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GOVERNMENT RESPONSES TO CLIMATE CHANGE

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INTRODUCTION

The climate emergency poses an existential threat that governments around the world have so far failed to address in an adequate manner. Massive reductions in emissions of greenhouse gasses on a global scale will be necessary to avert worst-case scenarios. Yet—because a safe and stable climate is a true global public good—firms and individuals may seek to free ride on the emissions-reducing behaviors of others. As a result, national and subnational governments will need to use their authority to incentivize, compel, and coordinate action to hasten the transition away from fossil fuels and other activities that contribute to the warming of the Earth's atmosphere.[1]

Despite an acceleration of social science research on the causes and consequences of government responses to climate change, scholars have not yet converged on core definitions or measurement strategies that can serve as a foundation for these analyses. These lacunae present a major impediment for scholarly research on the politics of climate change and for the very practice of policy-making in at least three ways.

First, such measures are essential for holding governments accountable. Both citizens and legislators can only make meaningful decisions about future policies when they have the capacity to evaluate current ones, and information asymmetries are particularly acute with respect to climate change. For example, expenditures may not indicate how much a government

prioritizes climate issues, since regulatory reform may be equally or more important. Moreover, governments typically address climate change by using a wide range of policy tools affecting many economic sectors but no straightforward way exists to aggregate these disparate interventions into simple measures of climate action.

Second, high quality measures are critical for sustaining international cooperation: agreements should be more effective when governments can monitor each other's actions. Compliance can be straightforward to measure when it involves large-scale, visible, transboundary activities such as trade, migration, or territorial disputes. But compliance with climate agreements is frequently opaque since it depends on domestic policies across a wide range of government sectors. Since the failure of the 1997 Kyoto Protocol—which set explicit targets for reduced emissions for the advanced economies—climate agreements have emphasized that governments should establish their own climate goals, as long as they reflect comparable efforts. Yet currently no agreement exists on how to assess this comparability.

Finally, conceptual clarity and reliable measures are necessary for social scientists who aim to describe and to make inferences about the causes and consequences of specific climate policies.

In this article, we focus on the fundamental challenge of describing and measuring such government action in a way that facilitates meaningful comparisons across countries and other administrative levels over time. We evaluate recent scholarly efforts to provide such frameworks, highlighting common conceptual and measurement challenges;[2] we conclude by discussing promising avenues for future research.

WHAT TO COMPARE? CLIMATE POLICY EFFORT

We are concerned with evaluating the measures that governments take to mitigate greenhouse gas emissions (GHGs) and to protect or augment carbon sinks, such as rainforests. We label the bundle of tools employed to advance such outcomes *climate policy effort* (CPE).

We distinguish CPE from decision-making processes, such as the accountability or inclusivity of institutions that make decisions about climate policies.[3] Although the entirety of this process might be understood broadly as climate governance, we believe research can benefit from defining and measuring the constituent parts separately.

As Table 1 summarizes, we identify three stages of CPE: *commitments*, meaning a government's climate pledges and goals; *actions*, which include the laws, policies, institutions and resources deployed to enact these goals; and *outcomes*, which might include changes in GHGs, carbon sinks, or the behavior of citizens.[4] Each is substantively important and merits attention. The links between the three are also critical.

TABLE 1 ABOUT HERE

Choices about measurement strategies necessarily involve tradeoffs. We focus on five challenges that affect the prospects for consistent and accurate measurement of CPE[5]: 1) *aggregating* the totality of efforts in a meaningful way; 2) *standardizing* measures to be comparable across time and space; 3) the *credibility* of indicators as representative of a government's policy efforts; 4) limitations on the *transparency* or observability of what governments do; and 5) ambiguity about the appropriate spatial and temporal *units* for measurement.

COMMITMENTS

Climate policy commitments have special significance. Internationally, countries are obliged under the Paris Agreement to produce detailed pledges that outline their plans. Such commitments are intended to help solve fundamental coordination and collective action problems.[6] Sometimes governments abide by a common (albeit loose) framework, such as the guidelines developed under the Paris Agreement. When the policies implied by pledges fall short of those needed to reach these goals—for example, limiting warming to 1.5 or 2 degrees C by the end of the 21st century—the difference is referred to as the "ambition gap."[7] Domestically, long-term planning is essential for bringing about the economic restructuring needed to significantly reduce emissions, and commitments provide information to the private sector about future market opportunities.

Scholars have investigated both the causes and consequences of such pledges. For example, some have modeled their likely effects on emissions, the cost of energy, the total cost of mitigation, and economic outcomes.[8] Public pledges can both define the terms of action and constrain the very behavior that governments seek to regulate—for example, by altering the long-term expectations (and hence behavior) of energy firms.

Commitment measures tend to have several desirable qualities. Since they are embodied in public documents, pledges are publicly available. They also tend to be transparent: when they lack clarity or specificity, these ambiguities can be readily observed and coded as such.

Still, comparing commitments is not always straightforward, and can present two problems. One problem is aggregation: they typically cover a range of economic sectors, policy instruments, and targets, whose emissions-reducing effects are often unknown but vary from country to country.[9] To estimate the likely effects of these pledges, they must be compared to a

country's counterfactual policies and emissions pathways, which cannot be observed. To determine whether the policies are sufficiently ambitious, analysts must make normative judgments about how the global burden of reduced emissions should be divided among countries—whose past and current emissions are radically unequal.

The second problem is credibility: to evaluate climate pledges, observers must make inferences about the likelihood that the government will actually implement them. Several studies have taken this issue head on: for example, Inhwan Ko, Nives Dolsak and Aseem Prakash assess the credibility of the net-zero emissions pledges made by governments by looking at their target dates, how often they plan to report progress, and the scope of their coverage across pollutants and sectors.[10] David Victor, Marcel Lumkowsky and Astrid Dannenberg take a different approach, surveying climate policy elites to elicit their views about the credibility of these pledges.[11]

The limitations of commitment measures—especially government commitments within national and international frameworks—are evident by their label: they do not necessarily provide strong signals concerning whether policies will be implemented, effective, or sustained by future governments. Analysts and stakeholders have good reason to be concerned with the proliferation of cheap talk, as governments often have incentives to overstate their actual intentions.

ACTIONS

Any complete understanding of CPE must include actions—the institutions, policy tools, financial resources, and human resources that governments deploy to achieve their climate goals. Beyond what they pledge, what actions do governments take to actually reduce their emissions? Do they implement their pledges?

Many studies take climate laws and policies as dependent variables, focusing on how and why they emerge over time. For example, Navroz Dubash and colleagues offer a framework for describing the "institutional machinery" of government action on climate, based on how these institutions address common challenges.[12] Tobias Schmidt and Nicolas Fleig use cross-national data to describe how climate laws and policies have proliferated over time.[13] Jonathan Guy, Esther Shears, and Jonas Meckling consider the national climate institutions of the twenty-one largest-emitting countries—their laws, executive agencies, and research bodies—and whether they focus on agenda-setting, policy formulation, or policy implementation.[14] Kai Schulze counts the number of new climate laws and policies in a given year and finds that in a sample of twenty-nine democracies, governments take more actions as elections approach, particularly when the incumbent party is left-leaning.[15]

Another set of studies uses climate laws and policies as independent variables: Shaikh M. S. U Eskander and Sam Fankhauser, for example, find a correlation between the number and timing of a country's climate-related laws and policies—based on cross-national data for 133 countries—and changes in its subsequent CO_2 emissions.[16] Leonardo Nascimento and Niklas Höhne find that climate-related laws and policies are also associated with projected emissions.[17] The most closely studied policy is probably carbon pricing (a term that covers carbon taxes, emissions trading systems, and sometimes other instruments that affect fossil fuel use). According to the World Bank, in 2023, 39 countries had adopted some form of carbon pricing.

Despite the clear and intuitive appeal of directly studying climate-related government action, we see four types of measurement challenges. The first issue is once again aggregation: any effort to develop holistic measures of government climate policies will require the aggregation of many types of policies, across many sectors, whose likely affects will vary

enormously. The count of climate-related laws and policies issued each year—drawn from the Climate Change Laws of the World database and used as a measure of climate effort by Eskander and Fankhauser, Nascimento and Hohne, and others—gives equal weight to far-reaching legal reforms and minor policy adjustments.

The second challenge is a lack of transparency, which makes it difficult to identify the full set of government actions. For example, initiatives may be decentralized and spread out across government departments. Whether policies not explicitly designed to address climate change but with clear climate implications—for example, trade, transportation, and access to birth control—ought to be included and aggregated into a summary measure is unclear. And even deliberate climate-related policies may not be explicitly labeled as such (the most important climate-related policy in the United States to date is the "Inflation Reduction Act"). As a result, different research efforts could plausibly identify different sets of policies for the same government.

A third challenge is the credibility of written policies as indicators of what governments actually do in practice. For example, carbon pricing systems are typically implemented in ways that are limited or inconsistent in their coverage of sectors, firms, and types of emissions; and their impact is offset by other types of taxes, fees, or subsidies.[18] All of this can produce misleading inferences about how governments are encouraging or discouraging fossil fuel use.

Another facet of the credibility problem concerns exemptions. Within any regulatory jurisdiction, self-interested actors will regularly seek special treatment. For example, taxes on carbon emissions are typically pockmarked with dilutionary carve outs and exceptions, and with a regular degree of forbearance.[19] Should such exemptions be viewed in terms of their stated intent or realized impact? In the area of carbon pricing, scholars have crafted measures that

document more accurately the scope of government policies: Michael Ross, Chad Hazlett, and Paasha Mahdavi measure a government's net implicit tax or subsidy on gasoline, which represents the sum of all policies, both direct and indirect, that affect prices.[20] Mark Carhart and coauthors calculate a "comprehensive carbon price" imposed by governments in twenty-five major emitters from 2008 to 2019, reflecting the collective price effects of seven types of CO_2-reducing policies.[21] Geoffroy Dolphin and Qinrui Xiahou construct carbon pricing measures that account for limits in both sectoral coverage and territorial extensions.[22] Paolo Agnolucci and colleagues develop a "total carbon price" that covers a wide range of both direct and indirect pricing tools.[23]

A fourth concern is how to properly standardize measures. Take, for example, budgetary outlays for investment in solar power. Should those investments be compared on a per capita basis, as a share of government expenditure, as a share of GDP, or some other metric? Each solution implies different assumptions about a government's capacity and obligations. Moreover, the cost of building new solar and wind power has fallen dramatically over the last three decades, making it difficult to conduct intertemporal comparisons based on the size of investments. Relatedly, the steady supply of sunshine or wind may make some investments more appealing in some places compared to others.

OUTCOMES

Finally, a growing literature has focused on measuring CPE in terms of key outcomes, largely interpreting variation, particularly over-time trends, as a product of government action. Most studies of outcomes focus on estimating the effects of carbon pricing—a literature large enough to generate several meta-analyses.[24] On a smaller scale, but with a greater capacity to make causal inferences, several studies have used randomized controlled trials to estimate the causal

impact of two types of treatments—information sharing and community monitoring—on forest protection, using satellite-based measures of the same places at different points in time.[25] Whether for experimental or observational studies, quantitative measures of greenhouse gas reductions arguably represent a powerful and comprehensive indicator of CPE as they plausibly reflect the net contributions of the commitments and actions described above. And because of recent advances in pinpointing sources of emissions, we expect these studies to grow quickly in quantity and quality.

Nonetheless, we want to highlight some important challenges to the credibility of outcome measures as indicators of government effort. For example, changes in emissions may also reflect implementation failures, policy reversals, new technologies, or economic and demographic changes unrelated to government efforts. Moreover, we cannot assume that either the stated or implemented policies will translate into intended outcomes. Emitters may respond to new policies in unexpected or perverse ways, and new circumstances (for example, lockdowns that were associated with the COVID-19 pandemic) or technologies could either accelerate or impede cuts in emissions.

Another central dilemma for an outcomes-based approach is how to determine the geographic and temporal units of measurement. One country's decarbonization policies can have strong effects on decarbonization in other jurisdictions. Some of these external effects are beneficial: innovations in renewable technologies can reduce emissions both nationally and globally. Others are harmful: countries can curtail domestic emissions by replacing locally produced steel with imported steel, effectively offshoring some of their emissions from steel manufacturing to a trading partner. A policy of removing high-emissions cars and trucks from the roads can reduce national emissions, but if these "clunkers" are resold in countries with lower

emissions standards such actions could produce a net increase in global emissions.[26] In short, because government actions are intended to contribute to a global public good, researchers may strongly under- or overinterpret any government's efforts simply by looking at outcomes within that government's jurisdiction.

Finally, an outcomes orientation also leaves open the question of the best approach to standardization. Most countries seem to follow historic emissions pathways that resemble an upside-down U: emissions first rise with population and income growth, then peak and decline as energy use becomes more efficient. Should low-income countries on the upward slope of the curve be judged by the same metric as wealthy countries on the downward slope? Should observers focus on a country's total emissions (which matters most for global warming), per capita emissions (which introduce an element of climate justice), or cumulative, historic emissions (which add another dimension of climate justice)? Should we account for geographic and geological conditions, which could reduce the cost of either clean or dirty energy? Indeed, the UNFCCC principle of "common but differentiated responsibilities"—first established in the 1992 Rio Declaration—acknowledges that countries should follow different mitigation strategies and may have different mitigation goals. Understanding how to operationalize such a principle is a different matter, and the choice of a relevant denominator necessarily assumes that such a factor is a critical constraint on government action.

Conclusions and Promising Pathways

A growing number of political scientists are heeding the siren call[27] to study the politics of the climate emergency and are making important theoretical and empirical contributions. Yet to develop a useful and cumulative body of evidence, we require a shared understanding of how to

measure government CPEs, to foster best practices in such measurement, and to be mindful of the implications of particular choices. Indeed, buried in many such choices are clear normative assertions about how to evaluate governments, and how the global burden of reducing future emissions should be shared among countries. Those assertions ought to be laid bare. Researchers need to make clear how their choices affect the scoring of variables, and the sensitivity of their findings to alternative approaches.

In this brief article, we have tried to move this agenda forward by parsing out three stages of the CPE—commitments, actions, and outcomes—and by describing the opportunities and pitfalls in each. Although a focus on government action would seem to be the most intuitive strategy for assessing CPE, the measurement challenges associated with this stage and the substantive importance of commitments and outcomes, indicate the need to pay attention to all three stages.

Moreover, for scholarly endeavors to be impactful on real-world policy and practice, conceptualization and measurement should be advanced in concert with policy actors, who are likely to have their own views on the salience and interpretability of any novel approaches. Since each country and region faces unique conditions—as their geography, geology, and economic history affects their emissions—intertemporal comparisons within states will be more straightforward and credible; cross-sectional comparisons are formidably challenging, but ultimately are critical, especially for a problem that requires coordination and oversight.

While political scientists have often focused on the causes and consequences of CPE, we suspect that important political dynamics lie in between each of the three stages that we have identified. Future researchers should also pay close attention to the gaps among commitments, actions, and results.

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KEY WORDS

climate change, emissions, government response, climate policy effort, commitments, actions, outcomes

[1] IPCC 2023, 24. [?/The source to which you are referring here needs to be added to reference list EL: Added in comment]

[2] Several nongovernmental and international organizations have created databases and frameworks that are sometimes used in scholarly studies, including the ones that we discuss here. We discuss only the scholarly use of such data.

[3] E.g., Dubash et al. 2021.

[4] Others have used similar typologies; see, for example, Guy, Shears, and Meckling 2023 and Fransen et al. 2023.

[5] Adcock and Collier 2001.

[6] Although responses to help societies adapt to the ravages of climate change are also clearly critical, we do not focus on those here because they embody a distinct set of social, economic, and political dynamics.

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[9] Rogelj et al. 2016; De Pauw 2017. [?/Please add DePauw source to ref. list]

[10] Ko, Dolsak, and Prakash 2022.

[11] Victor, Lumkowsky, and Dannenberg 2022.

[12] Dubash et al. 2021.

[13] Schmidt and Fleig 2018.

[14] Guy, Shears, and Meckling 2023.

[15] Schulze 2021.

[16] Eskander and Fankhauser 2023.

[17] Nascimento and Höhne 2023.

[18] Cullenward and Victor 2020.

[19] Dolphin and Xiahou 2022; Holland 2016.

[20] Ross, Hazlett, and Mahdavi 2017.

[21] Carhart et al. 2022.

[22] Dolphin and Xiahou 2022.

[23] Agnolucci et al. 2023.

[24] Green 2021; Minx et al. 2021.

[25] Jayachandran et al. 2017; Slough et al. 2021.

[26] Davis and Kahn 2011.

[27] Keohane 2015.