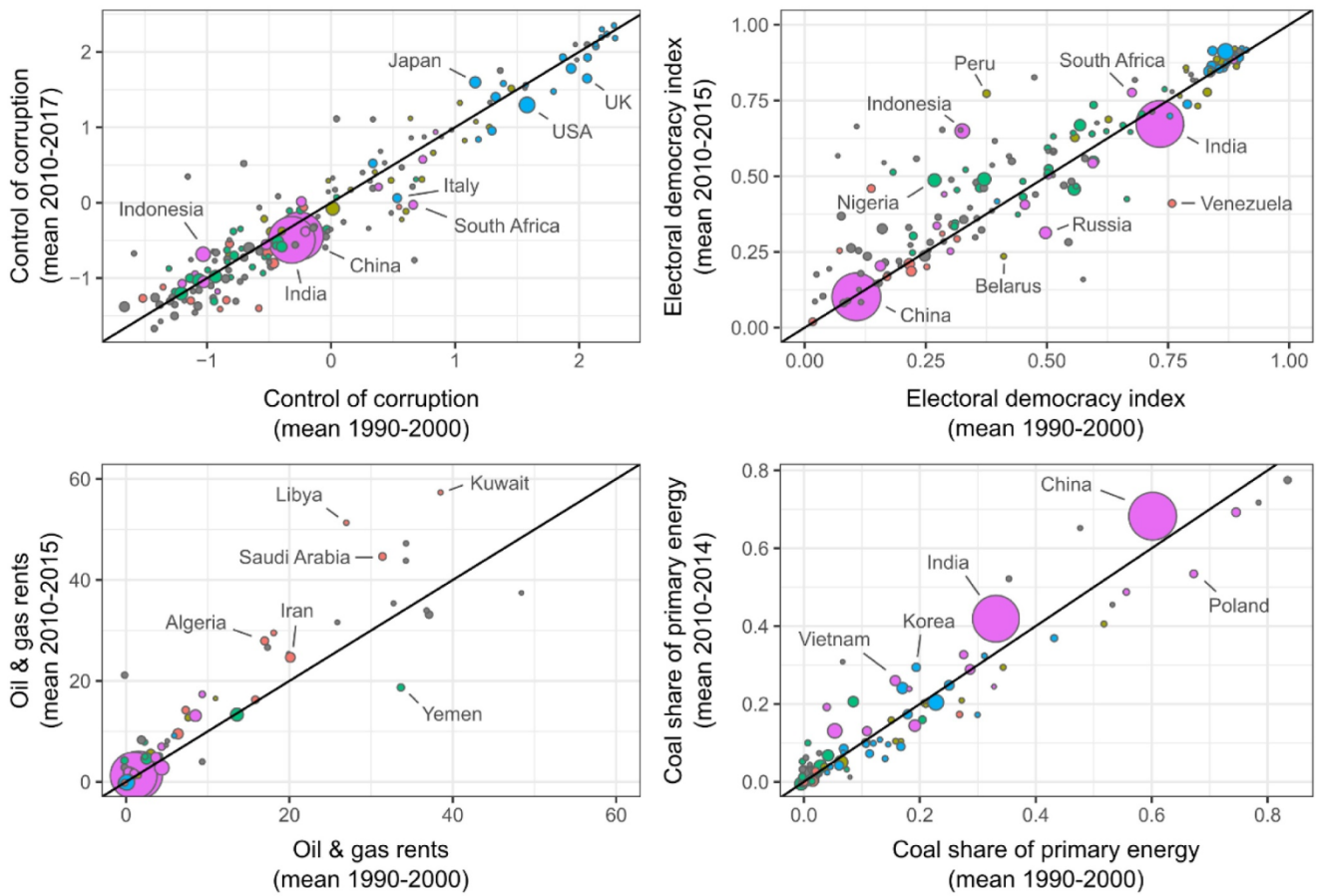

Fig. 3. trends in constrains by country. Data points are scaled to country population. Not all constraints are shown, due to insufficient time spans in the data. Colour is by cluster, identified in the following section.

assistance, development assistance and lending, tacit support for corrupt and autocratic leaders, Western preferences for neoliberal economic restructuring, and the availability of global tax havens for securing private wealth. These issues have received only limited attention to date in the environmental and climate policy literature [130]. Given that we find such a lack of progress in corruption levels across nations, as well as stability in many non-democratic regimes [131], focusing our attention on such international enabling conditions is a crucial direction for further comparative climate policy analysis.

6. Conclusion

This article explores political economic constraints to climate policy. We take a comparative focus at the national level and bring forward conceptual, synthetic and empirical contributions. On the conceptual side, a basic framework of interests, institutions and ideas structures the analysis. We discuss the dependent variable problem, identifying different measures for comparing national climate policy progress and highlighting their weaknesses. Much further work is needed here to move beyond legislative activity and carbon prices, towards systematising and comparing the adoption of broader instrument types across countries [132,133], as well as policy failures such as ongoing fossil subsidies and new commitments to fossil infrastructures.

We review and synthesise a diverse literature documenting political economic constraints to climate policy. These constraints include oil and gas extraction activities, supply-side fossil fuel penetration, undemocratic regimes, corruption, a lack of climate awareness, and low social trust. Besides these, a host of more nuanced and less easily traced factors are likely to hold influence, such as dominant political ideologies, lobbying, or institutional designs that offer veto-points. With exceptions [26,28,29,104,134] there have been few attempts to draw connections between these different factors, leaving a fundamental gap in our knowledge: how are constraints interrelated and mutually reinforcing?

We take a modest step towards unpacking this question by examining correlations and trends, and by conducting a principal component and cluster analysis. We demonstrate strong interrelations between constraints, with several dominant relationships captured in a vector of institutional strength (democracy, control of corruption), implicit social support for policy (climate awareness, social trust), and an absence of fossil extraction activities and subsidies. Strong democratic norms and institutions free from corruption are a rarity, coalescing in only one cluster of countries, the wealthy OECD group. That many constraints are stable over time (corruption), increasing (fossil rents), or subject to significant inertia (democracy, coal exposure) is a cause for significant concern, given the already pressing challenge of remaining within dwindling carbon budgets.

In this article, we argue for a focus on architectures of constraint: mutually reinforcing national conditions that are stable and resistant to intervention. With our analysis limited to large-*n* cross-national comparisons, we are only able to explore these architectures at a broad sweep. They are most evident in the oil and gas states, where regime stability is a very feature of these autocratic, fossil dominated societies. In other regime types – fragile or coal-dependent – different architectures will prevail that hinder a transition towards a rapid and full decarbonisation. It is clear that individual case studies and small-*n* comparisons are needed to explore these political economies in depth. Besides a deep knowledge of individual countries that builds on expert and stakeholder interviews, there is a clear role here for exploring national discourses. Discourse analysis can shine a light on the interest

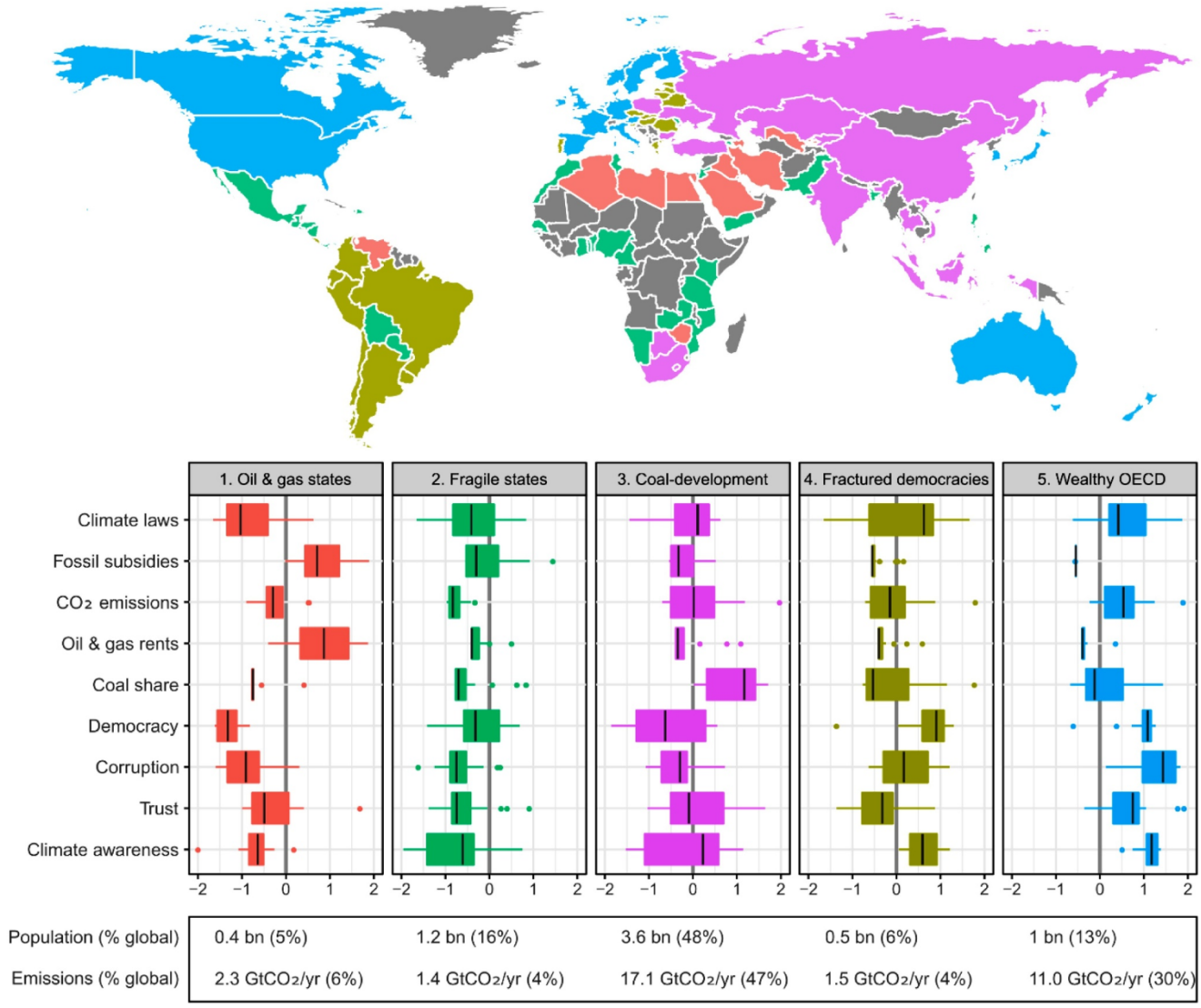

Fig. 4. Clusters of constraints across countries. Total population and emissions for each cluster are shown, but are not used as variables in the cluster analysis.

groups and actors structuring climate policy responses, and can indeed reveal 'complexes', or coherent sets of ideas that guide political and social action [135]. Mapping out such discourse complexes could be one route to identifying the wider hegemonic institutional and social structures that they support and legitimize.

It is important to have a clear-eyed view of these political economic challenges. If one cannot simply mobilise political will and technocratic skill to advance climate policy – because these ingredients are purposefully absent – then what are realistic intervention points? This question deserves our attention, but we cannot offer simple answers. Diverse approaches have been argued for, such as sequencing policy instruments to build supportive constituencies [70,71], challenging global finance [130], or building anti-fossil norms [41]. Given the urgency of this task, and the enormous costs of failure, rapid experimentation and learning on all such fronts is gravely needed.

Declaration of Competing Interest

The authors declare no competing interests.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.erss.2020.101429.

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