# Partisan Alignments and Climate Policy: Reassessing Ideological Effects on $CO_2$ Emissions

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## Abstract

This study examines how left-right partisan orientations may shape national efforts to mitigate climate change, focusing on per capita $CO_2$ emissions across 120 countries from 1990 to 2018. Existing research provides mixed evidence on whether political ideology consistently influences environmental outcomes. To address this gap, we employ advanced quantitative methods, including time-series cross-sectional analyses, and draw on multiple measures of political ideology. The findings suggest that left-leaning governments can be more effective under certain conditions at reducing $CO_2$ emissions. However, these effects vary considerably across socioeconomic and institutional contexts. Variation in socioeconomic and institutional contexts influences the extent to which ideological commitments translate into tangible climate mitigation. This complexity indicates that partisanship alone is insufficient, and broader structural environments are crucial. This study contributes to the literature on climate governance by offering an in-depth understanding of how political orientations interact with national settings to shape environmental performance. It highlights the conditional nature of ideological influences, informing future research on how partisanship can foster more effective climate policies sensitive to underlying conditions.

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## Introduction

Climate change, once perceived as a distant threat, now manifests as a pressing reality, with consequences for ecosystems, human health, and the resilience of societal and economic structures. From intensifying heatwaves, droughts, and floods to the rapid retreat of glaciers and rising sea levels, the impacts of a warming planet are already reshaping livelihoods and straining institutional capacities worldwide (Buis 2019; Silberg 2016). The urgent challenge of limiting global temperature rise to 1.5 degrees Celsius requires national governments to craft and implement policies that reduce greenhouse gas emissions. However, the trajectory of climate action varies widely from one country to another. Understanding what drives these differences is a debated question in the field of environmental politics.

Among the diverse forces shaping national climate policies, partisan political ideologies - especially the left-right divide - emerge as critical yet incompletely understood determinants of environmental performance. Left-leaning governments are associated with more interventionist economic strategies, socially redistributive policies, and a willingness to regulate markets to protect public goods. This orientation aligns with stronger environmental stewardship, more ambitious emissions reduction targets, and higher investment in renewable energy. Right-leaning governments, by contrast, tend to emphasize market efficiency, economic growth, and minimal regulation, which can lead to more hesitant or fragmented responses to climate change (Dunlap 1975; Neumayer 2004). While there is evidence that left-oriented administrations may be more inclined toward stringent climate policies (Chang et al. 2018; Wen et al. 2016; Neumayer 2003),

the empirical record remains mixed and contingent on economic conditions, temporal scope, and political pressures (Garmann 2014; King & Borchardt 1994). The universality, durability, and magnitude of ideological effects thus remain subjects of debate.

Addressing this scholarly gap requires looking beyond narrowly defined contexts, such as OECD countries, and considering a more diverse set of nation-states across different income groups, geographic regions, and institutional histories. It also calls for integrating a richer theoretical foundation drawn from global environmental governance and the international political economy of climate change. Existing research on environmental governance suggests that patterns of North-South economic dependency, the legacies of colonialism, and uneven access to technology and capital influence the capacity and willingness of states to enact robust mitigation policies (Conca 2015; Scruggs 2003). Likewise, scholarship in the international political economy highlights that the divergent national responses to climate challenges are often embedded in broader debates about economic development models, patterns of resource extraction and consumption, and global inequality. This literature underscores the importance of considering how left-right ideological divides interact with structural features of the international system, thereby shaping policy ambition, implementation, and outcomes in ways that transcend simple ideological dichotomies.

Therefore, by situating partisan ideology within this broader intellectual landscape, we can better understand why some governments forge ahead with climate solutions while others lag behind. This study takes up that challenge by examining the influence of left-

right partisanship on climate outcomes across 120 countries over a 29-year period. Moving beyond the methodological constraints and geographic limitations that have characterized previous research, it investigates whether and how left-leaning political orientations consistently translate into lower per capita $CO_2$ emissions. In doing so, it provides an opportunity to test the robustness of long-held assumptions and to clarify when, where, and under what conditions political ideology matters most. Although the specifics of the research design and data - such as the use of time-series cross-sectional models, multiple operationalizations of ideology, and extensive robustness checks - will be detailed later, it is important here to acknowledge that this work extends the frontier of comparative environmental politics by engaging a more comprehensive empirical base and a richer theoretical toolkit.

The insights derived from this inquiry extend beyond academic discussions, offering broader relevance and practical implications. As climate negotiations stall or succeed in part due to conflicting national interests and ideological commitments, understanding the political foundations of environmental action becomes increasingly urgent. Policymakers navigating polarized political landscapes may gain valuable perspective on how partisan divides shape the adoption, stringency, and durability of climate policies. While this introduction focuses on framing the intellectual and policy-relevant importance of ideology in climate politics, subsequent sections will explore the complexity of these relationships in detail, analyzing cross-national data and evaluating multiple indicators of left-right partisanship.

This research aims not only to advance theoretical and empirical knowledge but also to inform strategies that can bridge ideological gaps in pursuit of meaningful climate mitigation. By shedding new light on the interplay between left-right orientation and environmental governance - while integrating insights from global environmental politics, international political economy, and broader cross-national analysis—this study lays the groundwork for a deeper understanding of how political ideology can both enable and constrain global efforts to address the pressing challenges of climate change.

## Theoretical Framework

The influence of partisan ideology on environmental governance is acknowledged but remains theoretically and empirically contested. Existing research indicates that ideological orientations shape policy priorities, regulatory frameworks, and approaches to environmental externalities (Costantini & Hanf, 1972; Dillman & Christenson, 1972). Early studies found minimal partisan differences in environmental engagement, while subsequent research reveals that left-leaning parties advocate more stringent environmental policies (Buttel & Flinn, 1976; Neumayer, 2003). Empirical evidence, however, is mixed. While some analyses show that left-oriented governments correlate with lower $CO_2$ emissions and more ambitious climate policies (Chang et al., 2018; Wen et al., 2016; Neumayer, 2003), others, such as Garmann (2014), challenge this narrative by demonstrating that centrist regimes can sometimes outperform left-wing governments due to pragmatic approaches. For a summary of key empirical studies, see supplementary material, Appendix A, Table I.

These complexities arise from the ideological foundations of governance. Left-leaning ideologies emphasize government intervention, equitable resource distribution, and the correction of market failures. This worldview supports environmental stewardship, perceiving climate mitigation as a public good essential for future generations and marginalized communities. In contrast, right-leaning ideologies, while not inherently hostile to environmental goals, prioritize economic growth, market efficiency, and limited regulation (Neumayer, 2004; Dunlap, 1975). Influenced by frameworks such as partisan theory (Hibbs, 1986) and rational partisan theory (Alesina, 1987), left-wing governments may expand environmental protection as part of broader welfare agendas, whereas right-wing governments may prioritize capitalist interests, potentially reducing their willingness to adopt stringent climate measures.

Furthermore, this ideological spectrum interacts with a global landscape marked by uneven development, historical emissions responsibilities, and international negotiations. In wealthier nations with strong institutions and technical capacity, left-leaning orientations may align more seamlessly with renewable energy promotion, emissions regulation, and social investments that bolster climate mitigation. In less developed countries, economic dependencies and global market structures can constrain or enable how ideological commitments influence policy. Moreover, international regimes, climate clubs, and normative frameworks shape reputational dynamics, making it easier for left-leaning administrations to embrace global standards or harder for right-leaning governments to resist climate measures when facing diplomatic and market pressures.

Ideology is not a linear determinant of environmental performance. Instead, it is one dimension of a multifaceted interplay involving domestic political institutions, public demands, economic conditions, and transnational forces. While left-leaning governments may, on balance, exhibit a stronger inclination toward emissions reductions, variations in institutional capacity, economic prosperity, and international alignments mediate these outcomes. Similarly, right-leaning governments can deliver effective climate policies under certain conditions, though they may lean toward more incremental action. As subsequent sections detail the empirical approach, the study seeks to clarify the extent, consistency, and conditions under which partisan orientations shape climate outcomes across diverse temporal and spatial settings, deepening our understanding of the evolving and complex nature of global climate governance.

## Research Design

This study employs a time-series cross-sectional (TSCS) design to investigate how partisan political ideology affects national $CO_2$ emissions mitigation efforts. The analysis focuses on 120 countries between 1990 and 2018, capturing a formative period in international climate politics. During these years, global awareness of climate change intensified, and major policy milestones, including the establishment of the Intergovernmental Panel on Climate Change (IPCC), the United Nations Framework Convention on Climate Change (UNFCCC), and the Kyoto Protocol, shaped international and domestic agendas. Starting in 1990 aligns with both improved data

availability and the advent of an era in which climate policy became increasingly salient worldwide.

## Hypotheses

Drawing on the theoretical perspective, the study's core expectation is that left-leaning governments will, on average, be more likely to enact policies and regulatory frameworks that reduce $CO_2$ emissions relative to right-leaning governments (H1). At the same time, given the complexities of global environmental governance and international political economy, these ideological effects may vary across different national contexts (H2). Thus, the primary hypothesis is that countries governed by left-oriented political parties, all else being equal, will exhibit lower per capita $CO_2$ emissions. In the following sections, we will explore how this relationship may be conditioned by economic development, geographical characteristics, and the availability of renewable resources.

In this study, rather than pinpointing explicitly defined hypotheses at the outset, we adopt a more general framework that acknowledges multiple potential pathways linking partisan ideologies to climate outcomes. Our approach envisions the possibility that left-leaning and right-leaning governments influence environmental performance in different ways, and that the strength and direction of these effects vary by economic development, institutional capacity, and societal engagement.

## Dependent Variable

The dependent variable is $CO_2$ emissions per capita (metric tons), sourced from the World Bank's World Development Indicators. $CO_2$ emissions serve as a widely accepted

proxy for climate outcomes, reflecting how energy production, consumption patterns, and industrial activities contribute to global warming. The per capita measure enables cross-national comparability, accounting for population differences and providing insight into the intensity of carbon-based development strategies.

### Key Independent Variable: Political Ideology

The primary independent variable is each country's partisan orientation. To ensure robustness, multiple data sources and measures are employed in this study. From the Swank Comparative Parties Dataset, composite indices are constructed to capture the strength of left and left-libertarian parties in government, cabinets, and parliaments. The Comparative Political Dataset (CPD) provides analogous measures, allowing cross-validation and extending coverage beyond OECD contexts. In addition, the Database of Political Institutions (DPI) offers an ordinal classification (left, center, right) of governing parties. Both the original ordinal scale and a binary recoding (left vs. right) are tested. These complementary measures help ensure that the observed relationships are not artifacts of a single operationalization (see supplementary material, Appendix B, Table II for the definition of political ideology.)

### Control Variables

A range of control variables is included to isolate the ideological effect. GDP per capita (log-transformed) accounts for economic development, as wealthier countries often have greater capacity for investment in cleaner technologies. Trade openness controls for the influence of global economic integration on production structures and emission patterns. Population size (log-transformed) and urbanization levels capture

demographic pressures shaping energy demand. Renewable energy consumption and forest cover gauge environmental stewardship and resource management. Additional controls include Annex I status under the Kyoto Protocol, an island dummy variable, and latitude (log-transformed) to address ecological and geographic variation. Each control variable is chosen for its theoretical relevance and tested usage in prior empirical research. (See supplementary material, Appendix C, Table III for the definition and operationalization of control variables.)

**Methodological Approach**

The study employs TSCS regression models to exploit both temporal and cross-national variations. Fixed effects models help control for unobserved, time-invariant country characteristics, while random effects and within-between (REWB) models serve as robustness checks. Additional estimators, such as generalized least squares (GLS), panel-corrected standard errors (PCSE), and Driscoll-Kraay standard errors, address potential issues like heteroscedasticity, autocorrelation, and cross-sectional dependence. Additionally, various diagnostic tests including the Hausman test, Pesaran's cross-sectional independence test, and the Modified Wald test for groupwise heteroskedasticity were conducted to validate model assumptions and ensure specification accuracy. Furthermore, time-fixed effects were tested to capture period-specific influences, and multicollinearity diagnostics confirmed the reliability of variable selection. These extensive robustness checks reinforce the credibility of the regression estimates (See supplementary material, Appendix D for various diagnostic tests.)

## Empirical Results

Table 1 presents summary statistics for the main variables, illustrating substantial cross-country variability in per capita $CO_2$ emissions and the distribution of left-right partisan orientations. On average, per capita $CO_2$ emissions measure around 4.42 metric tons with a wide range from near zero to over 100 metric tons. Measures of political ideology such as those drawn from the Swank dataset shows considerable variation across countries and over time, reflecting diverse partisan landscapes. This ideological diversity provides a strong foundation for testing whether left-leaning governments are systematically associated with lower $CO_2$ emissions, as posited in Hypothesis 1.

**Table 1 Summary Statistics of the Study of Political Ideology (1990-2018)**

| Variables | Observation | Mean | Standard Deviation | Minimum | Maximum |
|---|---|---|---|---|---|
| Dependent variable | | | | | |
| CO2 emissions (metric tons per capita) | 9718 | 4.421 | 7.500 | -.020 | 101.051 |
| Independent variables | | | | | |
| DPI's execrlc variable | 7021 | 1.296 | 1.281 | 0 | 3 |
| Swank's partisanship variable | 1130 | 30.766 | 23.596 | 0 | 81 |
| CPD's partisanship variable | 1674 | 84.511 | 93.681 | 0 | 265.7 |
| Controls | | | | | |
| LnGDP per capita | 5392 | 9.028 | 1.231 | 5.889 | 11.812 |
| Trade openness | 8424 | 78.087 | 52.647 | 0 | 860.8 |
| Population | 12438 | 2.46e+0 | 1.02e+0 | 3893 | 1.39e+0 |
| Urbanization | 12323 | 50.696 | 25.725 | 2.077 | 100 |
| Renewable energy cons. | 5296 | 31.247 | 31.127 | 0 | 98.342 |
| Forest ratio | 5507 | 32.279 | 24.457 | 0 | 98.910 |
| Small island (dummy) | 12826 | .234 | .423 | 0 | 1 |
| Latitude | 12606 | 2.793 | 1.120 | -.693 | 4.276 |
| Annex I | 12885 | .094 | .292 | 0 | 1 |

Figure 1 provide a visual display of emissions trajectories in countries characterized by stronger left-party presence. While some left-leaning contexts exhibit modest downward trends in per capita $CO_2$ emissions, these descriptive patterns alone do not confirm

causal relationships. Hence, more rigorous time-series cross-sectional (TSCS) analyses are required to evaluate the assumed hypotheses.

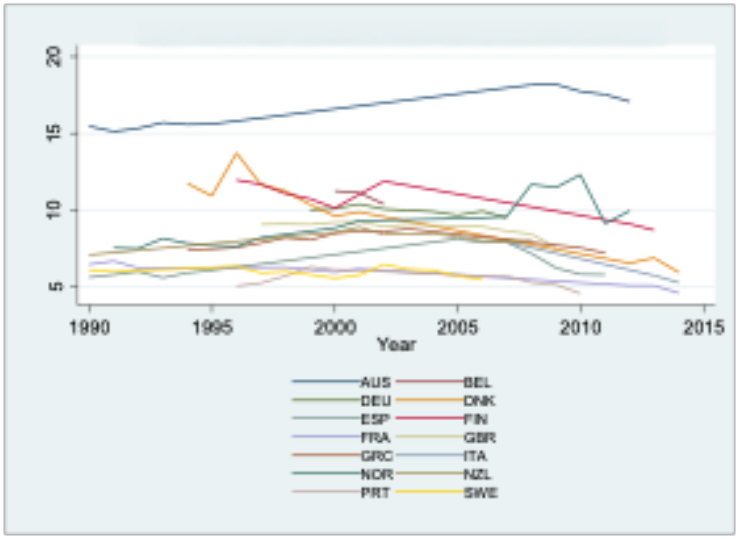


Figure 1 CO2 Per capita emissions by Left party/political forces ranked by Swank data

## Regression Analyses

The initial TSCS models, employing random effects generalized least squares (GLS) and panel-corrected standard errors (PCSE), are presented in

**Table 2** Across these baseline specifications, the coefficient estimates for left-party strength are generally negative, suggesting that stronger left-leaning governance is associated with lower per capita $CO_2$ emissions. However, these negative coefficients are not consistently statistically significant, leaving the initial support for Hypothesis 1 ambiguous. This lack of robust significance in the baseline models indicates that the relationship between partisan orientation and emissions may depend on specific circumstances, model specifications, or estimation strategies.

**Table 2 Estimated Variable Impact on CO2 emissions per capita with Political Ideology Data (1990-2018)**

| Variables | Random effects, generalized least-squares (1) | Panel-corrected standard errors (2) | GLS random-effects with Driscoll-Kraay standard errors (3) |
|---|---|---|---|
| Political ideology | -0.003 | -0.002 | -0.003 |
| | (0.002) | (0.000) | (0.002) |
| LnGDP per capita | 3.124** | 4.807 | 3.140 |
| | (0.974) | (0.000) | (0.549) |
| Trade | -0.011 | -0.002 | -0.011 |
| (% of GDP) | (0.009) | (0.000) | (0.007) |
| Population | -0.000*** | 0.000 | 0.000*** |
| | (0.000) | (0.000) | (0.003) |
| Urbanization (% of total | 0.001 | 0.057 | 0.000 |
| population) | (0.029) | (0.000) | (0.015) |
| Renewable energy cons | -0.168*** | -0.074 | -0.167*** |
| | (0.036) | (0.000) | (0.019) |
| Forest (% of land area) | 0.027 | -0.006 | 0.27 |
| | (0.050) | (0.000) | (0.028) |
| Annex I | - | - | -13.40 |
| | | | (16.87) |
| Island dummy | 0.665 | 1.563 | 0.682 |
| | (2.785) | (0.000) | (1.43) |
| Latitude | -1.671 | 0.804 | -1.63 |
| | (6.750) | (0.000) | (5.00) |
| Constant | -13.088 | | -0 |
| | (26.797) | | (omitted) |
| R2 | | 0.622 | 0.001 |
| sigma_u | 3.647 | | 3.647 |
| sigma_e | .575 | | 0.575 |
| Observations | 514 | 514 | 514 |
| Year FE | Yes | Yes | Yes |
| #Country | 21 | 21 | 21 |

To better disentangle within-country temporal dynamics from cross-country differences, we employ a random effects within-between (REWB) estimator. Table 3 presents these results. The REWB model reveals that the within-country effect of increased left-party strength is both negative and statistically significant. In other words, when a given country shifts toward more left-leaning governance over time, it experiences modest but significant reductions in per capita $CO_2$ emissions—approximately 0.03 metric tons lower emissions per capita—supporting the hypothesis 1. This finding implies that

changes in partisan orientation matter most as domestic conditions evolve, rather than when comparing static differences between countries.

**Table 3 Random Effect Within-Between Estimation for the Relationship between CO2 emissions (metric tons per capita) and Political Ideology (1990-2018)**

| | FE | RE | REWB |
|---|---|---|---|
| **Within-part** | | | |
| Constant | 9.185*** (0.105) | 9.154*** (1.104) | 1.988 (19.901) |
| Political ideology | -0.003* (0.001) | -0.003* (0.001) | -0.003* (0.001) |
| LnGDP per capita | 2.925*** (0.504) | 3.037*** (0.502) | 2.925*** (0.504) |
| Trade (% of GDP) | -0.010** (0.004) | -0.011** (0.004) | -0.010** (0.004) |
| Population | -0.000*** (0.000) | -0.000*** (0.000) | -0.000*** (0.000) |
| Urbanization (% of total population) | -0.005 (0.014) | -0.001 (0.014) | -0.005 (0.014) |
| Renewable energy cons | -0.173*** (0.013) | -0.170*** (0.013) | -0.173*** (0.013) |
| Forest (% of land area) | 0.015 (0.033) | 0.024 (0.029) | 0.015 (0.033) |
| Annex I | - | | - |
| Island dummy | - | 0.582 (3.218) | - |
| Latitude | - | -2.006 (6.024) | -1.813e+07 (15632305.245) |
| **Between-part** | | | |
| Political ideology | - | - | -0.101 (0.085) |
| LnGDP per capita | - | - | 6.131 (7.404) |
| Trade (% of GDP) | - | - | -0.047 (0.084) |
| Population | - | - | -0.000 (0.000) |
| Urbanization (% of total population) | - | - | 0.076 (0.150) |
| Renewable energy cons | - | - | 0.093 (0.107) |
| Forest (% of land area) | - | - | -0.049 (0.062) |
| Annex I | - | - | |
| Island dummy | - | - | 1.441 (3.294) |
| Latitude | - | - | -2.251 (7.841) |
| Level 2: Country | | | |
| sigma_u | | - | - |
| Level 1: Year | | | |
| sigma_e | | - | - |
| Observations | 514 | 514 | 514 |
| R2 | 0.634 | | - |
| #countries | 21 | 21 | 21 |
| Year FE | Yes | Yes | Yes |

In contrast, the between-country component does not yield a statistically significant relationship. This suggests that long-term differences in average partisan strength

across countries do not reliably predict distinct emission levels. Instead, it is the temporal shifts within individual countries such as a leftward turn in governance that appear to drive measurable reductions in emissions. These results highlight the complex nature of ideological impacts and underscore the importance of examining both within- and between-country dimensions of political change.

Beyond these core relationships, hypothesis 2 posits that the influence of political regimes like democracy and institutional strength may moderate the influence of partisan ideology on emissions outcomes. While the initial specifications controlling for institutional variables do not produce uniformly significant results, certain models indicate that the impact of left-leaning governance may be more pronounced in settings with stronger institutions and active civil societies. However, these institutional conditioning effects are not as robust or consistent as the primary within-country finding for Hypothesis 1. Instead, they emerge as partial or in patterns contingent on underlying conditions requiring further investigation. Thus, the findings offer only partial support for hypothesis 2, suggesting that while institutional environments matter, their exact role in shaping the ideological effects on climate mitigation remains inconclusive in these analyses.

The marginal-effect plots for the time-series cross-sectional (TSCS) model (Figure 3) illustrate a generally negative relationship between left-leaning governance and per capita $CO_2$ emissions. Specifically, the slope of the predicted emissions line declines as political ideology becomes more left-oriented, holding the other covariates at their means. Although the 95% confidence intervals widen at the extremes - likely reflecting limited observations in those ideological ranges - the overall trend supports the hypothesis that stronger left-party representation can reduce $CO_2$ emissions. These results underscore the importance of partisan orientation in shaping environmental outcomes, but they also suggest that this effect is conditional on broader contextual factors, such as socioeconomic development and institutional capacity.

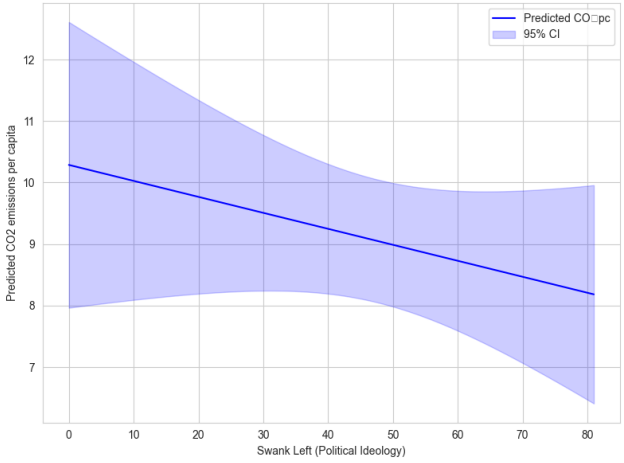


Figure 3 Predicted $CO_2$ Emissions vs. Political Ideology (Holding Controls at Mean)

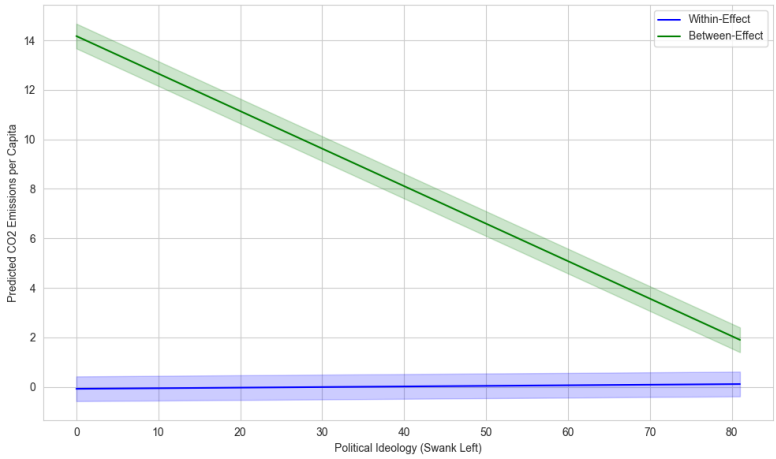


Figure 2 Within-Effect and Between-Effect of Political Ideology on $CO_2$ Emissions

By contrast, the within-between (REWB) plots (Figure *2*) distinguish changes in emissions linked to within-country ideological shifts (purple line) from those attributable

to cross-national differences in average partisan alignment (green line). The within-effect shows a weaker and statistically uncertain slope, indicating that short-term shifts in leftward governance may not yield immediate and substantial reductions in emissions within a given country. In contrast, the robust negative slope in the between-effect plot suggests that countries with consistently higher left-party strength over time tend to exhibit lower per capita $CO_2$ emissions. Taken together, these results reveal that sustained left-leaning governance appears more consequential for long-run climate mitigation, while short-term partisan fluctuations may be tempered by economic, institutional, or policy-inertia factors that constrain immediate environmental gains.

## Robustness Checks

The study conducts robustness checks using alternative ideological measures drawn from the Comparative Political Dataset (CPD) and the Database of Political Institutions (DPI). Models employing the CPD measure generally confirm the negative association between left-oriented governance and emissions, aligning with the main REWB findings. Yet, results using the DPI measure present a more contradictory picture. In some specifications, the DPI-based measure suggests that countries with left-leaning governments might even experience higher emissions, contradicting the core findings.

**Table 4 Robustness Check with DPI 2020 and Comparative Political Dataset (1990-2018)**

| Political Ideology Measures | Estimation Strategies | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Pooled OLS With robust (1) | Random effects, GLS (2) | Panel-corrected standard errors (3) | Random-effects GLS with DK standard errors (4) | Fixed effect (5) | Random effect (6) | Within-part, REWB (7) | Between-part, REWB (8) |
| Main Model | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Swank's Political ideology | -0.026*** (0.007) | -0.003 (0.002) | -0.002 (0.000) | -0.003 (0.002) | -0.003* (0.001) | -0.003* (0.001) | -0.003* (0.001) | -0.101 (0.085) |
| Robustness Check Models | | | | | | | | |
| DPI data | 0.269*** (0.058) | 0.066* (0.031) | 0.037 (0.000) | 0.066** (0.023) | 0.080** (0.027) | 0.083** (0.027) | 0.063** (0.019) | 0.239 (0.331) |
| Comparative Political Dataset (CPD) | -0.002^ (0.001) | - | - | -0.003 (0.002) | - | - | - | -0.029^ (0.016) |

These discrepancies highlight the sensitivity of results to the operationalization of political ideology. The Swank and CPD measures, which more closely align with the conceptualization of left-party strength as rooted in policy interventions and parliamentary representation, yield results consistent with Hypothesis 1. By contrast, the DPI coding, which may reflect a context-specific classification of party positions, introduces conflicting evidence as seen in Table 4. This divergence reinforces the need for caution in interpreting cross-national ideological measures and suggests that the theoretical assumptions underlying Hypothesis 1 are best supported by more subtle and substantively rich indicators of left-party strength.

In sum, the results provide a complex and partial support for Hypothesis 1. While simple cross-national comparisons are inconclusive, the REWB model's within-country estimates indicate that shifts toward left-leaning governance are indeed associated with statistically significant reductions in per capita $CO_2$ emissions. These within-effect findings underscore the importance of dynamic political changes over time and confirm that ideological orientation can shape environmental outcomes when countries transition from one partisan regime to another.

Hypothesis 2 receives only limited support, as evidence for the moderating role of institutional and societal factors is mixed. Moreover, the robustness checks using alternative measures of ideology highlight the complexity of capturing partisan orientations across diverse national contexts and the importance of carefully chosen indicators.

Overall, these results underscore that the relationship between left-right partisan orientation and climate mitigation is not straightforward. Rather, it depends on how ideology is measured, the nature of institutional and economic conditions, and the analytical approach used to distinguish within- from between-country effects.

## Discussion

This study advances our understanding of how political ideologies shape climate governance by systematically examining the relationship between left-leaning political orientations and $CO_2$ emissions mitigation across 120 countries over a 29-year period. By employing rigorous time-series cross-sectional models and comparing multiple measures of partisan ideology, it provides a more in-depth picture of the conditions under which political alignments matter for climate outcomes. In doing so, it helps address persistent gaps and inconsistencies in the literature, contributing to more sophisticated theoretical and empirical frameworks in environmental politics research.

The findings extend earlier scholarship by moving beyond simple cross-national comparisons and highlighting the importance of within-country ideological shifts. While the proposed hypotheses identified a central role for left-oriented governments, the

results confirm that these influences are most discernible when examining changes over time within individual countries. This echoes and refines prior work that suggested left-leaning parties might foster more ambitious environmental policies. By employing multiple ideological indicators and employing advanced modeling techniques, this study offers a richer empirical foundation than previous research, thus adding depth and specificity to the ongoing dialogue on ideology and climate governance.

The results indicate that left-oriented governance can promote measurable reductions in $CO_2$ emissions when considered within a country's evolving political landscape, supporting the logic that incremental policy shifts tied to ideology can accumulate into tangible environmental benefits. However, these effects are neither universal nor guaranteed. The sensitivity of results to different ideology measures underscores the complexity of linking partisan orientation to environmental performance. These insights suggest that scholars treat ideological categories as context-dependent, informed by national histories, institutional arrangements, and economic conditions. Recognizing these subtleties enhances our ability to build theories that accommodate the diverse political ecosystems in which climate policies unfold.

By employing time-series cross-sectional models with within-between estimators, this research demonstrates that more sophisticated analytical strategies can disentangle temporal from cross-sectional variations in climate outcomes. These methods reveal patterns that would remain obscured under simpler approaches. Scholars can build on these methodological tools to investigate causal mechanisms, examine policy inertia or reversal, and identify threshold effects that emerge as partisan alignments shift over

time. This statistical framework thus encourages more dynamic, process-oriented inquiries that capture the evolving nature of climate governance.

As climate change intensifies, understanding the interplay between political ideology and environmental policy will become increasingly critical. Future inquiries must adapt to the growing complexity of global environmental challenges, integrating insights from political economy, public opinion research, and innovations in climate modeling. The field will benefit from a more holistic approach that embraces diverse methodologies, richer datasets, and interdisciplinary perspectives. By exploring how ideology interacts with global market forces, international climate regimes, and emerging technologies, researchers can help guide policy development in a rapidly changing world.

The empirical approach deployed here combining large-scale datasets, advanced panel methods, and multiple measures of political ideology—represents a methodological advance that sharpens our understanding of how partisanship influences environmental outcomes. By distinguishing between within-country and between-country effects, it moves beyond static cross-national comparisons, enabling more precise inferences about when and how political factors impact climate mitigation. This methodological rigor sets a benchmark for future quantitative analyses, ensuring that studies can better capture the dynamic complexity of environmental politics.

This study's approach and findings serve as a catalyst for more integrative and finely grained research on environmental politics. Scholars can draw on its methodological insights to investigate other dimensions of climate governance, from the evolution of policy instruments to the role of non-state actors. By showing that certain ideological

orientations can influence emissions trajectories, and by demonstrating that these patterns are sensitive to measurement strategies and frameworks, this research encourages a richer dialogue around conceptual clarity, measurement validity, and model specification in future empirical endeavors.

By further refining our understanding of when and how ideological orientations impact climate mitigation, this study paves the way for more informed and context-sensitive environmental politics research. Its methodological innovations and empirical insights open the door to studies that probe deeper into the roles of non-state actors, local governance structures, and emerging policy instruments. As our understanding of the political determinants of climate policy evolves, the field can better guide scholars, policymakers, and advocacy groups toward strategies that leverage political alignments, strengthen institutional capacity, and enhance policy coherence in the face of escalating environmental crises.

While these findings highlight the complexity of partisan influences on emissions outcomes, they nonetheless suggest that shifts toward left-leaning governance can produce incremental, meaningful climate benefits—especially when considered within a country's evolving political landscape. Policymakers can capitalize on periods of left-oriented leadership to advance emissions reduction strategies, implement supportive regulatory frameworks, and invest in cleaner technologies. Simultaneously, the study's sensitivity checks underscore the need for carefully tailored interventions. Recognizing that ideological impacts are not uniform across different societal and economic conditions, decision-makers should adapt policies to local conditions, ensure adequate

institutional resources, and engage civil society to sustain momentum. These subtle insights can inform more strategic and adaptive policy design, fostering durable climate action as national political landscapes shift.

## Limitations of the study

Despite its contributions, this study is not without limitations. Focusing on $CO_2$ emissions per capita as the primary outcome variable, while $CO_2$ emissions per capita reflect climate mitigation performance, they do not capture the full spectrum of environmental challenges. Broader indicators - such as biodiversity conservation, renewable energy adoption, or adaptation measures - remain outside the scope of this analysis. Additionally, the heterogeneity of data quality and availability across countries may constrain the generalizability of the findings. Further, while we identify a robust within-country relationship between left-leaning ideologies and emissions reductions, the precise causal pathways remain unclear. Future research should integrate qualitative methods and case studies to illuminate the political decision-making processes underlying these statistical patterns.

## Conclusion

This study refines our understanding of how partisan ideologies shape climate outcomes by examining the relationship between left-right political orientations and per capita $CO_2$ emissions across 120 countries over a 29-year period from 1990 to 2018. The findings suggest that left-leaning governance can, under certain conditions, contribute to meaningful emissions reductions - particularly within individual countries

over time - lending cautious support to the proposed hypotheses. Yet these effects are not uniform, as varying national contexts, economic capacities, and institutional conditions influence the extent to which political orientations translate into tangible climate improvements.

The analysis highlights the importance of considering both temporal and cross-national dimensions, as well as the operationalization of political ideology. While the study's methodological rigor, including the use of time-series cross-sectional models and alternative ideology measures, strengthens the reliability of the results, it also underscores the need for more comprehensive indicators and integrative frameworks in future research. Future inquiries might extend beyond emissions data to include a broader range of environmental metrics and delve deeper into the micro-level mechanisms, policy instruments, and actor networks that underpin effective climate governance.

From a policy perspective, these findings emphasize that shifts toward left-oriented leadership may open windows of opportunity for more ambitious environmental action, but such progress often depends on complementary factors like institutional capacity, public engagement, and resource availability. As climate challenges intensify, scholars and policymakers alike should continue exploring how political ideologies interact with economic and institutional structures to foster sustained, equitable, and effective climate policies. Overall, this study offers a more context-sensitive view of how partisan alignments influence environmental performance, providing a foundation upon which

future research can build to better understand the dynamic interplay of political ideology and climate governance.

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