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Partisan Climate Action, Utility Interests, and Policy Choice in the U.S. Power Sector

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Abstract

This paper investigates how U.S. gubernatorial partisanship and electric utility interests jointly shape the adoption and stringency of three widely used electricity-sector climate policies: greenhouse gas cap-and-trade, emissions standards, and renewable portfolio standards. Using panel data for 48 states over 29 years, this study applies difference-in-differences and regression discontinuity designs that exploit within-state partisan alternation and quasi-random variation from close gubernatorial elections. The results indicate that Democratic governorships associate with higher probabilities of policy adoption and greater stringency than Republican ones. However, these partisan effects attenuate in states with fossil-intensive utility capacity and strengthen in renewable-rich states, particularly for discretionary and mandatory renewable portfolio standards. This work extends the empirical political economy literature by comparing instrument choice and stringency across three major electricity-sector climate policies and by evaluating how utility sector composition and reelection incentives moderate or amplify partisan influence. The findings highlight that electricity-sector decarbonization strategies need to account for both environmental externalities and the local political-economic conditions that shape feasible policy options.

JEL Classification: D72, L94, Q42, Q48, Q54

Keywords: Climate policies, Political parties, Electric utility interests

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1. Introduction

Economic theory often prescribes carbon pricing as a first-best climate instrument, yet U.S. states have largely relied on more complex, second-best tools such as emissions standards and renewable portfolio standards (RPS). This divergence suggests that political incentives and vested interests shape instrument choice beyond efficiency considerations (Basseches, 2024; Culhane et al., 2021; Kim et al., 2016; Trachtman, 2020; Trachtman et al., 2025). While a governor's party affiliation is a well-documented predictor of climate policy ambition (Bonnet & Olper, 2024; Caughey et al., 2017; Hall et al., 2024; Pacca et al., 2021; Trachtman, 2020), existing research provides limited evidence on how partisan motives interact with state-specific electric utility interests to shape the adoption and stringency of first- versus second-best climate instruments in the power sector. This study examines how U.S. gubernatorial partisanship and electric utility interests jointly influence the adoption and stringency of three key electricity-sector climate policies, comparing direct emissions-mitigating instruments (greenhouse gas cap-and-trade and standards) with indirect options (RPS).

The conceptual framework of this study posits state climate policy as the outcome of interacting partisan, electoral, and industry forces, operating over alternative policy instruments. Governors seek to adopt[1] party platforms on climate policy, but their actions may be moderated or amplified by electric utility interests and electoral incentives. This analysis proxies electric-utility interests with 1990 time-invariant utility fuel generation portfolios and an exogenous measure of state-specific renewable technical potential, and captures electoral motives with an indicator of binding gubernatorial term limits that modify reelection incentives. These proxies do not directly measure lobbying activity; instead, they approximate electric-utility economic interests—grounded in fuel portfolios and renewable resource endowments—that shape utilities' incentives to lobby and condition gubernatorial choices over instrument type and stringency (Bonnet & Olper, 2024; Brulle, 2018; Kim et al., 2016; Leippold et al., 2024; Pacca et al., 2021).

The United States provides an informative setting given strong state authority over electricity regulation, large cross-state heterogeneity in political institutions, and diverse climate policy portfolios. This study evaluates partisan effects using complementary quasi-experimental strategies that leverage several sources of variation: within-state alternation in gubernatorial party control between Democrats and Republicans; close gubernatorial elections that generate quasi-random variation in winners at the 50% vote-share threshold; and cross-state differences in binding term limits, renewable technical potential, and pre-existing utility fuel generation capacity as moderators of partisan effects. These elements establish a research design that links partisan control to policy outcomes and explicitly examines how fossil- versus renewable-oriented utilities and electoral incentives interact and moderate these partisan effects.

This paper combines a panel of 48 states[2] from 1990 to 2018 with two complementary designs. A difference-in-differences framework with two-way fixed effects evaluates average changes in policy adoption and stringency following alternation in gubernatorial party control, while interacting partisan control with electric utility interests and electoral variables. Parametric and nonparametric regression-discontinuity designs around narrow gubernatorial victories assess local effects of partisanship in highly competitive elections. Results indicate that Democratic governorships achieve approximately 6–7 percentage point higher probabilities of adopting GHG cap-and-trade programs and GHG standards, as well as somewhat more ambitious and stringent RPS targets. These partisan differences attenuate in states with fossil-intensive utility capacity and strengthen in renewable-rich states, particularly for discretionary and mandatory RPS targets. These findings are broadly robust across DID and parametric RD specifications, but the evidence indicates that in close elections local partisan

[1] The adoption term denotes the regulatory approval, enactment, passage or authorization of climate policies.
[2] Alaska and Hawaii are excluded due to their distinctive geographical and climatic characteristics, along with substantial federal funding dependence (Bonnet & Olper, 2024; List & Sturm, 2006; Pacca et al., 2021).

divergence concentrates on RPS stringency and mandatory RPS targets rather than on GHG cap-and-trade adoption.

This work relates to a growing literature on the political economy of environmental and climate policies in U.S. states (Bonnet & Olper, 2024; Fredriksson et al., 2011; List & Sturm, 2006; Pacca et al., 2021). Prior studies show that Democratic governors tend to increase environmental spending and renewable generation capacity relative to Republicans, but partisan differences attenuate or disappear in states where fossil fuel industries represent a large share of economic activity or where renewable endowments are limited (Bonnet & Olper, 2024; Pacca et al., 2021). This study contributes to the literature by focusing on instrument choice and policy stringency across three major electricity-sector climate instruments and by evaluating how electric utility interests and reelection incentives moderate or amplify partisan effects. In doing so, it provides exploratory evidence on whether and how utility pressures may differentially shape first-best instruments, such as cap-and-trade and more discretionary such as GHG standards and RPS.

The findings matter for U.S. climate governance because they suggest that state-level electricity decarbonization pathways depend not only on electoral outcomes but also on how instrument design interacts with heterogeneous utility structures. In states where fossil-oriented utilities hold large capacity, Democratic governors appear to scale back ambition on GHG standards and binding RPS targets, whereas in renewable-rich states under Democratic control, these policies tend to advance, consistent with utilities supporting instruments that offer predictable revenues and investment certainty (Basseches, 2024; Kim et al., 2016; Trachtman et al., 2025). These patterns imply that utilities likely exert greater influence over the design of standards and RPS than over economy-wide GHG cap-and-trade, suggesting that partisan climate platforms operate through, rather than independently of, local economic structures.

The policy implications are twofold. First, effective electricity decarbonization strategies may require policy packages that align climate objectives with the interests of incumbent utilities, for instance through credible frameworks for stranded-asset compensation, long-term contracting, and predictable regulatory timelines (Trachtman et al., 2025). Second, framing state climate instruments around visible co-benefits—such as energy security, local employment, and regional development—may facilitate support in politically competitive states where partisan polarization and entrenched fossil assets otherwise constrain clean energy ambition (Gustafson et al., 2020; Trachtman et al., 2025). In contexts where cross-party consensus is difficult, tailored mixes of GHG cap-and-trade, GHG standards, and RPS may help reconcile climate goals with electoral and utility interests' constraints, with sustained state leadership potentially influencing expectations and building momentum for broader energy transitions (Blanchard et al., 2023).

This analysis has several limitations. First, it focuses on three electricity-sector instruments and omits other relevant policies, such as energy-efficiency standards and solar tax credits. Second, the close-election RD design is data-intensive, and limited observations near narrow electoral margins reduce precision and make RD estimates sensitive to bandwidth choice, particularly for GHG cap-and-trade and GHG standards. Third, it relies on proxies for utility interests rather than direct measures of lobbying expenditures or position-taking, thus it cannot directly observe or precisely quantify differential lobbying intensity across policy types. Fourth, the empirical strategy does not address cross-state spillovers or interactions with federal policy, nor does it fully capture technology diffusion, evolving gas–renewables complementarities, or grid constraints that may co-determine policy choices. Finally, the focus on U.S. states may limit external validity for other federal systems with different institutional arrangements, party structures, and regulatory frameworks.

The remainder of this paper proceeds as follows: Section 2 outlines policy context; Section 3 presents the conceptual framework; Section 4 details the empirical strategy; Section 5 reports results; and Section 6 concludes with some policy implications.

2. Policy context

The United States offers an ideal setting given states' autonomy and diversity in climate approaches (Basseches et al., 2022; Bergquist & Warshaw, 2023; Hall et al., 2024; Lyon & Yin, 2010; Meckling & Trachtman, 2024). As a major fossil fuel power where fossil fuel interests have long dominated climate politics (Brulle, 2018; Leippold et al., 2024; Trachtman et al., 2025), it provides a distinctive context for examining three key state-level policies: Greenhouse Gas cap-and-trade programs (GHG cap), emissions standards (GHG standards), and renewable portfolio standards (RPS). These policies aim to promote clean energy and reduce power sector emissions.

GHG cap exemplifies the canonical first-best and economy-wide approach: it fixes an aggregate emissions cap and allows trading to achieve cost-effectiveness while delivering emissions certainty and price discovery (Parry et al., 2022; World Bank, 2021). Adoption in the United States has concentrated in the Regional Greenhouse Gas Initiative (RGGI) agreed in 2005 with first compliance period in 2009 (Congressional Research Service, 2017) and California's economy-wide program authorized by AB-32 in 2006 and launched in 2013 (C2ES, 2019). Influence pressures over design typically centers on free allocation and exemptions rather than discretionary sectorial rules (Blanchard et al., 2023; Goulder & Parry, 2008; Meng & Rode, 2019; Trachtman, 2020).

Second-best policies are more common and politically feasible. GHG standards require state-specific maximum CO_2 intensity (e.g., tons/MWh), channeling political bargaining toward technology rules (Goulder & Parry, 2008; Raff et al., 2022). RPS[3] require utilities to procure specified renewable shares and are the most widely adopted state instruments (Basseches et al., 2022; Bonnet & Olper, 2024; Carley, 2009; NCSL, 2021). RPS design features (mandatory vs. voluntary targets, cost-recovery through rates, renewable energy certificates, resource eligibility and in-state provisions) offer compliance flexibility that can align with incumbent utility interests (Basseches et al., 2022; Hall et al., 2024; Solomon & Zhou, 2021; Trachtman et al., 2025).

Figure 1 depicts that both parties, historically, initiated these three instruments (e.g., Iowa's early RPS in 1983; RGGI's bipartisan origins), with adoption often framed around jobs or local co-benefits rather than climate (Trachtman et al., 2025). During 2009–2017, partisan divergence intensified and federal measures—especially American Recovery and Reinvestment Act (ARRA) tax incentives and grants—shifted the focus for state policy choice (Bonnet & Olper, 2024; Trachtman, 2020; Trachtman et al., 2025). In this period, GHG cap became more contentious (including withdrawals/rollbacks in some Republican states), while RPS expansion persisted, increasingly in states where cost-competitiveness favored renewables and where marginal targets could be raised at relatively low political cost (Bonnet & Olper, 2024; Meng & Rode, 2019; Trachtman, 2020; Trachtman et al., 2025; Vormedal & Meckling, 2024). The diverging RPS adoption patterns by party post-2009, reflecting Democrats' prior RPS adoption and subsequent pivot toward more stringent targets, while Republicans adopted less strong RPS targets (Solomon & Zhou, 2021).

[3] In this study, the term renewable portfolio standards (RPS) include clean energy standards (CES) which expands the definition of qualifying resources to zero-carbon energy sources that may not be considered renewable, such as nuclear energy (Barbose, 2024; Climate XChange, 2025).

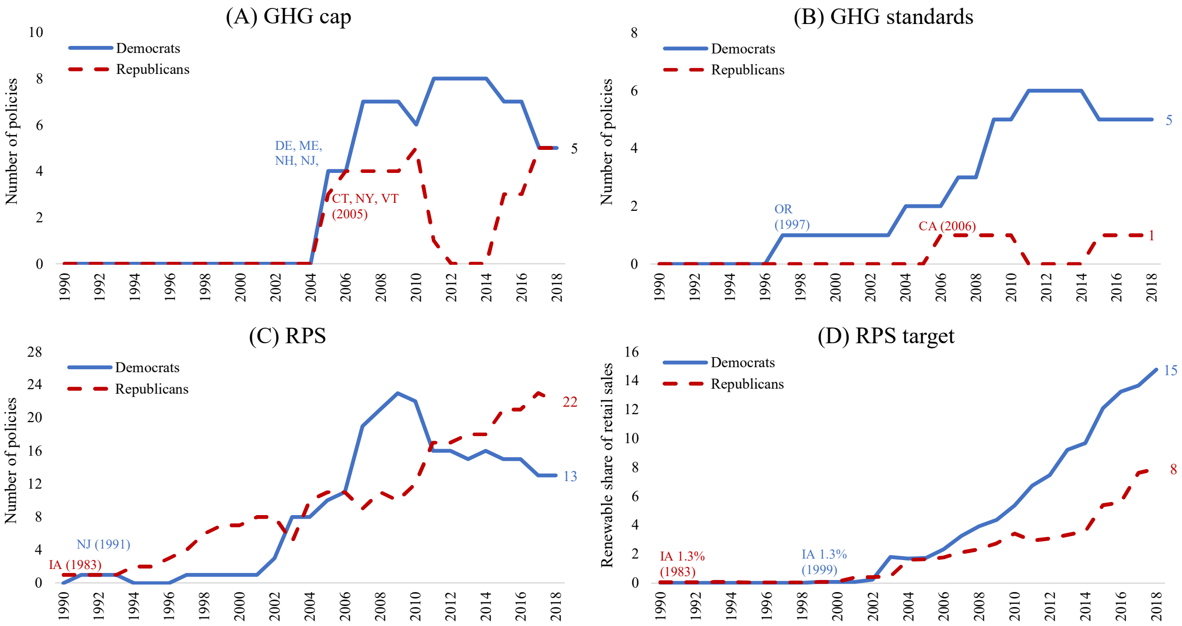


Figure 1. Evolution of three key climate and energy policies in the U.S. electric utility sector by party, 1990–2018.

Note: This figure illustrates the evolution of three major climate and energy policies by party (Democrat and Republican) across U.S. states' electric utility sectors: GHG cap (Figure 1A) and GHG standards (Figure 1B), RPS (Figure 1C), alongside electric utilities' RPS targets (Figure 1C). Estimates are averaged across 48 U.S. states over 1990–2018. State abbreviations identify the first adopters of each policy by party, with the year in parentheses indicating the initial enactment. State abbreviations: Connecticut (CT), Delaware (DE), Iowa (IA), Maine (ME), New Hampshire (NH), New Jersey (NJ), New York (NY), Oregon (OR), and Vermont (VT).

Source: Author's own elaboration based on information from Bergquist & Warsha (2023), Berkeley's EMP, CARB, C2ES, NCSL and RGGI.

3. Conceptual framework

This study examines state climate policy adoption and stringency within the institutional context of U.S. federalism, characterized by two-party competition between Democrats and Republicans in state electoral politics (Caughey et al., 2017; Kim & Urpelainen, 2017), substantial state-level autonomy in climate and energy policy amid diverse political institutions (Basseches et al., 2022; Bergquist & Warshaw, 2023; Bertrand et al., 2021; Lyon & Yin, 2010; Pacca et al., 2021), and the country's role as the world's largest oil and gas producer, which positions carbon-intensive industries as central actors in climate policymaking (Brulle, 2018; Leippold et al., 2024; Trachtman et al., 2025). In this setting, climate mitigation policy often reflects competing interests, values, and coalitions rather than broad consensus (Basseches et al., 2022; Hall et al., 2024). Democrats tend to prioritize renewable energy for climate mitigation, whereas Republicans place greater emphasis on regional economic development, employment, and energy security (Gustafson et al., 2020; Trachtman et al., 2025). Gubernatorial partisan control thus shapes climate policy choices, though its effects depend on underlying economic structure and institutional constraints (Basseches et al., 2022; Caughey et al., 2017; Hall et al., 2024).

The conceptual framework draws on political economy theories of regulation and posits state climate policy as the outcome of interacting partisan, electoral, and industry forces, operating over alternative policy instruments (Blanchard et al., 2023; Bonnet & Olper, 2024; Downs, 1957; Fredriksson et al., 2011; List & Sturm, 2006; Olson, 1965; Pacca et al., 2021; Stigler, 1971). Governors face multiple objectives and constraints and choose between theoretically efficient instruments, such as GHG cap-and-trade, and more discretionary standards and mandates.

First, governors may be policy-motivated, pursuing climate agendas aligned with party platforms and ideological commitments, which generates partisan divergence between Democratic and Republican administrations (Bonnet & Olper, 2024; Wittman, 1983). In highly polarized domains such as environmental policy, voters often select representatives with relatively fixed policy positions rather than inducing convergence toward the median voter (Kim & Urpelainen, 2017; Lee et al., 2004). Empirically, this policy preference channel is captured by partisan affiliation, measured by a binary indicator for Democratic governors in the difference-in-differences framework, and by the Democratic–Republican vote share margin in the close-election regression discontinuity design.

Second, governors also face electoral incentives that may push policies toward convergence in a Downsian framework, as parties compete for median-voter support (Downs, 1957; Fredriksson et al., 2011; List & Sturm, 2006). To capture this office-seeking motive, the analysis employs a binary indicator based on binding gubernatorial term limits, which exogenously relaxes reelection incentives and is conceptualized as moderating partisan policy effects.

Third, governors respond to organized industry interests. Private-interest theories postulate that policymakers supply regulation while organized groups demand it, with concentrated interests more likely to secure benefits than diffuse publics (Downs, 1957; Olson, 1965; Stigler, 1971). In U.S. climate politics, economic interests are relevant and skewed toward fossil-intensive sectors and electric utilities, generating asymmetric influence over policy design and implementation (Brulle, 2018). Utilities hold structural advantages—monopoly distribution networks, capital-intensive assets, and technical expertise—that enhance their capacity to shape policy stringency, cost recovery, and risk allocation (Basseches et al., 2022). However, direct measures of lobbying expenditures and contributions are prone to reverse causality with policy outcomes. This paper therefore proxies electric-utility interests using time-invariant utility fuel generation portfolios and an exogenous indicator of state-specific renewable technical potential (Bonnet & Olper, 2024; Pacca et al., 2021). The renewable potential measure derives from geographic and climatic conditions and is plausibly exogenous, while the fossil-fuel electricity capacity share is measured at the 1990 baseline to mitigate endogeneity concerns (Bonnet & Olper, 2024). The framework examines how these utility economic interests interact with gubernatorial partisanship to capture whether utilities with fossil-oriented or renewable-oriented portfolios are likely to oppose or support climate policy adoption and stringency. These proxies do not directly measure lobbying activity; instead, they approximate electric-utility economic interests—grounded in fuel portfolios and renewable resource endowments—that shape utilities' incentives to lobby and condition gubernatorial choices over instrument type and stringency (Bonnet & Olper, 2024; Brulle, 2018; Kim et al., 2016; Leippold et al., 2024; Pacca et al., 2021).

Fourth, utility positions toward climate policy vary with business models, generation portfolios, and regulatory environments (Basseches et al., 2022; Kim et al., 2016; Meckling & Trachtman, 2024; Vormedal & Meckling, 2024). Anticipated winners from climate policy, often utilities with significant renewable portfolios or opportunities for regulated investment, tend to influence individually for specific design features that generate private rents, whereas anticipated losers—especially coal-dependent utilities—frequently coordinate through trade associations to oppose stringent regulation (Kim et al., 2016). Comparative research documents how shifts in markets, technologies, and policy expectations can move firms from categorical opposition toward conditional support for climate regulation (Vormedal & Meckling, 2024).

Finally, state climate policymaking trades off economic efficiency and political feasibility. Carbon pricing instruments, such as GHG cap-and-trade, minimize abatement costs in theory but often face political resistance, especially from fossil-oriented utilities. GHG standards and renewable portfolio mandates tend to be more politically tractable and offer discretionary design elements—cost-recovery provisions, rate-basing rules, technology carve-outs, and timing flexibility—that can be tailored through regulatory processes in which utilities hold informational and procedural advantages (Goulder & Parry, 2008; Lyon & Yin, 2010). In this framework, instrument choice and policy design emerge from the interaction of gubernatorial partisanship, electoral incentives, and utility interests, operating over a portfolio of first-best and second-best climate policy options.

4. Empirical strategy

4.1. Data

This analysis employs an unbalanced panel dataset covering 48 U.S. states from 1990 to 2018. Alaska and Hawaii are excluded due to their distinctive geographical and climatic characteristics, along with substantial federal funding dependence (Bonnet & Olper, 2024; List & Sturm, 2006; Pacca et al., 2021). The dataset integrates policy outcomes from Bergquist & Warshaw (2023) and explanatory variables from Bonnet & Olper (2024).

The dataset comprises the following variables: three policy outcomes, two treatment variables, three electric utility interests' proxies, one gubernatorial term limit indicator, and six control variables (see **Table 1**). This analysis measures state-level climate policy adoption and stringency using three outcomes[4]. Greenhouse gas cap-and-trade (GHG cap) and GHG standards are binary indicators that equal 1 when the respective policies are adopted. RPS stringency is captured by (i) a categorical variable coded as 0 for no RPS, 1 for voluntary or minimal targets below 1%, 2 for mandatory targets below 100%, and 3 for 100% mandatory targets, and (ii) a continuous RPS target that records the binding renewable share of electricity sales. These outcomes enable comparisons between first-best instruments (GHG cap) and second-best instruments (GHG standards and RPS), as well as between policies that directly target electricity-sector emissions (GHG cap and GHG standards) and those that operate indirectly through renewable deployment (RPS).

Treatment variables include Democratic governorship (binary indicator) and Democratic victory margin (the centered vote share differential between Democratic and Republican gubernatorial candidates). Three proxies approximate electric utility interests. Opposition to climate policy is captured by the 1990 share of fossil fuel in total electricity capacity (representing electric utility interests) and the 1990 share of energy-intensive manufacturing in total gross state product (encompassing broader industrial interests including petroleum and coal products, primary metals, non-metallic minerals, paper manufacturing, printing, and food, beverage, and tobacco products). Support for climate policy is proxied by renewable natural endowment, which combines wind and solar potential converted to standardized daily energy per land area (MWh/m²-day). The term-limit dummy approximates re-election incentives, under which ineligible governors are presumed to act closer to preferred policies (Bonnet & Olper, 2024; Fredriksson et al., 2011; List & Sturm, 2006). Control variables include electricity consumption per capita, retail electricity prices for all end-users (covering generation, transmission, distribution, and commercialization across residential, commercial, and industrial sectors), real personal income per capita, total population, share of population over 65, and share of population aged 5–17 (Bonnet & Olper, 2024; List & Sturm, 2006; Pacca et al., 2021).

[4] This study introduces several adjustments to the GHG cap and RPS target data from Bergquist and Warshaw (2023). For GHG cap enactment dates, California is coded as 2006 rather than 2007, Pennsylvania as 2019 rather than 2020, and RGGI as 2005 rather than 2006. Washington is recoded as having no cap-and-trade program until 2021, rather than 2016. For RPS targets, Texas is assigned non-missing values for the 1990-1998 period, addressing the NA entries in the original dataset.

Table 1. Variables and data sources

Type	Variables	Units	Sources	Mean (sd)
Outcomes	Greenhouse gas cap (GHG cap)	Dummy	Bergquist and Warshaw (2023), CARB, C2ES, ICAP, Washington's Ecology	0.10 (0.30)
	GHG standards	Dummy	Bergquist and Warshaw (2023)	0.06 (0.24)
	Renewable portfolio standard (RPS)	Categorical (0,1, 2, 3)	Bergquist and Warshaw (2023)	0.74 (0.93)
	RPS target	% renewable of retail electricity sales	Bergquist and Warshaw (2023), C2ES, Berkeley's EMP	2.88 (6.63)
Independent variables				
Treatment	Democratic governorship	Dummy	Bonnet and Olper (2024)	0.44 (0.50)
	Democratic victory margin	Democratic minus Republican vote share	Bonnet and Olper (2024)	-2.87 (21.04)
Electric utility interests' proxies	Fossil capacity share in 1990	% of total capacity	EIA	71.40 (25.00)
	Energy-intensive GSP share in 1990	% of GSP	BEA	5.55 (2.14)
	Renewable endowment (wind + solar potential)	MWh/m2-day	NREL	4.33 (5.89)
Term-limited governors	Term limit	Dummy	Bonnet and Olper (2024)	0.24 (0.43)
Controls	Electricity use per capita	MWh per person	EIA	16.88 (13.25)
	Retail electricity price for all consumers	US$ cents/kWh	EIA	8.17 (2.76)
	Real personal income per capita	thousands of 1982-1984 US$ per person	BEA	17.27 (3.31)
	Population	Millions of people	BEA	6.02 (6.49)
	Population share over 65	% of population	BEA	13.46 (1.99)
	Population aged 5–17 share	% of population	BEA	17.93 (1.65)

Note: This table reports variables, units of measurement, data sources, and descriptive statistics (means with standard deviations in parentheses) for the complete dataset (48 states, 1990-2018). Source acronyms: Berkeley Lab's Energy Markets & Policy (EMP), Bureau of Economic Analysis (BEA), California Air Resources Board (CARB), Center for Climate and Energy Solutions (C2ES), Database of State Incentives for Renewables & Efficiency (DSIRE), International Carbon Action Partnership (ICAP), Energy Information Administration (EIA), National Renewable Energy Laboratory (NREL), Washington State Department of Ecology (Ecology).

Appendix 1 reports descriptive statistics and correlation matrices. Democratic governorships associate with higher mean values of policy outcomes than Republican ones in the full sample, whereas most mean values of utility and state characteristics that shape policy outcomes display similar magnitudes across parties (See **Table 5** in **Appendix 1**). Democratic governorship also exhibits positive correlations with all policy outcomes (See **Table 6** in **Appendix 1**).

4.2. Identification and estimation

4.2.1. Identification strategy

This analysis exploits three complementary sources of variation to identify partisan effects on climate policy outcomes. First, it leverages within-state alternations in gubernatorial party control between Democrats and Republicans. The approach conditions on observed state-level covariates to address selection bias from non-random partisan assignment (Roth et al., 2023). Second, it employs quasi-random variation from narrow gubernatorial victories via a vote-share cutoff to address unobserved endogeneity in partisan treatment. Third, it uses exogenous shifts in electoral incentives induced by binding gubernatorial term limits as a moderator of partisan effects (Fredriksson et al., 2011; List & Sturm, 2006). The empirical framework estimates partisan effects conditional on political and economic determinants, which proves particularly relevant given that utilities operate under capital-intensive constraints and extensive state-level regulatory oversight, making them responsive to shifts in the regulatory environment (Basseches et al., 2022; Meckling & Trachtman, 2024).

Preliminary evidence suggests no statistically significant partisan differences in policy outcomes in 1990, the earliest year in the dataset preceding large-scale policy adoption (see **Figure 2**). Significant variation emerges across the 1991-2018 period between Democratic- and Republican-governed states. Negative gaps indicate greater policy adoption or stringency under Democratic governorships, suggesting that Democratic governors pursue more ambitious climate policy enactments (see **Table 7** in **Appendix 1**).

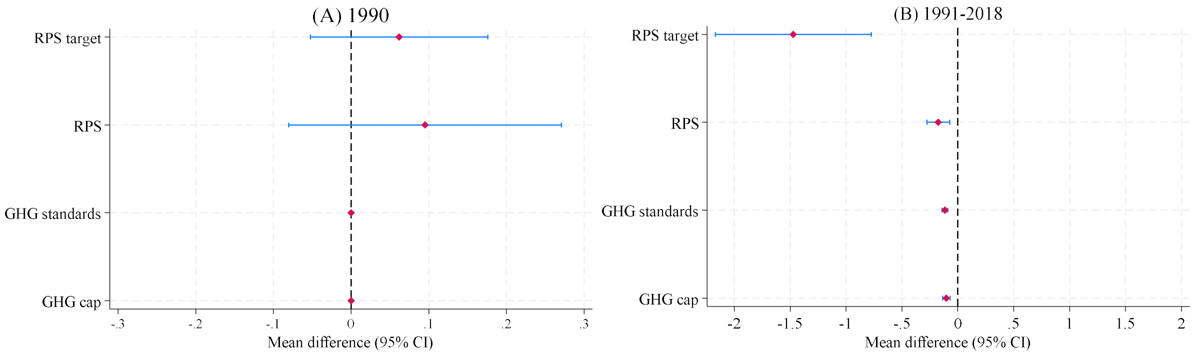


Figure 2. Mean-comparison tests of policy outcomes between Republican and Democratic governorships for 1990 and 1991-2018 period

Note: This figure presents mean-comparison tests (t-tests) of adoption probabilities for two climate policies, greenhouse gas (GHG) cap and GHG standards, renewable portfolio standards (RPS) stringency, and electric utilities' RPS targets (measured as the binding share of renewable retail electricity sales) between Republican and Democratic governorships. Estimates are averaged across 48 U.S. states in 1990 (Figure 2A) and 1991–2018 period (Figure 2B).

Mean-comparison tests for 1990 indicate no significant differences in most explanatory variables between Democratic and Republican states (see **Figure 3**), suggesting potential comparability in initial observed characteristics across partisan groups. However, renewable endowment exhibits a significant difference for Republican states, raising endogeneity concerns (see **Table 8** in **Appendix 1**). To address this issue, the analysis complements the DID strategy with a close-election RD design that exploits quasi-random variation in narrow gubernatorial outcomes as an alternative source of identification.

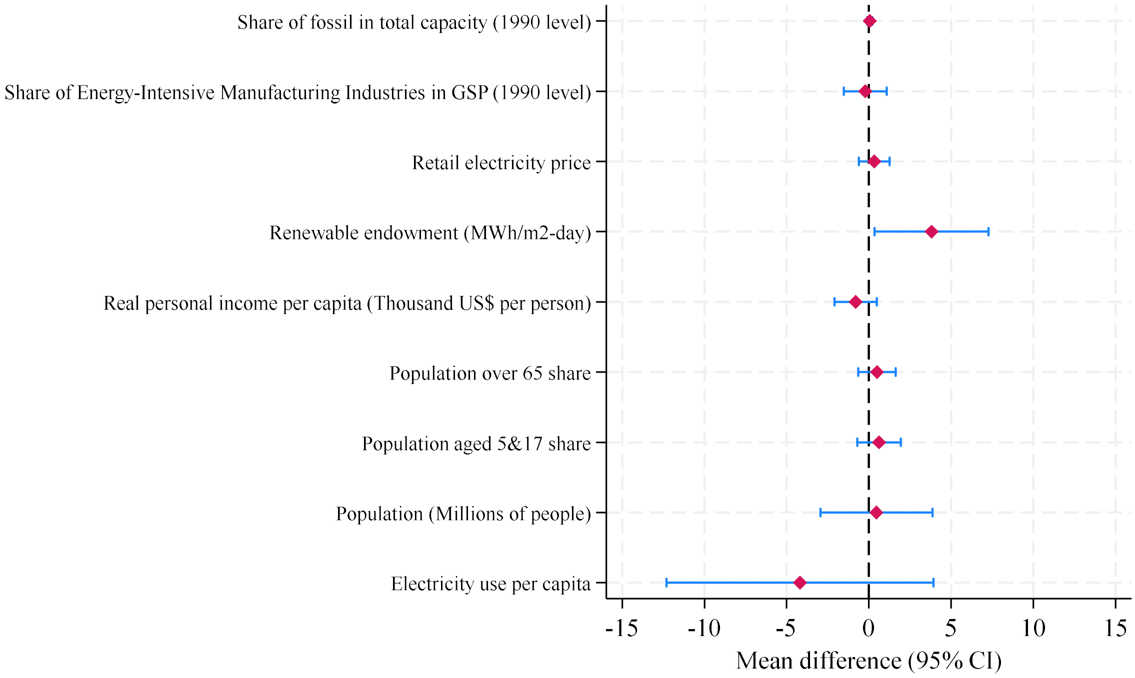
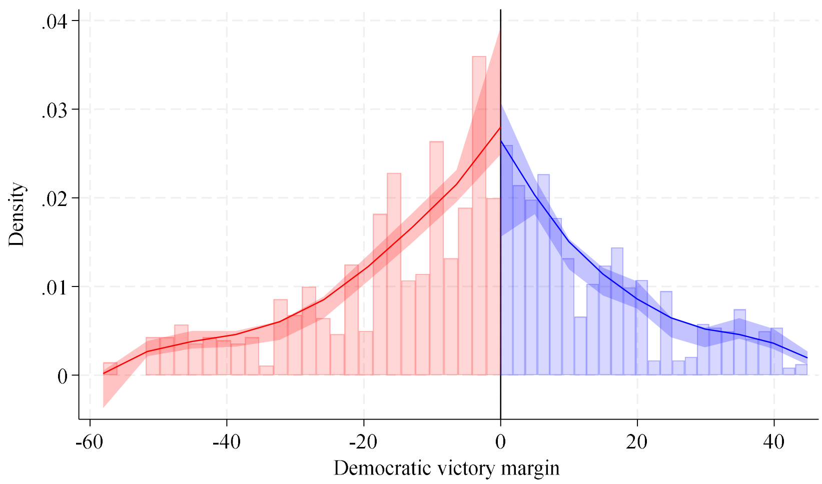


Figure 3. Mean-comparison tests of explanatory variables between Republican and Democratic governorships in 1990

Note: This figure displays mean-comparison tests (t-tests) of electric utility interests' proxies (fossil capacity share, energy-intensive GSP share, and renewable endowment) and control variables (electricity consumption per capita, retail electricity prices, real personal income per capita, total population, share of population over 65, and share of population aged 5–17) between Republican and Democratic governorships in 1990.

The RD diagnostics show no statistical evidence of systematic manipulation in Democratic margin of victory around the 50% vote share threshold (see **Figure 4**). This validates that treatment assignment approximates randomization and units cannot manipulate their threshold position.



Method	t statistic	P-values
Conventional	-0.44	0.66
Robust	-1.61	0.11
	Below cutoff	Above cutoff
Observations	498	352
Bandwidth	19.4	15.0

Figure 4. Continuity test of Democratic margin of victory around the cutoff

Note: This figure shows the results of the default robust bias-corrected RD manipulation test (Cattaneo et al., 2018, 2020), using local quadratic polynomial density estimation (rddensity) and triangular kernel function.

Figure 5 provides visual evidence of discontinuous increases in climate policy adoption and stringency at the threshold, indicating that narrow Democratic victories in closely contested elections are associated with higher climate policy ambition.

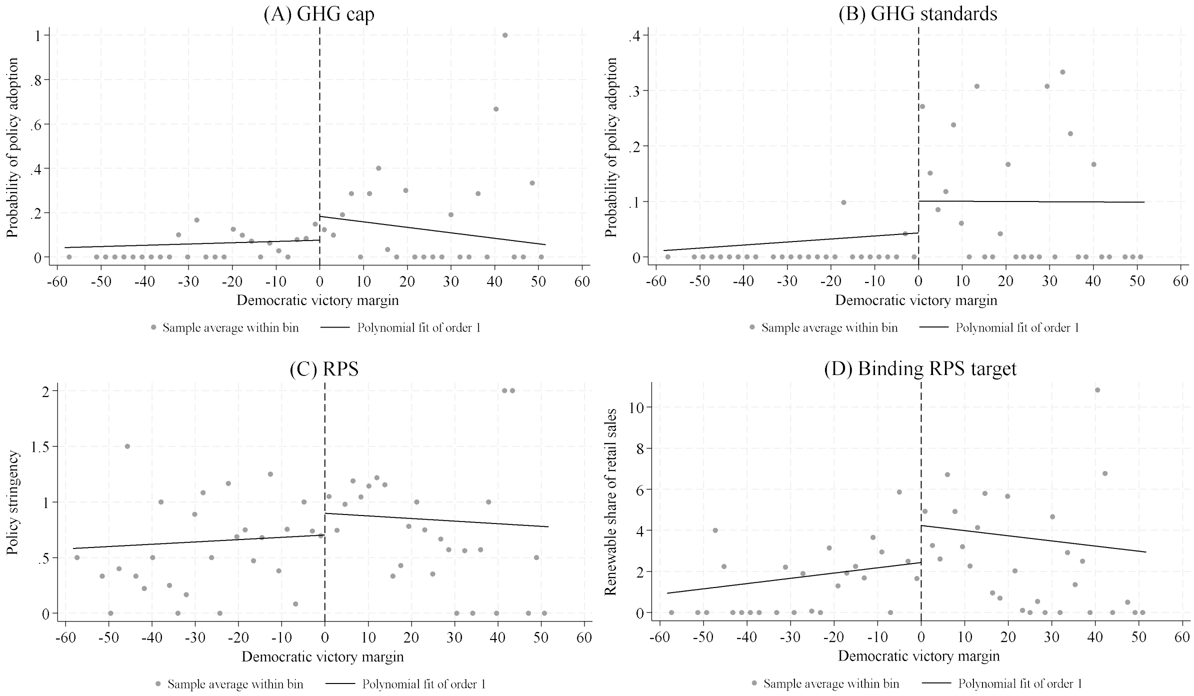


Figure 5. Non-parametric RD plots of Democratic governorship on policy outcomes, 1990-2018
Note: This figure displays RD estimates of narrow Democratic electoral victories on policy adoption and stringency. Plots employ local-linear regression with uniform kernel function, evenly-spaced mimicking variance bandwidths, and robust confidence intervals calculated by rdrobust (Calonico et al., 2014, 2017).

4.2.2. Estimation procedure

This analysis employs difference-in-differences (DID) and regression discontinuity (RD) designs—complementary, design-based approaches well suited to studying partisan effects in non-experimental settings (Bonnet & Olper, 2024; Caughey et al., 2017; Fredriksson et al., 2011)(Bonnet & Olper, 2024; Caughey et al., 2017; Fredriksson et al., 2011). The DID framework captures within-state changes under alternating gubernatorial partisanship, while the RD design leverages quasi-random assignment from very close elections as a robustness exercise.

The baseline Two-Way Fixed Effects (TWFE) estimator in a DID approach is a linear model for the adoption and stringency of climate policy j state i and year t:

$$Y_{ijt} = \beta_0 + \beta_1 D_{it} + \beta_2 (D_{it} \times L_i) + \beta_3 (D_{it} \times R_{it}) + \beta_4 X_{it} + \mu_i + \delta_t + \varepsilon_{it} \qquad (1)$$

Here, the dependent variable Y_{ijt} is the outcome for policy j in state i at time t (adoption or stringency). The treatment D_{it} equals one under a Democratic governor (zero under a Republican). L_i summarizes a baseline-period (1990) state economic interests: (i) the fossil-fuel share of electricity capacity and (ii) the energy-intensive manufacturing share of gross state product (opposition proxies), and a renewable natural endowment index combining wind and solar potential (support proxy). R_{it} equals one when the governor is term-limited (ineligible for reelection). X_{it} includes standard controls of energy-policy enactment—electricity consumption per capita, retail prices, real personal income per capita, total population, and age structure shares. State fixed effects μ_i absorb time-invariant heterogeneity; year fixed effects δ_t absorb common shocks, so identification relies on within-state variation (Fredriksson et al., 2011). Finally, ε_{it} is an error term.

This analysis evaluates whether governors deviate from their party's typical policy orientation when exposed to heterogeneous electric-utility interests. The heterogeneous partisan effect is captured by interactions between the time-varying partisan indicator $D_{it}$and the time-invariant electric utility interests' proxies L_i, whose main (non-interacted) effects are absorbed by state fixed effects in the TWFE specification, whereas their moderating role on partisan treatment effects remains identifiable. The interaction terms $D_{it} \times L_i$ proxy the potential influence of economic groups that are likely to oppose or support climate policy adoption and stringency.

Even with rich observable controls and two-way fixed effects, unobserved political preferences may correlate with both election outcome (whether a Democrat or a Republican wins) and policy adoption and may be some anticipation effects in the Democratic governorship treatment (Bonnet & Olper, 2024; Caughey et al., 2017; Fredriksson et al., 2011). DID offers a transparent baseline but may be sensitive to residual selection into treatment. To address potential endogeneity of gubernatorial partisanship, the study implements close-election RD that approximate random assignment at the Democratic–Republican vote-share cutoff (Di Maria et al., 2024; Lee et al., 2004; Payson, 2020; Raff et al., 2022). This quasi-experimental close-election design isolates partisan effects on climate policy outcomes by holding voters' mean preferences constant and comparing states where narrow races generate similar voter preference distributions and approximately equal probabilities of electing either party's candidate, thereby shifting the focus away from a purely Downsian paradigm of office-motivated politicians (Bonnet & Olper, 2024; Kim & Urpelainen, 2017; Lee et al., 2004).

The running variable m_{it} measures the Democratic margin of victory, defined as the Democratic minus the Republican vote share. Values above zero indicate a Democratic victory, whereas values below zero indicate a Republican victory. Two RD approaches are employed:

(i) Global parametric RD by fitting a polynomial in the running variable on either side of the cutoff, using all observations (both close to and far from the threshold) to maximize sample size and evaluate the heterogeneity of partisan effects to state-specific utility interests:

$$Y_{ijt} = \beta_0 + \beta_1 D_{it} + \beta_2 (D_{it} \times L_i) + \beta_3 (D_{it} \times R_{it}) + f(m_{it}) + \beta_4 X_{it} + \mu_i + \delta_t + \varepsilon_{it} \quad (2)$$

where $f(m_{it})$ includes side-specific polynomials up to order p.

$$f(m_{it}) = \alpha_{01} m_{it} + \cdots + \alpha_{0p} (m_{it})^p + \alpha_{11} D_{it} m_{it} + \cdots + \alpha_{1p} D_{it} (m_{it})^p \quad (3)$$

(ii) Local nonparametric RD estimating the jump at the cutoff:

This is implemented with bias-corrected local polynomial estimators, data-driven bandwidth selection, and robust confidence intervals. This focuses on elections within an optimally chosen neighborhood around m=0 and reports conventional RD diagnostics such as manipulation tests, sensitivity to bandwidth/kernel choices, and continuity of covariates (Calonico et al., 2014).

$$\tau(m) = \lim_{m \downarrow 0} \mathbb{E}[Y_i | m] - \lim_{m \uparrow 0} \mathbb{E}[Y_i | m] \quad (4)$$

Close-election RD is data-intensive; limited sample sizes near the cutoff can reduce precision, often require wider bandwidths and yield local effects that complement but do not replace DID estimates. Consistent with the literature, the RD results are presented as a stringent robustness check on the DID findings regarding partisan effects and their interaction with economic interests (Bonnet & Olper, 2024; Payson, 2020; Raff et al., 2022).

5. Results

This section reports findings from two complementary research designs. A difference-in-differences (DID) framework with two-way fixed effects (TWFE) evaluates global effects by exploiting gubernatorial party alternation between Democratic and Republican governors. Parametric and nonparametric regression-discontinuity (RD) designs then assess global and local effects in narrow gubernatorial elections.

Table 2 presents DID estimates of gubernatorial party effects on climate policy adoption and stringency from 1991 to 2018. Relative to Republican governors, Democratic governors achieve a 6.4 percentage points higher probability of adopting GHG cap-and-trade, a 6.7 percentage points higher probability of adopting GHG standards, 0.17 points stronger RPS categorical stringency, and 1.5 percentage points higher mandatory RPS targets.

Table 2. Summary of DID estimates by policy outcomes

	Dependent variables			
	GHG cap	GHG standards	RPS	RPS target
Democratic governorship	0.064**	0.067***	0.170**	1.504***
	(0.025)	(0.022)	(0.069)	(0.458)
Democratic governorship x Fossil capacity share	0.143	-0.214***	-0.411*	-5.081**
	(0.122)	(0.074)	(0.242)	(2.393)
Democratic governorship x Renewable endowment	-0.009*	0.012***	0.001	0.121**
	(0.005)	(0.004)	(0.015)	(0.057)
Democratic governorship x Term-limit	-0.062	0.001	0.019	0.342
	(0.040)	(0.036)	(0.128)	(0.819)
State F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
R2	0.52	0.56	0.70	0.65
Observations	1116	1116	1116	1116

Note: This table reports interaction effects between Democratic party affiliation and three moderators across 48 U.S. states over 1991–2018: 1990 fossil-fuel share of electricity capacity, renewable natural endowment, and term-limited governor status. Policy outcomes include GHG cap-and-trade adoption, GHG standards adoption, RPS categorical stringency, and binding RPS targets (measured as renewable share of retail electricity sales). The estimation employs a TWFE linear model within a DID framework, controlling for electricity consumption per capita, retail electricity prices, real personal income per capita, total population, share of population over 65, and share of population aged 5–17, alongside state and year fixed effects. Standard errors (in parentheses) are clustered at the state-electoral term level. * $p<0.1$, ** $p<0.05$, *** $p<0.01$.

Interactions between party affiliation and electric utility interests' proxies suggest that Democratic governors moderate policy choices in response to state-specific utility pressures. Coefficients associated with opposition from fossil-oriented utilities are larger in magnitude than those linked to supportive renewable-oriented utilities, consistent with evidence that fossil-intensive interest groups mobilize more intensively than renewable-energy utility interests (Brulle, 2018; Leippold et al., 2024). Democratic partisan effects decline as fossil-intensive utility capacity increases, particularly for GHG standards and mandatory RPS targets (see **Figure 6**). Where pollution-intensive utilities dominate, Democratic effects diminish and may become statistically indistinguishable from Republican effects. Conversely, renewable endowments amplify Democratic effects on GHG standards and RPS targets, consistent with supportive pressure from utilities positioned to benefit from these policies (Bonnet & Olper, 2024; Vormedal & Meckling, 2024).

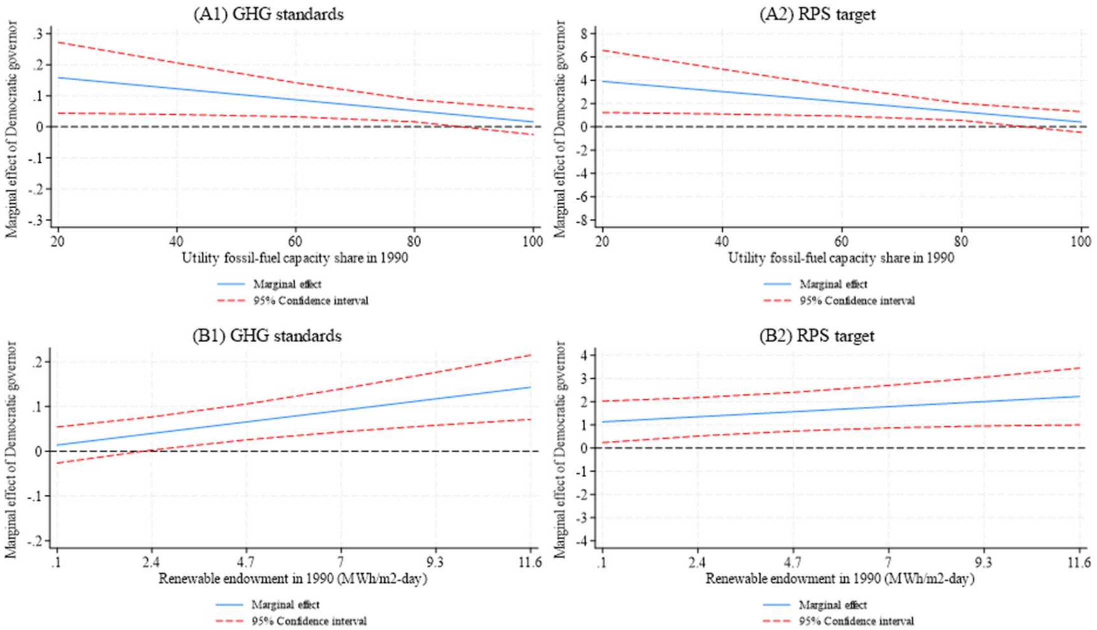


Figure 6. Heterogeneous effects of Democratic governorship on policy outcomes

Note: This figure depicts the marginal effect of Democratic party affiliation on GHG standards adoption and RPS target stringency. The estimation employs a TWFE linear model within a DID framework, controlling for electricity consumption per capita, retail electricity prices, real personal income per capita, total population, share of population over 65, and share of population aged 5–17, alongside state and year fixed effects.

These interaction patterns suggest differential influence across policy instruments. Emissions-intensive utilities appear more opposed to discretionary second-best instruments, GHG standards and RPS, than to economy-wide cap-and-trade. Fossil-heavy utility capacity significantly reduces Democratic effects on GHG standards and stringent RPS targets but not GHG cap-and-trade adoption. Using energy-intensive manufacturing's share on gross state product as an alternative proxy produces a different pattern: opposition concentrates against GHG cap-and-trade rather than RPS (see **Table 9** in **Appendix 2**), consistent with that sector's direct exposure to carbon-pricing costs (Culhane et al., 2021; Trachtman, 2020). Meanwhile, utilities in renewable-rich states may oppose technology-neutral, level-playing-field GHG cap-and-trade while supporting GHG standards and predictable-revenue RPS targets, consistent with economic influence that favors discretionary instrument (Basseches, 2024; Kim et al., 2016; Trachtman et al., 2025).

Term limits exhibit no significant moderating effect on partisan policy choices, implying governors align more with party preferences than electoral incentives. This finding supports the use of the close-election RD design for identifying partisan divergence effects while holding median voter preferences constant.

This analysis addresses unobserved potential endogeneity in DID approach through a quasi-experimental design that exploits narrow electoral margins. By conditioning on close races, the RD design identifies discontinuous policy-outcome changes at the 50% vote share threshold, mitigating concerns about unobservable confounders such as constituency preferences or anticipatory effects.

Table 3 presents gubernatorial partisan effects using a global parametric RD design. Coefficient magnitudes and directions align closely with DID findings, supporting robustness across estimation strategies. Relative to Republican governors, Democratic governors achieve a 7.2 percentage points higher probability of adopting GHG cap-and-trade, a 7.5 percentage points higher probability of adopting GHG standards, 0.21 points stronger RPS categorical stringency, and 1.5 percentage points higher mandatory RPS targets. Similar patterns arise under global quadratic specifications (see **Table 10** in **Appendix 3**).

Table 3. Summary of global parametric RD estimates by policy outcomes

	Dependent variables			
	GHG cap	GHG standards	RPS	RPS target
Democratic governorship	0.072**	0.075**	0.208**	1.499**
	(0.032)	(0.030)	(0.093)	(0.620)
Democratic governorship x Fossil capacity share	0.139	-0.218***	-0.430*	-5.080**
	(0.122)	(0.074)	(0.247)	(2.491)
Democratic governorship x Renewable endowment	-0.010*	0.012***	0.001	0.120**
	(0.005)	(0.004)	(0.015)	(0.058)
Democratic governorship x Term-limit	-0.059	0.005	0.044	0.335
	(0.043)	(0.034)	(0.133)	(0.979)
Controls	Yes	Yes	Yes	Yes
State F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Estimation	Parametric	Parametric	Parametric	Parametric
Polynomial order	I	I	I	I
Bandwidth	Global	Global	Global	Global
R2	0.66	0.56	0.70	0.65
Observations	1116	1116	1116	1116

Note: This table presents partisan effects and their interactions using global parametric linear RD across 48 U.S. states over 1991–2018, controlling for electricity consumption per capita, retail electricity prices, real personal income per capita, total population, share of population over 65, and share of population aged 5–17, alongside state and year fixed effects. Standard errors (in parentheses) are clustered at state-electoral term level. * p<0.1, ** p<0.05, *** p<0.01

Nonparametric RD does not enable interactions between running variable and moderator factors but allows validation of partisan effects on policy outcomes. Except for GHG cap-and-trade, Democratic partisan effects on second-best policies persist under a data-driven local nonparametric RD design with first-order (Panel A) and second-order (Panel B) polynomial specifications (see **Table 4**). Statistical significance depends on bandwidth choice: most coefficients remain significant within bandwidths between 6.6 and 14.4 percentage points across both polynomial specifications.

Table 4. Summary of local nonparametric RD estimates by policy outcomes

	Dependent variables			
	GHG cap	GHG standards	RPS	RPS target
(A) Local linear nonparametric RD				
Democratic governorship	0.031	0.154***	0.376***	5.110***
	(0.05)	(0.05)	(0.13)	(1.10)
Bandwidth	10.6	6.6	10.3	8.4
Observations (below/above cutoff)	310/285	203/203	306/277	239/246
(B) Local quadratic nonparametric RD				
Democratic governorship	0.024	0.150***	0.324*	4.864***
	(0.07)	(0.05)	(0.18)	(1.31)
Bandwidth	14.4	12.1	12.4	13.1
Observations (below/above cutoff)	358/324	334/295	338/298	346/312
Estimation	Nonparametric	Nonparametric	Nonparametric	Nonparametric
Polynomial order	I	I	I	I
Kernel	Triangular	Triangular	Triangular	Triangular

This table summarizes two RD estimations with different polynomial orders across 48 U.S. states over 1991–2018. Panel A shows partisan effects using local-linear regression and Panel b displays partisan effects using local-quadratic regression. Both estimates employ triangular kernel function, MSE-optimal bandwidth, robust confidence intervals, calculated by rdrobust (Calonico et al., 2014, 2017).
Standard errors (in parentheses) are clustered at state-electoral term level. * p<0.1, ** p<0.05, *** p<0.01

Figure 7 evaluates sensitivity of Democratic effects across bandwidths using local linear RD with 95% confidence intervals. The estimates exhibit sensitivity to bandwidth selection, particularly for GHG cap-and-trade and GHG standards. At narrow electoral margins, Democrats and Republicans show no significant differences on GHG cap-and-trade and GHG standards but diverge significantly on RPS categorical stringency and mandatory RPS targets, with Democrats advancing more ambitious renewable energy policies in electorally competitive states. These results warrant cautious interpretation given limited sample sizes at very narrow margins, especially elections with margins below three percentage points.

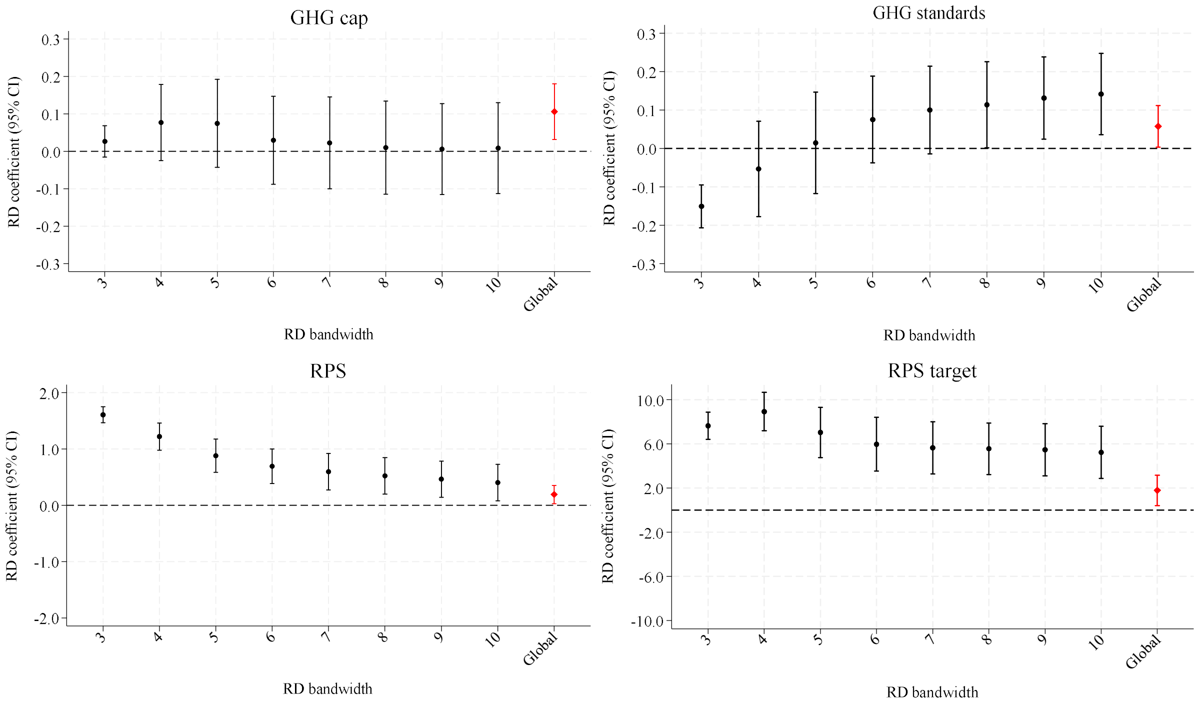


Figure 7. RD sensitivity to bandwidth choice

Note: This figure displays RD estimates of Democratic victory margin effects on policy adoption and stringency using different bandwidths at 95% confidence intervals across 48 U.S. states over 1991–2018. Point estimates employ local-linear regression with triangular kernel function, MSE-optimal bandwidth, and robust confidence intervals calculated by rdrobust (Calonico et al., 2014, 2017). Global regression coefficients use linear polynomials of the forcing variable, controlling state and year fixed effects.

These findings provide empirical evidence that electric utilities likely exert stronger influence on discretionary instruments, GHG standards and RPS, than on GHG cap-and-trade programs, though this analysis cannot establish causality regarding differential influence intensity across policy types.

6. Conclusions and policy implications

This study evaluates how gubernatorial partisanship and electric utility interests jointly shape the adoption and stringency of key climate policies in the U.S. power sector, comparing direct emissions instruments (GHG cap-and-trade and GHG standards) from indirect renewable portfolio standards (RPS). Using a panel of 48 U.S. states over 29 years and combining Difference-in-Differences with parametric and nonparametric Regression Discontinuity designs, results indicate that Democratic governorships associate with increased policy adoption and stringency, with effects moderated in states with fossil-intensive utility capacity and amplified in renewable-rich states, particularly for discretionary RPS targets. These findings are broadly robust across DID and parametric RD specifications, but the non-parametric RD evidence indicates that in close elections local partisan divergence concentrates on mandatory RPS stringency rather than on GHG cap-and-trade adoption. This study contributes to the empirical political economy literature by focusing on instrument choice and policy stringency across three major electricity-sector climate policies and by evaluating how electric utility interests and reelection incentives moderate or amplify partisan effects.

The findings matter for U.S. climate governance because they suggest that state-level electricity decarbonization pathways depend not only on electoral outcomes but also on how instrument design interacts with heterogeneous utility structures. In states where fossil-oriented utilities hold large capacity, Democratic governors appear to scale back ambition on GHG standards and binding RPS targets, whereas in renewable-rich states under Democratic control, these policies tend to advance, consistent with utilities supporting instruments that offer predictable revenues and investment certainty (Basseches, 2024; Kim et al., 2016; Trachtman et al., 2025). These patterns may imply that utilities may exert greater influence over the design of standards and RPS than over economy-wide cap-and-trade and that partisan climate platforms operate through, rather than independently of, local economic structures.

The policy implications are twofold. First, effective electricity decarbonization strategies may require policy packages that align climate objectives with the interests of incumbent utilities, for instance through credible frameworks for stranded-asset compensation, long-term contracting, and predictable regulatory timelines (Trachtman et al., 2025). Second, framing state climate instruments around visible co-benefits—such as energy security, local employment, and regional development—may facilitate support in politically competitive states where partisan polarization and entrenched fossil assets otherwise constrain clean energy ambition (Gustafson et al., 2020; Trachtman et al., 2025). In contexts where cross-party consensus is difficult, tailored mixes of GHG cap-and-trade, GHG standards, and RPS may help reconcile climate goals with electoral and electric utility interests' constraints, with sustained state leadership potentially influencing expectations and building momentum for broader energy transitions (Blanchard et al., 2023).

This analysis has several limitations. First, it focuses on three electricity-sector instruments and omits other relevant policies, such as energy-efficiency standards and solar tax credits. Second, the close-election RD design is data-intensive, and limited observations near narrow electoral margins reduce precision and make RD estimates sensitive to bandwidth choice, particularly for GHG cap-and-trade and GHG standards. Third, it relies on proxies for utility influence rather than direct measures of lobbying expenditures or position-taking, thus it cannot directly observe or precisely quantify differential lobbying intensity across policy types. Fourth, the empirical strategy does not address cross-state spillovers or interactions with federal policy, nor does it fully capture technology diffusion, evolving gas–renewables complementarities, or grid constraints that may co-determine policy choices. Finally, the focus on U.S. states may limit external validity for other federal systems with different institutional arrangements, party structures, and regulatory frameworks.

Future research could extend this work in several directions: First, complementing this analysis with granular lobbying data, such as position-specific expenditures and testimony records, would enable more direct tests of differential lobbying across policy types, in line with Hall et al. (2024). Second, integrating composite policy indices that incorporate multiple climate instruments as outcomes to better capture overall decarbonization ambition, following Bergquist & Warshaw (2023). Third, analyzing policy sequencing and interactions across instruments under varying political and economic interests' conditions would clarify how states build policy portfolios over time, aligning with Linsenmeier et al. (2022) and Stechemesser et al. (2024). Finally, applying the framework to other federal systems, such as Canadian provinces or German Länder, would assess whether these partisan–utility influence dynamics generalize beyond the U.S. context.

7. Appendices

7.1. Appendix 1: Descriptive statistics

This appendix presents a summary of the main descriptive statistics of the analysis and mean-comparison tests of the policy outcomes.

Table 5 shows statistical descriptives of main variables by gubernatorial parties across 48 U.S. states for 1990–2018 period.

Table 5. Statistical descriptive by gubernatorial parties

Type	Variables	Sample		
		Full	Democrats	Republicans
Outcomes	GHG cap	0.10	0.15	0.05
		(0.30)	(0.36)	(0.23)
	GHG standards	0.06	0.12	0.01
		(0.24)	(0.33)	(0.11)
	RPS	73.70	81.60	66.00
		(0.93)	(0.97)	(0.89)
	RPS target	2.88	3.49	2.11
		(6.63)	(6.99)	(5.67)
Electric utility interests' proxies	Fossil capacity share	71.40	72.40	74.60
		(25.00)	(0.25)	(0.20)
	Energy-intensive GSP share	5.55	4.36	4.25
		(2.14)	(2.28)	(2.09)
	Renewable endowment	4.33	3.44	5.10
		(5.89)	(4.51)	(6.79)
Controls	Electricity use per capita	16.88	16.96	17.07
		(13.25)	(13.30)	(13.47)
	Retail electricity price	8.17	8.13	8.14
		(2.76)	(3.10)	(2.47)
	Real personal income per capita	17.27	17.45	17.14
		(3.31)	(3.47)	(3.17)
	Population	6.02	5.90	6.27
		(6.49)	(6.26)	(6.77)
	Population over 65 share	13.46	13.43	13.47
		(1.99)	(1.90)	(2.07)
	Population aged 5&17 share	17.93	17.61	18.21
		(1.65)	(1.49)	(1.71)

Table 5 shows the correlations matrix between the main variables of the analysis.

Table 6. Correlation Matrix

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
(1) GHG cap	1.00															
(2) GHG standards	0.15	1.00														
(3) RPS	0.40	0.24	1.00													
(4) RPS target	0.55	0.30	0.56	1.00												
(5) Democratic governorship	0.16	0.21	0.08	0.12	1.00											
(6) Democratic victory margin	0.14	0.13	0.05	0.10	0.77	1.00										
(7) Fossil capacity share	-0.11	-0.32	0.03	-0.07	-0.05	-0.02	1.00									
(8) Energy-intensive GSP share	-0.12	-0.06	-0.11	-0.02	0.06	0.03	0.08									
(9) Renewable endowment	-0.17	-0.02	0.07	-0.01	-0.13	-0.17	0.22	0.11	1.00							
(10) Term limit	-0.02	0.02	-0.09	-0.04	0.01	-0.01	0.06	0.09	-0.09	1.00						
(11) Electricity use per capita	-0.18	-0.04	-0.19	-0.15	0.01	-0.04	0.21	0.03	0.18	-0.01	1.00					
(12) Retail electricity price	0.68	0.11	0.55	0.56	0.00	0.06	-0.08	-0.12	-0.20	-0.07	-0.36	1.00				
(13) Real personal income per capita	0.50	0.17	0.54	0.40	0.05	-0.02	-0.07	-0.23	-0.13	-0.05	-0.18	0.69	1.00			
(14) Population	0.11	0.20	0.16	0.21	-0.05	0.00	0.07	0.17	0.13	-0.01	-0.28	0.31	0.23	1.00		
(15) Population over 65 share	0.12	0.03	0.17	0.17	0.03	0.06	0.03	-0.36	-0.12	-0.02	0.04	0.25	0.10	-0.10	1.00	
(14) Population aged 5&17 share	-0.31	-0.17	-0.34	-0.30	-0.20	-0.19	0.04	0.35	0.28	-0.06	0.05	-0.49	-0.51	-0.07	-0.58	1.00

Table 7 provides mean-comparison tests (t tests) of the policy outcomes by gubernatorial parties across 48 U.S. states for 1990 and 1991–2018 period.

Table 7. Mean-comparison tests (t tests) of outcomes by gubernatorial parties

	Democrats	Republicans	t statistic	P-values on differences	Difference size
1990					
GHG cap	0.00	0.00	0.00	0.00	
GHG standards	0.00	0.00	0.00	0.00	
RPS	0.00	0.10	1.09	0.28	
RPS target	0.00	0.06	1.09	0.28	
1991-2018					
GHG cap	0.16	0.06	-6.21	0.00	3
GHG standards	0.13	0.01	-8.76	0.00	10
RPS	0.85	0.68	-3.40	0.00	1
RPS target	3.64	2.16	-4.15	0.00	2

Table 8 reports mean-comparison tests (t tests) of the explanatory variables by gubernatorial parties across 48 U.S. states for 1990.

Table 8. Mean-comparison tests (t tests) of explanatory variables by gubernatorial parties in 1990

Variables	Democrats	Republicans	t statistic	P-values on differences
Fossil capacity share (%)	69	74	0.73	0.47
Energy-intensive GSP share (%)	6	5	-0.34	0.74
Renewable endowment (MWh/m2-day)	3	7	2.22	0.03
Electricity use per capita (MWh/person)	18	14	-1.04	0.30
Retail electricity price (US$ cents/kWh)	6	7	0.72	0.48
Real personal income per capita (thousand US$ per person)	15	14	-1.26	0.21
Population (Millions)	5	5	0.27	0.79
Population over 65 share (%)	12	13	0.87	0.39
Population aged 5&17 share (%)	19	19	0.95	0.35

7.2. Appendix 2: DID estimations

Table 9. DID estimates using energy-intensive GSP share influence proxy by policy outcomes

	Dependent variables			
	GHG cap	GHG standards	RPS	RPS target
Democratic governorship	0.069***	0.065***	0.156**	1.390***
	(0.025)	(0.022)	(0.070)	(0.448)
Democratic governorship x Energy-intensive GSP share	-0.018**	-0.012**	0.038	0.162
	(0.008)	(0.006)	(0.027)	(0.183)
Democratic governorship x Renewable endowment	-0.008	0.010***	-0.003	0.070
	(0.005)	(0.003)	(0.014)	(0.056)
Democratic governorship x Term-limit	-0.062	-0.009	0.015	0.224
	(0.039)	(0.036)	(0.129)	(0.819)
State F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Controls	Yes	Yes	Yes	Yes
R2	0.66	0.55	0.70	0.65
Observations	1116	1116	1116	1116

Note: This table reports interaction effects on adoption and stringency of climate policies between Democratic party dummy and three alternative moderators across 48 U.S. states over 1991–2018: 1990 energy-intensive manufacturing share of gross state product, renewable natural endowment, and term-limited governor status. The analysis examines four climate policy outcomes: GHG cap adoption, GHG standards, RPS categorical stringency, and binding RPS targets measured as the renewable share of retail electricity sales. The estimation applies a Two-Way Fixed Effects (TWFE) linear model within a difference-in-differences (DID) design, controlling for electricity consumption per capita, retail electricity prices, real personal income per capita, total population, share of population over 65, and share of population aged 5–17, alongside state and year fixed effects.

Standard errors (in parentheses) are clustered at state-electoral term level.

* $p<0.1$, ** $p<0.05$, *** $p<0.01$

7.3. Appendix 3: RD estimations

Table 10. Global parametric quadratic RD estimates by policy outcomes

	Dependent variables			
	GHG cap	GHG standards	RPS	RPS target
Democratic governorship	0.096**	0.125***	0.353***	1.974**
	(0.043)	(0.045)	(0.129)	(0.826)
Democratic governorship x Fossil capacity share	0.145	-0.197***	-0.370	-4.970*
	(0.125)	(0.074)	(0.249)	(2.569)
Democratic governorship x Renewable endowment	-0.010*	0.012***	-0.001	0.115**
	(0.005)	(0.004)	(0.015)	(0.057)
Democratic governorship x Term-limit	-0.057	0.011	0.062	0.387
	(0.044)	(0.034)	(0.134)	(0.981)
State F.E.	Yes	Yes	Yes	Yes
Year F.E.	Yes	Yes	Yes	Yes
Estimation	Parametric	Parametric	Parametric	Parametric
Polynomial order	II	II	II	II
Bandwidth	Global	Global	Global	Global
R2	0.66	0.56	0.71	0.66
Observations	1116	1116	1116	1116

Notes: This table reports interaction effects on adoption and stringency of climate policies between Democratic party dummy and three alternative moderators across 48 U.S. states over 1991–2018: 1990 fossil-fuel share of electricity capacity, renewable natural endowment, and term-limited governor status. The analysis examines four climate policy outcomes: GHG cap adoption, GHG standards, RPS adoption, and binding RPS targets measured as the renewable share of retail electricity sales. The estimation applies a global parametric quadratic regression discontinuity (RD) design, controlling for electricity consumption per capita, retail electricity prices, real personal income per capita, total population, share of population over 65, and share of population aged 5–17, alongside state and year fixed effects
Standard errors (in parentheses) are clustered at state-electoral term level.
* p<0.1, ** p<0.05, *** p<0.01

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