Does distributive conflict explain variation in green stimulus spending? Evidence from 40 major economies during the Global Financial Crisis and the Covid-19 recession

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Abstract

The 2008 Global Financial Crisis (GFC) and the 2020 Covid-19 pandemic triggered large economic stimulus packages in most countries. While aimed primarily at saving the domestic economy from widespread bankruptcies and mass unemployment, these stimulus packages also offered governments windows of opportunity for pivoting towards decarbonization. Drawing on a new dataset covering 40 of the world's largest economies' stimulus spending during the two crises, this article addresses two questions: 1) Did the allocation towards green investments increase in government stimulus packages from the GFC to the Covid-19 downturn? 2) What country characteristics are associated with green stimulus spending in each crisis? Grounded in distributive-conflict theory, we hypothesize that the relative strength of green and fossil stakeholders in the economy is decisive in shaping climate policy outcomes. Consistent with this theory, our empirical analysis reveals (1) a (small) uptick in major economies' net green spending from 2008 to 2020 and (2) that robust green industrial interests strongly predict cross-country variation in green stimulus spending. In contrast, countries' levels of fossil fuels production did not exert a proportional influence. Notably, our research also uncovers a pattern of path dependency, with countries leading in green stimulus spending during the GFC maintaining this position also through the Covid-19 pandemic. Overall, this article contributes new insights to the comparative political economy literature on climate change by analyzing how economic recessions affect the energy transition and how economic structures drive cross-country variation in investment-based climate policy.

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1. Introduction

The economic downturns triggered by the 2008 Global Financial Crisis (GFC) and the 2020 Covid-19 pandemic prompted governments worldwide to enact extensive stimulus packages. Although primarily designed to rescue domestic economies from widespread bankruptcies and mass unemployment, these stimulus packages also presented unique opportunities for governments to instigate structural changes by investing in decarbonization.

A growing body of political science literature posits that economic crises can serve as catalysts for the energy transition (Aklin & Urpelainen, 2018; Barbier, 2010; Blazquez, Galeotti, & Martin-Moreno, 2021; Gawel & Lehmann, 2020; Geels, 2013; Gusheva & de Gooyert, 2021). During such crises, governments often resort to stimulus spending, which presents an opportunity to accelerate decarbonization by directing investments towards sustainable economic shifts away from fossil fuels, thereby reducing greenhouse gas (GHG) emissions (Tienhaara, 2014; Burns and Tobin, 2016). However, the design of economic stimulus packages can also incite distributive conflict over climate policy, as policymakers face pressure to make swift and significant decisions about which industries and interest groups to support financially. The incentives for governments to invest in decarbonization vary considerably, and the extent to which they leverage economic crises to promote energy transition is likely influenced by the political clout of green versus fossil fuel stakeholders.

This article contributes to the literatures on the impacts of crises on decarbonization efforts and the distributive conflict of climate policy by examining cross-country variations in green (GHG-reducing) and fossil stimulus spending across two economic crises. Our analysis draws on a new dataset that covers the stimulus packages of 39 countries and the EU in response to the 2008 GFC and to the 2020 Covid-19 recession.[4]

Based on the distributive-conflict perspective in the climate politics literature, we theorize that the emissions profiles of economic stimulus packages depend on the relative political influence of green and fossil economic stakeholders (Aklin & Mildenberger 2020, 2022; Colgan, Green & Hale 2020; Hughes and Urpelainen 2015). Between the two crises, the relative prowess of green economic stakeholders surged globally, whereas that of their fossil counterparts declined. Thus, we expect an overall rise in the share of green spending in

[4] Our dataset includes both spending by the EU Commission and spending by major individual EU member countries. Our descriptive statistics include both, while the regression analysis only includes country-level spending

governmental stimulus packages from 2008 to 2020. We also anticipate that countries with more influential green economic sectors allocate a higher proportion of their stimulus budgets to green initiatives than those more strongly dominated by fossil fuel interests.

We thus aim to answer two research questions: First, did the share of green spending in governments' stimulus packages increase from the GFC to the Covid-19 recession? And second, which country characteristics are associated with green stimulus spending across these two economic crises?

Our empirical analysis renders three main findings. First, in line with the distributive-conflict perspective, net green spending in economic stimulus packages increased from 2008 to 2020; however, this increment was modest. Overall, very few countries in our sample devoted substantial shares of their stimulus spending to advance a climate agenda in either crisis. This finding challenges the idea that economic crises are critical junctures for the advancement of the energy transition (e.g., Bowen and Stern 2010; Tienhaara 2014; Burns and Tobin 2016; Aklin & Urpelainen 2018).

Second, countries with strong green industrial interests adopt more emissions-decreasing measures in their economic stimulus packages. This finding, too, aligns with distributive-conflict theory. More surprisingly, our analysis does not indicate that countries with high fossil-fuels production are systematically less likely to adopt green stimulus packages than other countries. Contrary to the notion that fossil-fuels interest groups capture the policymaking process through lobbying, our analysis reveals no clear association between a country's fossil fuels production and its levels of green stimulus spending.

Finally, our analysis indicates that the frontrunners of green stimulus spending were largely the same countries in the GFC and the Covid-19 recession. This finding suggests the presence of significant path dependencies in countries' stimulus spending. Even when controlling for a range of country characteristics, the emission profiles of the GFC stimulus packages explain a substantial amount of the cross-country variation in the emission profiles of the Covid-19 packages.

This article provides a novel analysis of climate policy outcomes amid economic crises, complementing existing literature in at least two main ways. First, using more comprehensive and systematic data than previous studies, our article offers a new empirical test of the theorized link between exogenous shocks to the economy and the advancement of the energy transition and climate policy more broadly (Aklin & Urpelainen 2018; Barbier 2010; Blazquez, Galeotti, and Martin-Moreno 2021; Gawel and Lehmann 2020; Geels 2013; Seto et al. 2016; Hepburn et al. 2020; Gusheva and de Gooyert 2021). Notably, we leverage a novel dataset that covers stimulus spending in 40 of the world's largest economies during both the 2008 GFC and the Covid-19 pandemic (Tørstad et al. 2025), which facilitates an in-depth investigation into how the drivers of green stimulus spending evolved between these two major crises. Furthermore, it enables us to extend the analysis beyond the scope of the G20 nations, which have typically been the focus of previous similar studies (e.g., Quitzow et al. 2021; Nahm et al. 2022).

Second, our article contributes a systematic evaluation of the widely held assertion that governments' climate policy preferences are shaped by conflicts between pro- and anti-climate reform interests (Aklin & Mildenberger 2020). While recent research has convincingly traced this mechanism in case studies of climate policy regulation (e.g, Breetz et al. 2018; Mildenberger 2020), we conduct a macro-level evaluation of the overarching patterns between countries' economic structure and their stimulus spending. By focusing on whether and if so, how distributive conflict shapes climate-related spending decisions, rather than how it impacts regulation, this article offers new insights for the burgeoning literature on investment-based climate politics (Armitage et al. 2023; Darvass and Wolf 2023) and green industrial policy (Allan et al. 2021).

The remainder of this article is organized as follows. In section 2, we explain the general theory behind crises as opportunities for decarbonization, including how green stimulus spending differs from regular climate policy. Based on the distributive-conflict perspective, we also develop two hypotheses about green stimulus spending. In section 3, we describe our data and methods. In section 4, we report our empirical results. Finally, in section 5, we discuss our findings and conclude.

2. Theory

2.1 Economic crises as windows of opportunity for the energy transition

Economic downturns have traditionally been viewed as impediments to environmental policy progress, as they generate an urgent need for governments to stabilize the economy and revive economic growth that can conflict with less immediate climate- and environmental objectives (see Meckling and Allan 2020). However, a new narrative emerged in the mid-2000s, centering around the concept of green growth. Highlighting the possibility of *complementarity* between climate policy and economic progress (Meckling and Allan 2020), this perspective depicts economic downturns as potential catalysts for redirecting economic development in a more sustainable direction (Aklin & Urpelainen 2018; Barbier 2010; Blazquez, Galeotti, and Martin-Moreno 2021; Gawel and Lehmann 2020; Geels 2013; Hepburn et al. 2020; Gusheva and de Gooyert 2021; Seto et al. 2016). According to this more recent narrative, events like the GFC and the Covid-19 pandemic can function as external shocks to the economy that create windows of opportunity for setting off – or accelerating – the energy transition (Aklin & Urpelainen 2018).

This change in narrative became evident during the 2008–2009 GFC, which saw a new focus on the implementation of green industrial policy and green Keynesianism in economic stimulus packages (Hepburn et al. 2020; Meckling and Allan 2020). Although primarily aimed at saving the domestic economy from widespread bankruptcies and mass unemployment, economic stimulus packages also offer governments an opportunity to invest in decarbonization through structural changes in the economy – changes that can help reduce emissions and sustainably shift the global economy away from fossil fuels (Bowen and Stern 2010; Tienhaara 2014; Burns and Tobin 2016).

Traditional regulatory mitigation policies tend to impose concentrated costs on industries and businesses (e.g., renewable energy standards) or on consumers (e.g., fuel taxes) (see, e.g., Mildenberger 2020). In contrast, green stimulus spending typically provides concentrated benefits to at least one and sometimes both types of actors in the form of subsidies, investments, or tax relief. A potential upside of relying on positive rather than negative incentives is that the former will more likely garner political support. While businesses face incentives to lobby against cost-inducing climate policies, and disadvantaged consumers might express disapproval of negative incentives at the ballot box, green stimulus spending will more likely mobilize political support from specific economic groups (Meckling 2021; Meckling et al. 2022).

In the literature on green industrial policy, a key idea holds that it is better to start decarbonization efforts with green spending initiatives that help build supportive coalitions than to start with market-based policies that could create political backlash. Moreover, empirical research has shown that green industrial policy can facilitate environmental goals, such as GHG emissions reductions, as well as the adoption of environmental policies, such as carbon pricing (Meckling et al. 2015; Meckling 2021).

Beyond case studies, prior efforts to elucidate cross-country disparities in green economic recovery spending have been scant. An important exception is Quitzow et al. (2021), who analyze green stimulus spending directed towards the energy supply sector in G20 countries during the Covid-19 pandemic. They identify an institutional lock-in effect whereby existing trends are reinforced, leading to a widening gap between leaders and laggards in the energy transition. Renewable-energy leaders continue the deployment of green energy and divest from coal, whereas countries with a strong lock-in in fossil-fuel industries direct stimulus spending at propping up those industries.

Andrew et al. (2022) also analyzed Covid-19-related stimulus spending in the G20 but with a broader lens. Their findings highlight a relationship between a country's green spending and various factors, such as GDP per capita and the severity of the pandemic's impact. They also find some evidence that green spending is positively related to renewable-energy consumption (as a share of total energy consumption) and negatively related to emissions intensity.

2.2 GFC vs COVID stimulus packages: expectations for overall spending

Shortly after it became clear that the Covid-19 pandemic would adversely impact the global economy, policymakers worldwide began designing Keynesian stimulus packages, seemingly drawing inspiration from strategies deployed to mitigate the GFC of 2008–09. The interim decade between the two crises witnessed major shifts in the global climate policy landscape: the nearly universal ratification of the Paris Agreement, the growing recognition of climate change as a pressing issue, plummeting renewable energy costs, and a significant surge in global renewable energy production.[5] Consequently, the 2020 discourse around green stimulus was more pronounced in 2020 than in 2008–2009.

Apart from the changed climate policy landscape, the two crises' nature and economic implications were also distinct. First, the GFC originated in financial markets and erupted in the United States as the value of mortgage-based securities tied to American real estate collapsed. In the first phase of the economic rescue efforts, many governments were compelled to bail out financial institutions that were "too big to fail", rather than to help consumers directly. In contrast, the Covid-19 recession was a direct consequence of a public health crisis,

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[5] Global renewable energy production had almost doubled in absolute terms (https://www.statista.com/statistics/1029063/renewable-energy-production-globally/) increasing its share of total energy production from 8.7% to 11.2% (see: https://www.c2es.org/cleaontent/renewable-energy/)

causing widespread disruptions in the real economy. It was spurred by governmental responses to a public health emergency, including lockdowns that prohibited consumers from conducting regular economic activities.

Second, the pandemic's impact was more uniformly felt across countries, with more severe effects on unemployment levels and GDP growth. In contrast, countries varied significantly regarding how hard the GFC struck.

Third, central banks played a more pronounced role in mitigating the GFC than they did under Covid-19. With already low interest rates at the onset of Covid-19, central banks had limited tools at their disposal, putting the onus on governments to adopt substantial fiscal spending packages.

Finally, and related to the previous point, the Covid-19 stimulus packages were generally around four times bigger in real terms than the corresponding packages under the GFC, allowing for more discretion in spending allocations under Covid-19. Overall, these differences between the two crises lead us to expect that countries allocated a greater share of their stimulus spending to green objectives during the Covid-19 pandemic than during the GFC.

2.3 Distributive conflict and cross-country variation in green crisis spending

Theoretically, our work leverages green spending during economic crises to assess whether—and if so, how—investments that promote decarbonization can be explained by the relative strength of green and fossil economic stakeholders in society (Aklin & Mildenberger 2020, 2022; Colgan, Green & Hale 2020; Hughes and Urpelainen 2015). The recent 'distributive conflict' perspective in climate policy research argues that divisions in the material interests of political and economic stakeholders trigger distributive conflict over climate policymaking (Aklin & Mildenberger 2020). The essence of the distributive-conflict perspective is succinctly summarized by Aklin & Mildenberger (2020: 5), who postulate that "governments' preferences are shaped by conflicts between pro- and anti-climate reform interests" and that "climate policies create new economic winners and losers." Moreover, "sharp divisions in the material interests of political and economic stakeholders trigger subsequent distributive conflict over climate policy making." In line with this perspective, the gist of our theoretical argument is that the relative strength of different domestic economic interests shapes governments' ability to combine economic recovery and decarbonization efforts.

Under distributive politics, the structural composition of the domestic economy constitutes a key factor for explaining when interest groups favoring investments in clean-energy industries (and climate policy more broadly) are likely to prevail. The relative balance of fossil-fuel versus green-technology interests determines the size and political clout of vested-interest opposition to green measures (Meckling et al. 2015; Stefes 2020). A domestic economy dominated by actors invested in fossil fuels will likely generate substantial opposition against green stimulus packages and strong demands for using economic stimulus funds to bolster the competitiveness of incumbents in high-emitting industries (Aklin and Urpelainen 2013; Tvinnereim and Ivarsflaten 2016). Conversely, economies in which sizeable industries likely to benefit from green stimulus measures have already been developed, for instance because of previous industrial policies, will likely face less interest-group opposition against—and more interest-group support for—investments in green sources of economic growth (Meckling et al. 2017).

The politics of economic stimulus spending represents a particularly relevant case for distributive conflict theory because the formulation of stimulus packages in times of crises compels politicians to prioritize which industries and interest groups to support with substantial and rapid financial allocations. Economic crises increase the pressure on policymakers for swift, impactful decisions, and intensify the conflicts between competing interests (Eady & Rasmussen 2024; Tørstad et al. 2024). The threat and uncertainty that arise in these crises necessitate that policymakers obtain information from and grant access to business groups and trade associations (Brulle & Downie 2022) to create effective policies that protect jobs and industries (Eady & Rasmussen 2024).

The passage of the US CARES Act during the Covid-19 pandemic exemplifies this dynamic. In the lead-up to the adoption of this $2.2 trillion stimulus package, major companies and trade associations swiftly mobilized lobbyists in efforts to secure billions in government aid. Illustrating the scramble between industries for substantial financial allocations, the package drew lobbying efforts from nearly 1600 clients (OpenSecrets 2020), a significant portion of which represented either fossil-fuels exposed or clean energy-related industries (see Tørstad et al. 2024).

2.4 Alternative explanations

Our theoretical focus on distributive conflict entails deemphasizing several potentially important alternative explanations for cross-country variation in green stimulus spending, such as national economic structure and development levels (Pianta & Brutschin 2022), domestic public support for climate policies (e.g., Andre et al. 2024; Tørstad et al. 2020), party politics (Schulze 2021), state capacity (e.g., Aklin & Urpelainen 2013; Jewell et al., 2019; Meckling and Nahm 2022), and economic growth models (IPCC 2022: 242ff.; Chancel et al. 2023; Nahm 2022).

In the statistical analyses, we include proxies for some of these alternative explanations. First, we control for GDP/Capita because existing research has shown that GDP/Capita is associated with both the deployment of new technologies (Pianta & Brutschin 2022) and with climate policy ambition (Tørstad et al. 2020). Second, in line with Pianta & Brutschin (2022), we include GHG emissions/capita as a proxy for the level of carbon 'lock-in' across countries (see also Seto et al. 2016). Countries with high levels of GHG emissions/capita will likely exhibit higher resistance toward the adoption of green stimulus policies from both producers and consumers (Pianta & Brutschin 2022). Third, we control for state capacity, which has previously been shown to drive both climate policy adoption (Aklin & Urpelainen 2013; Jewell et al., 2019) and the extent to which green and fossil interest groups can easily lobby climate politics (Meckling and Nahm 2022). Finally, we also control for EU membership, because the EU has developed common climate policy targets for its member states and adopted economic stimulus packages of its own during the two crises.

We leave other potentially important alternative explanations, such as domestic support for climate policy, party politics, and economic growth models, for future research. Regarding the potential link between domestic support and cross-country variation in climate policy, previous research shows mixed results (Schwander and Fischer 2024; Tørstad et al. 2020). A plausible reason is that publics across the world exhibit widespread and consistently high support for governmental climate action, with a large majority (>60%) in every country supporting the statement that the national government should do more to fight climate change (Andre et al. 2024). Moreover, domestic support likely affects climate policy in complex ways, depending on a country's political institutions, form of governance, which party governs, etc. (see Schwander and Fischer 2024). The cross-sectional nature of our dataset and its moderate sample size limit the number of explanatory variables and interactions thereof we can reasonably include.

Related to the above discussion, previous research has also shown that the orientation and ideology of governing political parties can matter in important ways for climate policy outcomes (e.g., Aklin & Urpelainen 2018; Schulze 2021; Schwander and Fischer 2024; Tørstad et al. 2023). However, given the highly heterogenous political systems of the countries in our sample, which include a significant share of non-democracies and hybrid regimes, simply including conventional measures of political orientation (e.g., left-right indices) in our cross-sectional analyses would not necessarily be informative or effective. Alternative research designs, including qualitative studies that better account for country-specific contextual differences, are likely more suitable for understanding the role of political parties.

Finally, Nahm (2022) argues that decarbonization challenges vary based on whether a country's growth model is consumption-led or export-led and whether its economic structure is dominated by manufacturing or services. However, there is currently no comprehensive overview of countries' economic growth models, and the potential ways that the growth model could affect green stimulus spending remain unclear. For instance, while consumption-led economies might encounter less resistance against green spending from vested interests than export-led economies, they are also less likely to benefit materially from such spending (Nahm 2022: 459).

3. Data and methods

Our analysis is based on a novel dataset (Tørstad et al. 2025) that provides comprehensive information on governmental stimulus spending efforts during the GFC and the Covid-19 pandemic in 40 of the world's largest economies (39 countries plus the EU). Unlike previous data collection efforts that primarily focused on the G20 or the OECD, our dataset includes all major emitters and a diverse range of countries at various levels of development. Our selection approach ensures a heterogenous sample of countries, capturing a wide range of governmental responses to economic crises as well as diverse state characteristics such as industrial composition, form of governance, and economic size. Note that the European Commission's stimulus package is included in the descriptive statistics but not in the regressions because our explanatory variables are national level.

Our dataset evaluates the expected GHG emissions impact (decrease, neutral, or increase) of all stimulus spending measures passed during the two recessions. We label spending measures that likely generated decreased greenhouse gas emissions as 'green' spending, measures that likely increased GHG emissions as ‘fossil’ spending, and measures with no clear emissions impact as ‘neutral’ spending. This means that the broader environmental impacts of spending—on factors such as biological diversity, air pollution, et cetera—are not included. Examples of green spending include subsidies to renewable energy deployment, battery production, and public transportation, while examples of fossil spending comprise subsidies to coal, oil, or natural gas production, airlines, and highway construction projects. Finally, examples of neutral spending encompass support for health care, education, or wage subsidies to avoid layoffs.

Our data are based on announced spending amounts because most governments outside the OECD do not make detailed budgetary information publicly available, making it very difficult to reliably gather data on actual spending. Announced spending is typically more accessible, because it is often publicized as part of political communication or policy announcements. We have—wherever possible—verified that announced spending amounts correspond with approved spending. In cases where we found evidence that announced spending packages were not approved, we removed these packages from the database.

Our dataset builds on the data collection efforts of Nahm et al. (2022), which covered the G20 countries in the Covid-19 recession, and applies the same methodology and coding schemes. The details of the GFC and Covid-19-related fiscal stimulus spending measures included in the database were primarily sourced directly from the text of the appropriate legislation or from government websites, white papers, press releases, et cetera. In some cases, information pertaining to spending measures was also drawn from other reliable sources, such as academic papers, news reports, and policy trackers. Supplementary Material I offers more information about our procedures for evaluating the GHG impact of the spending measures.

In the empirical analysis, we first provide a descriptive overview of cross-country variation in the emissions profiles of economic stimulus packages. Next, we fit a series of regressions to test which country characteristics are associated with the share of green and fossil measures in the stimulus packages. We analyze the relationship between proxies for the relative importance of green and fossil industries in the domestic economy on the one hand and green stimulus spending on the other.

In our regressions, we employ two different dependent variables as measures of green stimulus spending: gross green spending and net green spending. Gross green spending is defined as the share of a country’s total stimulus spending devoted to emissions-reducing measures. Net green spending is defined as the difference between the share of a country’s stimulus spending allocated to emissions-reducing measures and the share of its spending allocated to emissions-increasing measures.

Our main independent variables are based on the distributive-conflict perspective and capture the centrality of fossil and green industries, respectively, in the economies of our observational units. To capture the centrality of fossil industries, we measure the share of gas, oil, and coal production in countries' GDP. These fossil production data are drawn from the Global Fossil Fuels Registry (2023), while the GDP data are from World Bank (2023a). To capture the centrality of green industries, we use the Green Industrial Performance (GIP) Index developed by Moll de Alba and Todorov (2022). The GIP index is constructed by ranking countries on six factors that jointly capture their amounts of green exports, green domestic production, and green employment.[6] The index provides a measure the climate profile of a country's domestic production and international trade of goods, based on the World Bank's list of climate-friendly products. Its methodology is similar to the competitive manufacturing performance index developed by the United Nations Industrial Development Organization.

As explained in section 2.4, we include a set of controls that could potentially affect both our independent and dependent variables: GDP/capita (World Bank 2023b), GHG emissions/capita (World Bank 2023d), EU membership, and state capacity (Hanson and Sigman (2021). To measure state capacity, we use Hanson and Sigman's (2021) state capacity index, which combines 21 different indicators related to states' extractive, coercive, and administrative capacities. Supplementary Material II lists the operationalization and data sources for all control variables.

We perform several robustness checks on our results. The results are robust to the inclusion of countries' renewable energy consumption as share of total final energy consumption (World Bank 2023); the size of countries' real GDP and their total stimulus spending; and to using a different measure of state capacity (tax revenue as % of GDP). The results also hold when we exclude all the control variables outlined above. Finally, four countries (China, Russia, Taiwan, and Nigeria) have missing values on the GIP score values in the GFC analysis. The results are substantively unchanged when we impute missing values for these countries instead of dropping them from the analysis.

[6] The six factors are: green manufacturing value added per capita, green manufactured exports per capita, share of green manufacturing value added in total manufacturing value added, share of green manufactured exports in total manufactured exports, share of green manufacturing employment in total manufacturing employment, and co2 emissions from manufacturing per unit of manufacturing value added.

4. Empirical analysis

4.1 Overall stimulus spending patterns

Our first expectation was that countries would allocate a larger share of their economic stimulus packages toward emissions-decreasing measures during the Covid-19 pandemic compared to the GFC. Table 1 provides an overview of countries' share of gross green, gross fossil, and net green spending in their economic stimulus packages during the two crises. On average, gross green spending declined from the GFC to the Covid-19 recession: the countries in our sample devoted 10.3% of their stimulus packages to green objectives during the GFC and 8.5% during Covid-19. Nevertheless, the net difference between green and fossil spending suggests that the Covid-19 packages were somewhat more climate-friendly than the GFC packages. On average, net green spending (the difference between gross green and gross fossil spending) was 5.5 percentage points (pp) in countries' Covid-19 stimulus packages, compared to -0.2 pp in the stimulus packages under the GFC. Thus, net green spending increased from the GFC to the Covid-19 pandemic; however, this increase was mostly due to a substantial decline in gross fossil spending.

Table 1. Average share of green and fossil spending in GFC and Covid-19 economic stimulus packages.

Economic stimulus package	**Gross green spending**	**Gross fossil spending**	**Net green spending**
GFC	10.3 %	10.5 %	-0.2 pp
COVID	8.5 %	3%	5.5 pp
GFC-COVID change	-1.8 pp	-7.5 pp	5.7 pp

Figure 1 displays cross-country variation in *gross* green stimulus spending both under the GFC and under the Covid-19 pandemic, ranked according to their average value across the two crises. The figure shows that South Korea, Denmark, and the EU stand out as consistent green spenders during both crises. Other countries that consistently do reasonably well in terms of gross green spending include Germany, Italy, and China. Still other countries had high gross green spending only under the GFC (e.g., Nigeria and Switzerland) or only under the Covid-19 pandemic (e.g., Poland, Spain, and Belgium). The horizontal blue and yellow lines show the sample mean share of gross green spending for each crisis.

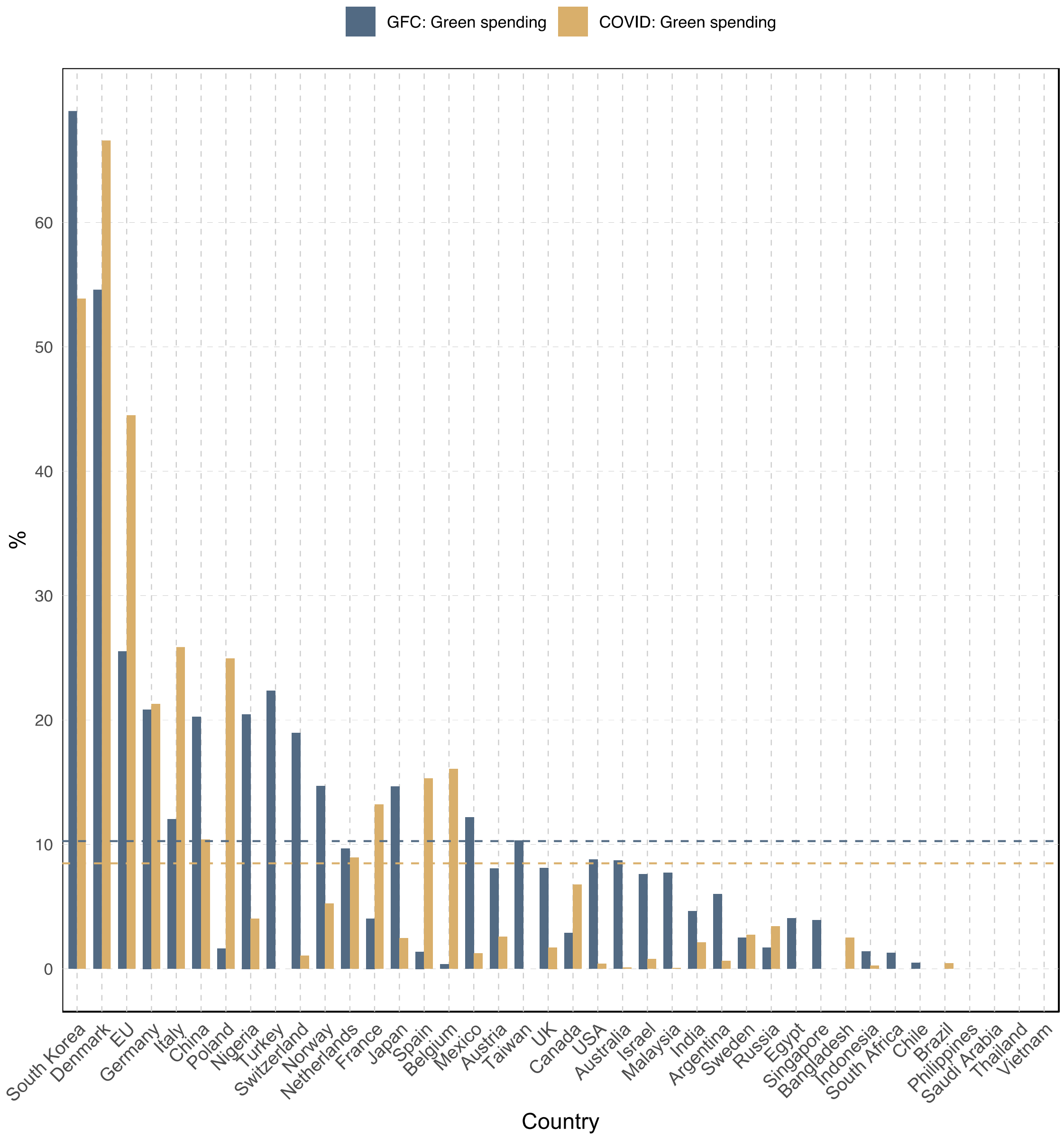

Figure 1. Overview of gross green spending (as share of total stimulus). Dashed lines represent means across all countries. Countries are sorted by highest to lowest average values across the two crises.

Figure 2 shows cross-country variation in *net* green spending in countries' stimulus packages during the two crises. The number of countries in which net green spending was positive increased slightly from the GFC to the Covid-19 pandemic. Nineteen countries (and the EU) increased their net green stimulus spending from the GFC to the Covid-19 pandemic, while eighteen countries reduced it. The ranking of countries in Figure 2 resembles that in Figure 1, with the top six countries unchanged. Nevertheless, further down the list there are some changes. For example, countries such as Switzerland, Norway, Nigeria, and Mexico rank considerably lower on net green spending than on gross green spending, while the opposite is true for Saudi Arabia, Singapore, and Brazil. Thailand and Vietnam did not devote any stimulus funds toward either fossil or green objectives in either crisis; hence their balance in net green spending was the same (0) in both crises. In summary, the figures show considerable variation in green and fossil spending both across countries and across the two crises.

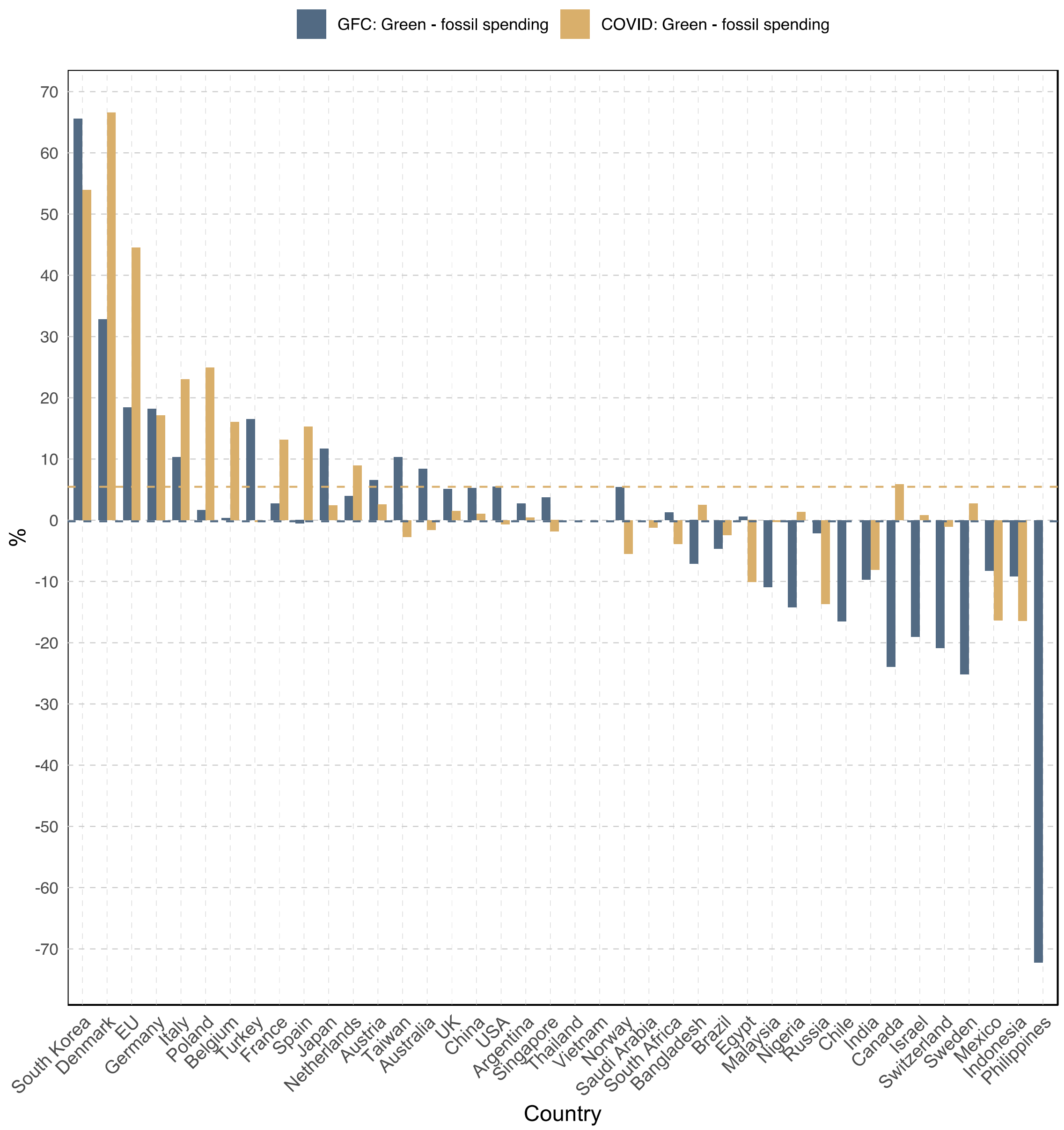

Figure 2. Overview of net green spending (measured as share of total stimulus). Dashed lines represent averages across all countries. Countries are sorted by highest to lowest average values across the two crises.

4.2 Drivers of cross-country variation

We now proceed to assess the drivers of cross-country variation in green spending. Our second theoretical expectation was that the relative strength of countries' green and fossil-fuel-based industries would affect the level of green crisis spending. To test this expectation, we fit Ordinary Least Squares (OLS) regressions. We present separate models for gross and net green stimulus spending in each of the two crises. Table 2 reports models for the GFC, while Table 3 reports models for the Covid-19 recession.

Table 2 displays two multivariate OLS regression models with gross and net green stimulus spending under the GFC as dependent variables. Consistent with our theoretical expectation that the relative clout of domestic green and fossil economic interests affects countries' stimulus spending, the coefficient for the green industrial performance index is positive and statistically significant in the regression with gross green spending as dependent variable. None of the coefficients for fossil fuel production are significant, however.

We also note that in the model with gross green spending as dependent variable, the coefficient for EU membership is negative and statistically significant. The explanation might be that during the GFC, the EU adopted a separate institution-wide stimulus package that contained a substantial amount of green stimulus measures, which are not included in the regression analysis (see Figures 1 and 2). This package might have crowded out green spending by individual member states, by enabling them to prioritize other spending more than they would have done absent the EU package. Gross green spending in the EU package was 25.5%, while the aggregate figure across the member states' packages was 10.3%.

Finally, while the coefficients for some of our independent variables are statistically significant in the model with gross green spending as dependent variable, none of the corresponding coefficients are statistically significant in the model with net green spending as dependent variable. In other words, while the models in Table 2 predict cross-country variations in green spending rather well, their predictions for variations in fossil spending are less impressive, as is also reflected in the R^2 values.

Table 2. OLS regressions. Dependent variables: Gross and net green spending in GFC stimulus packages.

	Dependent variable:	
	(1)	(2)
	Gross green spending (GFC)	Net green spending (GFC)
Constant	100.548 (121.388)	175.361 (203.792)
Green Industrial Performance index	83.080*** (24.348)	60.038 (40.876)
Coal production / GDP	-10.046 (8.871)	-4.265 (14.893)
Gas production / GDP	11.906 (8.691)	13.749 (14.590)
Oil production / GDP	0.450 (27.686)	-22.248 (46.480)
EU membership	-11.110* (5.590)	2.943 (9.385)
GDP / capita (log)	-10.592 (8.676)	-9.809 (14.566)
GHG emissions / capita (log)	4.835 (7.705)	18.603 (12.936)
State capacity	6.741 (5.670)	-4.263 (9.519)
Observations	35	35
R^2	0.479	0.262
Adjusted R^2	0.318	0.035
F Statistic (df = 8; 26)	2.984**	1.154
Note:		*p<0.1; **p<0.05; ***p<0.01

Table 3 displays four OLS regression models with gross and net green spending in Covid-19 stimulus packages as dependent variables. The first two models include the same covariates as the regressions in table 2, while the last two models add variables capturing countries' levels of green spending during the GFC. Evincing the relationship between green economic interests and green spending, the coefficient for countries' green industrial performance score again has the expected sign and is statistically significant across all models except number 3 (gross spending controlling for GFC spending). The coefficients for coal and oil production have the expected sign, but only that for oil in model 3 is significant at the 90% confidence level. Among the control variables, GDP per capita has a consistently negative coefficient, significant at the 90% level for gross spending and at the 95% level for net spending. For emissions per capita, the coefficients are positive, and significant in models 2 (95% confidence) and 3 (90% confidence). As during the GFC, gas production has a positive coefficient, but it is significant only in model 3. Opposite of during the GFC, EU membership has a positive coefficient, although significant only in model 3.

A striking feature of Table 3 is that the coefficients for green spending levels during the GFC are highly significant, and their inclusion greatly increases the R^2 values of the models. We interpret this as an indication of path dependency: The explanation for the cross-country variations in green spending during both crises seems rooted in factors existing already prior to the two crises.

Across both crises, the green industrial performance index emerges as the most consistent predictor, having the hypothesized positive sign and being statistically significant in most models. In contrast, there is little evidence supporting that fossil-fuel production predicts green stimulus spending. The only significant coefficients are for oil and gas on gross green spending during Covid-19 when controlling for GFC spending, and for gas, the sign is opposite of our hypothesis. Among the control variables, none are consistently significant. The most robust is GDP per capita, which has consistently negative coefficients that are statistically significant during Covid-19. This variable has also been found to correlate negatively with countries' climate policy ambition level under the Paris Agreement (Tørstad et al. 2020).

Table 3. OLS regressions. Dependent variables: Gross and net green spending in Covid-19 stimulus packages, with and without control for GFC green spending.

	Dependent variable:			
	Gross green spending (COVID)	Net green spending (COVID	Gross green spending (COVID)	Net green spending (COVID)
	(1)	(2)	(3)	(4)
Constant	247.478* (126.975)	291.691** (139.633)	135.660* (67.253)	224.539* (122.286)
Green Industrial Performance index	67.520*** (24.302)	64.687** (26.724)	3.803 (14.533)	43.329* (23.968)
Coal production / GDP	-9.347 (10.075)	-13.722 (11.079)	-3.941 (5.277)	-11.771 (9.586)
Gas production / GDP	5.922 (6.319)	4.553 (6.949)	7.885** (3.295)	1.334 (6.080)
Oil production / GDP	-6.219 (24.034)	-14.402 (26.430)	-21.761* (12.627)	-8.883 (22.885)
EU membership	9.700 (6.002)	10.583 (6.600)	16.140*** (3.206)	9.342 (5.712)
GHG / Capita (log)	11.520 (6.785)	13.894* (7.461)	7.594** (3.558)	7.641 (6.716)
GDP / Capita (log)	-19.786** (9.540)	-22.954** (10.491)	-9.711* (5.092)	-19.098** (9.135)
State capacity	4.148 (5.984)	6.955 (6.581)	2.045 (3.123)	7.773 (5.689)
GFC gross green spending			0.800*** (0.090)	
GFC net green spending				0.364*** (0.110)
Observations	38	38	38	38
R^2	0.455	0.472	0.858	0.620
Adjusted R^2	0.304	0.326	0.812	0.498
F Statistic	3.025** (df = 8; 29)	3.239*** (df = 8; 29)	18.722*** (df = 9; 28)	5.071*** (df = 9; 28)
Note:				*p<0.1; **p<0.05; ***p<0.01

5. Discussion and Conclusion

Using a novel dataset on 39 countries and the EU, this article analyzes green stimulus spending during the 2008 GFC and the 2020 Covid-19 pandemic. Based on distributive-conflict theory on climate policymaking, we expected that the green share of total stimulus spending would have increased from 2008 to 2020 and that the relative clout of green and fossil industries would be associated with the emissions profile of countries' stimulus packages.

Our results offer mixed support for these expectations. First, the average share of net green spending did increase from 2008 to 2020, but only marginally and primarily due to decreased gross fossil spending rather than to increased gross green spending. Overall, our analysis paints a rather dismal picture of countries' willingness to use economic stimulus to advance ambitious climate policies. While economic crises in principle offer a political window of opportunity to advance climate goals, very few countries exploited this opportunity extensively in any of the two crises we examine. Hence, our findings provide sobering empirical evidence to the literature arguing that economic crises can serve as effective catalysts for path-breaking climate policy change (e.g., Seto et al. 2016; Aklin & Urpelainen 2018).

Second, our statistical tests suggest that a higher relative strength of green industrial interests in their domestic economy leads countries to adopt greener stimulus packages on average. Hence, countries such as South Korea, Denmark, and Germany (ranked sixth, second, and third, respectively, on the GIP index) – as well as the EU – adopted a high share of green stimulus measures during both crises. The Korean case is in many respects an outlier, as different Korean political administrations since 2008 have aggressively pursued green industrial policies to secure diverse export markets for its domestic industries and to pursue a first mover's advantage in the green economy (Kupzok et al. 2024). In Denmark, on the other hand, the government pursued a bottom-up process where it actively consulted with industries and business to forge the country's green Covid-19 stimulus package. The Danish Covid-19 recovery plan built on recommendations from 13 climate partnerships with business and industry that were tasked with "identifying and developing new green solutions, which would both reduce business and industries' emissions and strengthen companies' green competitiveness" (Danish Ministry of Finance 2021, p.9).

Conversely, few of the major fossil-fuel countries engaged in any significant green stimulus spending. Countries such as Australia, Russia, and Saudi Arabia come across as consistent laggards on our green stimulus spending indicators. Nevertheless, the statistical analysis does not provide evidence that fossil-fuel producers were systematically less likely to adopt green stimulus packages. This finding may suggest that at least some governments are able to bypass distributive conflict and lobbying from vested interests during economic crises. In line with this argument, Tørstad et al. (2023) find that (liberal) governments in Canada and the US were surprisingly capable of overcoming resistance from fossil-fuel-based interests against green stimulus spending. At least part of the explanation might be that green spending does not produce negative incentives (unlike climate policies such as carbon pricing); instead, it offers positive incentives to achieve climate outcomes. Whereas climate policy instruments that impose concentrated costs have often seen intense lobbying from affected industries, the allocation of concentrated benefits through stimulus spending may reduce the incentives for green and fossil industries alike to invest heavily in lobbying. Moreover, economic stimulus packages are often negotiated within a short time span, which leaves only limited room for lobbying before political compromises are made. Yet, most of the countries in our sample ultimately failed to use stimulus spending to sufficiently advance a climate agenda, which is puzzling if fossil-fuel lobbies were indeed unable to sway the policymaking process.

Finally, we find that overall, the countries engaging the most in green stimulus spending during the Covid-19 pandemic were largely the same as those engaging the most in such spending during the GFC. Indeed, the stimulus spending of the countries included in our database are strikingly similar across the two crises despite these crises' vastly different nature and context. Based on this consistency within countries across time, we conclude that the two economic downturns have largely mirrored governments' climate policy priorities prevailing prior to the downturns. This conclusion aligns with that of Quitzow et al. (2021). Analyzing green stimulus spending directed towards the energy supply sector in G20 countries, they find an institutional lock-in effect and suggests that the Covid-19 pandemic exacerbated existing inequalities in the energy transition landscape across countries. Our results point in the same direction.

Whereas these findings suggest a largely pessimistic outlook for crises-induced accelerations of energy transitions, a methodological limitation of our coding is its lack of differentiation between conditional and unconditional fossil spending. Andrew et al. (2022) found that around 25% of the fossil energy-related stimulus spending during the Covid-19 pandemic was conditional, requiring recipients such as the automotive and aviation sectors to commit to future emissions reductions in exchange for support. Hence, a significant proportion of the stimulus spending we have coded as fossil can potentially generate net greenhouse gas emissions reductions in the longer run, provided that the recipients comply with the requirements of these 'green bargains' (Meckling and Strecker 2023).

Our work suggests at least three avenues for future research. First, future research should look further into why only some countries seized the opportunities offered by the GFC and the Covid-19 pandemic for accelerating decarbonization efforts. Our study only establishes overarching associations; hence, more research is needed to unpack in more detail *how* green and fossil interest groups affect policy outcomes. Second, while our analysis has focused on political economy factors, alternative explanations such as the role of elite political ideology (Aklin & Urpelainen 2018), economic growth models (Nahm 2022), lobbying (Brulle & Downie 2022), public opinion and party politics (Schwander and Fischer 2024), and the intensity of political competition (Aklin & Urpelainen 2013; Schulze 2021) may hold promise in explaining diverging green spending outcomes and variations in green industrial policy more broadly. Finally, our analysis is limited to assessing governments' announced spending amounts and does not establish whether – and if so, how – green stimulus spending has been effective in reducing GHG emissions. With the global rise of investment-based climate politics (Armitage et al. 2023; Darvass and Wolf 2023) and green industrial policy (Allan et al. 2021), spearheaded by the massive US Inflation Reduction Act, future research should more systematically examine the emissions effects of economic spending packages and thereby draw lessons about how to channel green funding effectively. This would be a valuable contribution to the literature on the emissions effect of environmental policy more generally (e.g., Knill et al. 2012, Le Quéré et al. 2019, Fransen et al. 2023, Stechemesser et al. 2024).

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World Bank. 2023d. Total greenhouse gas emissions (kt of CO2 equivalent). Link: https://databank.worldbank.org/metadataglossary/world-development-indicators/series/EN.ATM.GHGT.KT.CE

Supplementary Material I: Measurement of green and fossil spending

Our definitions of green and fossil spending are based on the potential climate change (GHG emissions) impact of spending measures in stimulus packages. We label measures that likely generated decreased GHG emissions as green spending and measures that likely increased greenhouse gas emissions as fossil spending.

Granted that the overall policy goal of economic stimulus packages is to spur economic growth, the overall distinction between green and fossil spending in our framework is based on whether spending measures potentially reinforce or decouple GHG emissions and economic activity. "Green" spending measures are aimed at decoupling GHG emissions from economic activity, while "fossil" spending measures are those that reinforce the link between economic recovery and fossil fuels (Hepburn et al. 2020). We consider both consumption and production measures on the demand-side and supply-side of economic activity.

Our measure of green/fossil spending is relatively narrow in the sense that it is focused on climate impacts rather than the broader environmental footprint. Moreover, our analysis is limited to governments' *announced* spending amounts: it does not evaluate the actual implementation trajectories of spending measures nor quantify the amount of GHGs these eventually lead to.

We code a relatively narrow set of spending items as "green" or "fossil". While all economic sectors in a country generally emit GHGs, we restrict our coding of industrial support measures to economic sectors that have a clear tie to the usage, production, or deployment of either fossil fuels or renewable energy. In cases where the climate impacts are highly complex or indirect, such as for spending directed toward the health sector, services, telecommunications, and education, we classify the emissions impact as "neutral".

The main categories for fossil and green spending, developed inductively based on which types of policies that are includes in recovery packages, include employment programs; energy infrastructure; housing; cross-cutting energy efficiency measures; research and development; transportation infrastructure; transport subsidies; direct industrial support; and tax incentives for individuals and companies. Within these categories, we classify spending measures that likely will likely help decoupling GHG emissions from economic activity as "green"; while we classify those that likely reinforce the link between economic recovery and fossil fuels as "fossil" (Hepburn et al. 2020). Some spending items, such as support for deployment of biofuels and R&D measures for carbon capture and storage, are not straightforward to classify. Biofuels may have emissions-reducing effects where consumed but emissions-increasing effects at the production stage; and the effectiveness of carbon capture and storage technology is disputed. In such cases of doubt, we qualitatively assess the stimulus measures' likely *national* GHG emissions effects compared to the counterfactual scenario under which a given measure was not enacted. We also cross-verify our coding choices with the Global Recovery Observatory (Global Recovery Observatory - Oxford University Economic Recovery Project) and the *International Energy Agency*'s *Government Energy Spending Tracker* (https://www.iea.org/reports/government-energy-spending-tracker-2).

Supplementary Material II: Variable names, operationalizations, and data sources

Variable name	Description	Source
Green Industrial Performance index	Index composed of six factors: green manufacturing value added per capita, green manufactured exports per capita, share of green manufacturing value added in total manufacturing value added, share of green manufactured exports in total manufactured exports, share of green manufacturing employment in total manufacturing employment, and co2 emissions from manufacturing per unit of manufacturing value added. We use 2013 scores for the GFC analyses, as these are the earliest publicly available data. We use 2019 scores for the Covid-19 analyses, as these are the latest available data.	2013 data: Halkos et al. (2021) 2019 data: Moll de Alba and Todorov (2022).
Coal production / GDP	Metric tonnes of coal produced divided by log-transformed GDP values. The GDP data are current US$. We use 2008 scores for the GFC analyses and 2020 scores for the Covid-19 analyses.	Coal production data: Global Fossil Fuels Registry (2023) GDP data: World Bank (2023a)
Gas production / GDP	Cubic meters (m³) of gas produced divided by log-transformed GDP values. The GDP data are current US$. We use 2008 scores for the GFC analyses and 2020 scores for the Covid-19 analyses.	Gas production data: Global Fossil Fuels Registry (2023) GDP data: World Bank (2023a)
Oil production / GDP	Continous variable Barrels of oil produced divided by log-transformed GDP values. The GDP data are current US$. We use 2008 scores for the GFC analyses and 2020 scores for the Covid-19 analyses.	Oil production data: Global Fossil Fuels Registry (2023) GDP data: World Bank (2023a)
EU membership	Dichotomous variable capturing whether a country is member of EU or not.	
GHG / Capita (log)	Total greenhouse gas emissions (kt of CO2 equivalent) (log-transformed) divided by population. We use 2008 scores for the GFC analyses and 2019 scores for the Covid-19 analyses as these are the latest available data.	GHG data: World Bank (2023d) Population data: World Bank (2023c)
GDP / Capita (log)	GDP per capita, PPP (current international $, log-transformed).	World Bank (2023b)

	We use 2008 scores for the GFC analyses and 2020 scores for the Covid-19 analyses.	
State capacity	Country scores on Hanson and Sigman's (2021) state capacity index, which combines 21 different indicators related to states' extractive, coercive, and administrative capacities. See Hanson and Sigman (2021) for further details. Higher sores = higher state capacity. We use 2008 scores for the GFC analyses and 2015 scores for the Covid-19 analyses as these are the latest available data.	Hanson and Sigman (2021)