Do Households Separate Politics from Investment? Evidence from Residential Solar*

Aymeric Bellon† Cameron LaPoint‡ Avantika Pal§

September 2026

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Abstract

Do households separate their investment decisions from their political preferences? We study this question using residential solar adoption in California. We link over two million solar permits to property transactions, mortgage records, and voter registration data, allowing us to compare successive Republican and Democratic owners of the same house. Republicans are much less likely to install solar than Democrats, with a gap equal to about 42 percent of the average annual adoption hazard. The gap is larger among politically engaged households, widens after the 2016 presidential election, and narrows when financial incentives increase via more generous rebates or greater potential solar radiation in an area. Conditional on adoption, we find little evidence of economically meaningful partisan differences in investment scale, as measured by solar system kilowatts. A simple model shows that these results are consistent with political preferences shaping investment decisions, rather than simply reflecting differences in expected financial returns.

Keywords: residential solar, household finance, political identity, partisanship, technology adoption, green investment, climate finance, energy transition

JEL Classifications: D72, G41, G51, Q42, Q48, R21

*We thank Stefano Giglio for many helpful suggestions. We thank representatives from Cotality (recently rebranded from CoreLogic) for answering our questions about their data products. This research was financially supported by the Yale Tobin Center for Economic Policy and by a grant from Yale Planetary Solutions. We thank Aurel Rochell, Luke Ranawake, and Riley Sze for their excellent research assistance.

†UNC Chapel Hill, Kenan-Flagler Business School. E-mail: **aymeric_bellon@kenan-flagler.unc.edu**, website: **www.aymericbellon.com**

‡Yale School of Management. E-mail: **cameron.lapoint@yale.edu**, website: **www.cameronlapoint.com**

§University of Illinois Urbana Champaign. E-mail: **pal8@illinois.edu** , website: **sites.google.com/view/avantikapal**

1 Introduction

Do households separate their investment decisions from their political preferences? A classic theorem in economics suggests that they should. Under the Fisher separation principle, individuals first choose investments that maximize financial value and then use the resulting wealth to pursue their personal objectives (Fisher, 1930). Friedman's argument on corporate social responsibility similarly assigns economic and political choices to separate spheres, implying that individuals should pursue value through investment and express their social objectives through voting, charitable giving, and other forms of political participation (Friedman, 1970). Yet, households may also use investment itself as a means of expressing their political preferences, particularly when investments have salient social or environmental consequences (Bénabou and Tirole, 2010). Whether political preferences shape investment decisions is therefore ultimately an empirical question. This paper provides evidence that they do.

Establishing this influence empirically, however, requires distinguishing political preferences from other partisan differences that also affect investment. In the United States, Republicans and Democrats may hold different expectations about future economic conditions (Meeuwis et al., 2022; Engelberg et al., 2026). These differences can generate partisan variation in investment even when political preferences do not directly enter the investment decision. Republicans and Democrats also tend to live in different locations and therefore face different investment opportunities, prices, and regulations (Brown and Enos, 2021). As a result, differences in average investment cannot distinguish the direct influence of political preferences from differences in expected financial returns.

To mitigate these challenges, we focus on household investment in residential solar, a setting which offers several empirical advantages. First, solar adoption has a clear environmental dimension. By reducing reliance on carbon-intensive electricity generation, residential solar contributes to climate change mitigation, an objective whose importance differs sharply across Republicans and Democrats.[1] Solar investment therefore provides a setting in which political preferences are likely to be economically relevant.

Second, we assemble unusually rich data that allow us to examine a broad set of outcomes, incorporate granular controls and fixed effects, and implement several complementary empirical designs. Specifically, we construct a property-owner panel for California by linking Cotality property and mortgage records to over two million Cotality solar permits, which identify the timing of adoption and project characteristics such as system size and permit-reported value. We then merge these records with L2 voter registration data to attach the political affiliation of each owner.

We organize our empirical analysis around a simple model that yields three main predictions. Households choose whether to adopt solar and, conditional on adoption, the size of the system. Adoption generates both financial returns and a non-pecuniary benefit from solar's environmental attributes, which we assume is larger for Democrats than for Republicans, as well as an idiosyncratic preference shock that follows a Type-I extreme-value distribution. The model predicts that (1) Democrats are more likely to adopt solar, (2) conditional on adoption, Democrats and Republicans choose the same system size, and (3) Republican adoption responds more strongly to changes in financial incentives because non-pecuniary benefits account for a smaller share of their total surplus from adoption. Each of these predictions is supported by the data.

Specifically, consistent with our first prediction, we find significant partisan gaps in residential solar adoption. Our baseline results indicate that solar adoption is lower under Republican ownership across both same-street and within-house specifications. In our preferred within-house specification, which includes property fixed effects, zip code-by-year fixed effects, ownership-start-year-by-year fixed effects, and mortgage-amount- and mortgage-term-decile-by-year fixed effects, Republican ownership is associated with a 0.48

[1] For example, Leiserowitz et al. (2023) document pronounced partisan differences in attitudes toward climate change. In the Fall 2023 Yale Climate Change Opinion Surveys, 82% of Democrats, compared with 28% of Republicans, are classified as either "Alarmed" or "Concerned" about global warming.

percentage point lower annual adoption hazard. Relative to the 1.14 percent annual adoption hazard in the sample, this estimate is about 42 percent of the sample mean. The estimate is unchanged when mortgage controls are added to the corresponding ownership-cohort specification. Specifications that additionally control flexibly for property characteristics produce larger coefficients, though on a substantially smaller sample.

We provide two complementary dose-response tests of this interpretation, exploiting variation in the salience of political identity both over time and across households. In the time series, we show that the identity wedge varies with the political salience of environmental issues. This interpretation is motivated by evidence that partisan differences in climate skepticism among Republicans increased following Donald Trump's rise to the presidency (Xia and Du, 2025). Motivated by this evidence, we estimate a dynamic event study around the 2016 presidential election. We find little evidence of differential pre-trends immediately before 2016, followed by a persistent negative Republican differential in solar adoption.

In the cross-section, we use political donations and political engagement to test whether the identity wedge becomes stronger as political preferences become more salient. In the model, this amounts to allowing the magnitude of the partisan wedge to vary across households, with more politically engaged households exhibiting a larger non-pecuniary preference. The data display precisely this dose-like pattern. The Republican adoption gap is substantially larger among donors than among non-donors and among high-engagement rather than low-engagement owners. With mortgage controls, for example, the Republican coefficient is -0.0171 among donors compared with -0.0034 among non-donors, and -0.0179 among high-engagement owners compared with -0.0039 among low-engagement owners. These gradients are consistent with political identity creating a larger adoption hurdle when partisan preferences are more strongly engaged.

Broadly consistent with the model, we find little evidence of economically meaningful partisan differences in investment scale conditional on adoption. Republican owners install modestly larger, as measured by kilowatt (kW) output, and slightly more expensive systems than comparable Democratic owners. This pattern is difficult to reconcile with an explanation driven solely by differences in expectations about future solar incentives. As we show in an extension of the model, systematic differences in such expectations would also generate pronounced differences in system size across parties, which we do not observe empirically.

We next test the model's prediction that the partisan adoption gap should affect the elasticity of financial incentives to adopt solar panels. In the model, households with a smaller non-pecuniary benefit from adoption rely more heavily on pecuniary returns, implying that improvements in the financial attractiveness of solar should disproportionately increase Republican adoption and compress the partisan gap. We examine two distinct sources of variation in private financial returns: rebates, which lower the upfront cost of installation, and geographic variation in solar irradiance, which increases the electricity generated by a given system and therefore its private financial return. Consistent with the model, the Republican adoption gap is substantially larger in low-rebate environments. In high-rebate environments, the Republican coefficient is essentially zero. Similarly, the Republican adoption deficit is roughly 40–45 percent smaller in high-irradiance areas than in low-irradiance areas. Stronger financial returns therefore sharply attenuate, and in some specifications nearly eliminate, the partisan adoption gap. This interaction is policy-relevant because subsidies intended to accelerate residential solar take-up may have heterogeneous effects across households with different political preferences, potentially narrowing partisan gaps in adoption.

We also examine whether the partisan adoption gap reflects the owner's political identity or instead the broader political environment in which the household lives. Republicans and Democrats may sort into neighborhoods with different installer networks, peer effects, permitting practices, social norms, or expectations about future solar policies and financial returns, which could generate partisan differences even absent an owner-level identity channel. We therefore estimate our same-street and within-house specifications separately in Republican- and Democratic-leaning counties. The Republican adoption gap remains negative within the same house in both environments, indicating that local political conditions do not explain away the owner-level effect. Moreover, the gap is consistently larger in Democratic-leaning counties. A channel driven primarily by partisan expectations about future solar policy would instead predict a smaller gap in Democratic counties, where Republicans and Democrats face the same relatively favorable policy environment toward solar panels. The observed pattern is therefore more consistent with local political norms and the salience of solar interacting with household political identity.

Contributions. First, our paper contributes to the literature on non-pecuniary preferences and sustainable investment. A large literature asks whether investors allocate capital based only on expected risk and return or also derive utility from holding assets consistent with their social and environmental values (Hong and Kacperczyk, 2009; Riedl and Smeets, 2017; Hartzmark and Sussman, 2019; Barber et al., 2021; Pástor et al., 2021; Pedersen et al., 2021; Bauer et al., 2021; Heeb et al., 2023). Recent work provides increasingly direct evidence that investors are willing to sacrifice financial value to align their portfolios with moral or environmental preferences (Bonnefon et al., 2025; Giglio et al., 2025; Rodemeier, 2026).

Our paper differs from this literature in two important respects. First, most existing evidence concerns the allocation of financial capital, such as mutual funds, stocks, private-market investments, or voting rights. We study instead a large, irreversible investment in physical household capital. Political and environmental preferences therefore affect whether households undertake a real investment and adopt a new technology, rather than only how they allocate a given amount of financial wealth. In this sense, we provide evidence that the distinction between financial value and investors' values emphasized by Starks (2023) extends beyond portfolio choice to real household capital allocation. Second, much of the sustainable investing literature identifies non-pecuniary preferences from portfolio tilts, willingness to pay, fund flows, or deviations from standard asset pricing benchmarks. Our empirical design provides a complementary way to study non-pecuniary preferences through observed household investment choices. Our analysis also complements Heeb et al. (2026), who study whether green investing affects subsequent political behavior. We instead ask whether political preferences shape the decision to undertake a green investment.

Second, our paper contributes to a growing literature on how political preferences shape financial and economic decisions. Relatedly, Diaz-Bazan (2026) documents partisan differences in household investments that improve resilience to wind risk. We study instead investment in clean energy technology, where the investment good itself has a clear political encoding – residential solar is closely associated with climate mitigation and environmental identity. This feature of our setting allows us to examine whether partisan preferences directly enter households' valuation of an investment, and how this non-pecuniary component interacts with the investment's financial returns.

More broadly, prior work shows that political affiliation is associated with stock market participation and portfolio choice (Kaustia and Torstila, 2011; Hong and Kostovetsky, 2012; Meeuwis et al., 2022), corporate and professional decisions (Di Giuli and Kostovetsky, 2014; Kempf and Tsoutsoura, 2021; Dagostino et al., 2023; Gao et al., 2026), residential choices (Bernstein et al., 2022; McCartney et al., 2024), and entrepreneurship and innovation (Engelberg et al., 2025, 2026). Recent work also highlights the role of identity in financial participation (Henkel and Pugnaghi-Zimpelmann, 2026). We add to this literature by using a politically salient household investment to distinguish an identity-based valuation channel from explanations based on differences in expected financial returns or local investment environments.

Finally, we relate to the climate finance and household green investment literatures. Existing work shows that beliefs about climate change affect asset prices and real estate valuations (Baldauf et al., 2020; Bernstein et al., 2022), that climate risks and environmental preferences affect investor behavior (Krueger et al., 2020; Choi et al., 2020; Bolton and Kacperczyk, 2021), and that prices, subsidies, peer effects, and regulation shape household adoption of energy efficient and renewable technologies (Bollinger and Gillingham, 2012; Hughes and Podolefsky, 2015; Borenstein, 2017; De Groote and Verboven, 2019; Clara et al., 2026). We complement these papers by showing that the diffusion of green technologies also depends on the political meaning households attach to the investment. This distinction matters because political preferences and financial incentives are not substitutes in our data. Instead, they interact. Households with weaker non-pecuniary preferences are more responsive to improvements in the private economics of solar, so sufficiently strong financial incentives substantially reduce or even eliminate the partisan adoption gap. Our results therefore suggest that understanding the energy transition requires accounting not only for prices, subsidies, financing constraints, and beliefs about future returns, but also for the identity and non-financial value households attach to adopting politically salient technologies.

The remainder of the paper proceeds as follows. Section 2 develops the conceptual framework and derives the empirical predictions. Section 3 describes the data and sample construction, and Section 4 presents the empirical strategy and identification. Section 5 establishes the partisan gap in solar adoption and examines how it varies with political engagement and the salience of political identity. Section 6 uses variation in financial incentives and investment intensity to distinguish the political-preference channel from differences in expected financial returns. Section 7 evaluates alternative explanations related to the local political environment, and Section 8 concludes.

2 Empirical Predictions

We develop a simple framework in which households decide whether to install solar panels and, conditional on adoption, how large a system to install. The formal derivation of the model is described in Appendix A.

Solar provides standard financial benefits through lower electricity bills, tax credits, net-metering revenues, and other private cash flows. It may also generate non-pecuniary benefits associated with environmental preferences, political identity, or social image.

The key assumption is that Democrats derive greater non-pecuniary utility from adopting solar than Republicans, consistent with well-documented partisan differences in environmental preferences and concern about climate change (e.g., Gromet et al., 2013; Gustafson et al., 2020; Leiserowitz et al., 2023). We model this utility primarily as a fixed benefit of becoming a solar adopter. This captures the idea that much of the environmental, identity, or social-image value of solar comes from taking the discrete action of adopting a visible green technology. Installing solar allows a household to act in accordance with its environmental preferences and potentially signal those preferences, while the incremental non-pecuniary benefit from adding one more panel is likely to be comparatively small.

The framework delivers three empirical predictions. First, Democrats should adopt solar more frequently than otherwise comparable Republicans. Even when households face the same installation costs and expected financial returns, a household that derives greater environmental or identity value from solar is more willing to adopt. Political preferences can therefore affect the extensive margin of household investment.

Second, political affiliation should have little effect on system size conditional on adoption. Once a household has decided to install solar, the optimal amount of capacity is determined by the marginal financial benefits and costs of additional panels. Because the political component operates mainly through the fixed value of becoming an adopter, it should affect whether a household installs solar but not how large a system it chooses. The model therefore predicts a partisan gap in adoption but not in investment intensity among adopters.

Third, Republican adoption should be more responsive to changes in economic incentives. Households that derive substantial non-pecuniary value from solar are willing to adopt even when the financial case is relatively weak. Households that derive less non-pecuniary value require more favorable economics to adopt. Improvements in the financial attractiveness of solar, such as lower installation costs or more generous incentives, should therefore generate a larger proportional increase in adoption among Republicans. As solar becomes economically more attractive, the partisan adoption gap should narrow.

In an extension of the baseline framework, we distinguish the political preference channel from an alternative mechanism based on heterogeneous beliefs about future financial returns. Democrats and Republicans may differ in their expectations about future electricity prices, the persistence of tax incentives, net-metering compensation, or the reliability of solar technology. Unlike a fixed non-pecuniary benefit, such beliefs affect the perceived return to additional solar capacity and should therefore influence not only whether households adopt but also how large a system they install. The extension thus provides a useful empirical distinction: a partisan difference in adoption combined with little or no difference in system size is more consistent with political identity affecting the fixed value of solar adoption, whereas systematic partisan differences in system size would be more consistent with heterogeneous beliefs about future financial returns.

3 Data and Descriptive Statistics

We introduce our data sources in this section and describe how we create a property owner-year panel linked to solar installations observed in permitting data.

3.1 Data and Sample Construction

Our analysis combines several property-level datasets from Cotality (recently rebranded from CoreLogic) with individual-level voter registration records from L2, local measures of electricity prices, and solar incentives. The Cotality data include building permits, deed transfers, tax assessment information, and mortgage deed records. These datasets share Cotality's property identifier, clip, which allows us to link the timing of residential solar adoption to the owner occupying a property at that time, while separately measuring characteristics of the house and its financing.[2] The resulting data allow us to construct a property-owner panel that follows successive owners of the same house and identifies whether and when each owner adopts solar. Throughout the paper, we restrict our sample to single-family homes which change owners through an arms-length transaction.

Solar permits. We identify residential solar adoption using Cotality building permit records for California. The permit data contain the property identifier, permit type and subtype, project description, permit effective date, permit status, contractor information, permit-reported job value, and solar-specific information such as reported system capacity in kilowatts (kW). The raw California permit data contain approximately 2.11 million solar permits across roughly 1.37 million properties.

We identify solar permits using both Cotality-assigned project categories and permit text. We follow the text-parsing strategy in Bellon et al. (2024), who use the same permits data to identify clean energy and resiliency projects tied to home improvement loans. We classify a permit as solar if the Cotality project type includes *Solar Installation*, if the project name refers to solar or photovoltaic installation, or if the permit description contains terms such as "solar," "photovoltaic," or "photo voltaic," subject to exclusions for non-photovoltaic projects such as solar thermal or solar water heating. We additionally exclude permits associated with new construction so that the adoption measure captures retrofit decisions by existing homeowners rather than solar installed as part of the construction of a new house.

We distinguish solar photovoltaic installations from battery- or generator-only projects using permit descriptions and project classifications. We also use the permit description text to extract reported system capacity when this information is available. Permit-reported job value and system capacity are retained for the intensive margin analysis.

[2] The unique property identifier constructed by Cotality (i.e., the clip id) is the concatenation of the assessor's parcel number (APN), parcel sequence number, and geolocation. Cotality further adjusts the clip to accounts for subdivision and redefinition of the parcel boundaries over time, so that the resulting identifier is time-invariant.

We define the solar adoption date of a property as the earliest valid solar permit effective date associated with that property. When multiple solar permits are observed for the same clip, only the first permit determines the adoption event because solar adoption is treated as an absorbing property-level state. Subsequent permits may represent expansions, battery additions, repairs, or other modifications and are therefore not coded as additional first-adoption events. In our main analysis, we restrict attention to permits with a final status indicating that the project was completed. However, we retain permits attached to incomplete solar installations to use in a placebo analysis, since, conditional on applying for a solar permit and paying the associated permit fee, there is no clear political motivation for Republicans to abandon the project at different rates than Democrats.[3]

Applying our permit classification and data quality restrictions yields 2,035,285 permits with an identified residential solar adoption date.

Owner Transfer Data. We use the Cotality *Owner Transfer* data to construct the ownership history of each property. These records contain the clip, transaction and recording dates, transaction classifications, sale amounts, property addresses, and buyer and owner names. Unlike a mortgage-based ownership definition, the transfer records allow us to observe ownership changes even when a transaction is not associated with a mortgage. This substantially expands the ownership panel beyond households for which mortgage information is available.

The raw *Owner Transfer* data contain 8,203,538 unique properties. We retain records with a non-missing clip, a valid transfer date, and the ownership-transfer categories used to identify relevant residential transactions. When multiple records correspond to the same property and transaction date, we retain a single transaction, prioritizing the observation

[3] In the Cotality data, completed permits are those assigned to one of the following final statuses recorded by the town permitting office: "approved," "complete," "filed," "final," "issued," "reinstated." Incomplete permits instead have one of the following final statuses: "applied," "plancheck," "canceled," "rejected," "revoked," "suspended," "triage," or "withdrawn." Our results are robust to a more restrictive definition of a completed permit, since 98% of permits in our completed set have a final status of "complete," "final," or "issued."

with the most complete transaction information. We also collapse closely spaced transfer records that appear to represent the same underlying ownership event.

We order the resulting transactions within each clip to construct successive ownership spells. An ownership spell begins with an observed ownership transfer and ends at the next ownership transfer, the first solar adoption date if the property adopts during the spell, or the end of the sample period, whichever occurs first. Owners who acquire a property after it has already adopted solar are excluded from the adoption risk set because they did not make the property's original solar adoption decision.

The *Owner Transfer* data therefore serve two central purposes. First, they identify which household owns a property at each point in time and hence which household is at risk of adopting solar. Second, they provide owner names and property addresses that we use to match owners to voter registration records.

Tax data and property characteristics. We merge the ownership panel to the Cotality *Tax* data (officially known as Cotality *Property Basic*) using clip. The *Tax* data provide characteristics of the physical house that may affect both the feasibility and expected returns to residential solar. These include, where available, the year the property was built, building square footage, number of stories, property and land use classifications, and roof characteristics.

These variables are distinct from the ownership information contained in the *Owner Transfer* data. The *Tax* data characterize the underlying capital asset, while the transfer records identify the household currently occupying and owning that asset. This distinction is particularly useful for our empirical design because many relevant property characteristics are fixed or slow-moving across successive owners.

In robustness specifications, we flexibly control for observable property characteristics by interacting bins or categories of these variables with calendar year. In particular, we use year-built bins, building-square-footage deciles, number-of-stories bins, and roof-type categories. These controls allow the relationship between housing characteristics and solar adoption to vary over time. Our primary within-house specification instead includes property fixed effects, which absorb all time-invariant observed and unobserved features of the house.

Mortgage records. We separately merge Cotality *Mortgage* records to the ownership panel using the clip. The mortgage files contain information on mortgage origination and recording dates, mortgage amount, mortgage term, loan type (e.g., conforming or non-conforming), and other characteristics of property-level financing.

Because a property can have multiple mortgage records over time, we associate mortgages with ownership spells rather than simply assigning all mortgage records observed for a property to every owner. For each ownership spell, we identify the mortgage record most closely associated with the beginning of ownership and retain measures of mortgage amount and term. We also construct indicators for whether a property has any mortgage record and whether an ownership spell can be associated with a for-purchase mortgage as opposed to a refinancing event.

Mortgage information is not required for a property to enter the baseline ownership panel. This is important because cash purchases, inherited properties, and other ownership transfers may not generate an observable mortgage. Instead, mortgage characteristics enter as additional financing controls in specifications estimated on the subset for which the relevant mortgage information is available. To allow financing conditions to affect adoption flexibly over time, we construct mortgage-amount and mortgage-term deciles and interact these measures with calendar year. These controls absorb differences in financing capacity and borrowing conditions across households without requiring the ownership panel itself to be restricted to mortgage borrowers.

Voter registration and political affiliation. To measure homeowner partisanship, we use voter registration records from L2, a commercial voter file provider widely used in academic research. The L2 data contain repeated snapshots of California registered voters and report voter names, residential addresses, party registration, and additional political characteristics.

We match property owners in the Cotality *Owner Transfer* data to the voter file using standardized owner names and property location information. Political affiliation is assigned at the owner-spell level. Our main analysis restricts attention to owners identified as registered Democrats or Republicans; owners registered with another party, with no party preference, or for whom party affiliation cannot be identified are excluded from the main two-party analysis.

The voter file match produces a matched analysis sample of 35,909,317 owner-year observations, corresponding to 2,354,502 unique properties and 2,647,813 owner spells. Democratic owners account for 19,578,232 owner-year observations and Republican owners for 16,331,085. Table 1 reports descriptive statistics for this matched sample.

The voter data also provide measures of political engagement and modeled ideology. We use political donation information to distinguish politically active owners from non-donors and to construct measures of engagement intensity. We separately use modeled ideology to examine whether the Republican adoption gap varies with the ideological orientation of the owner. These variables are used only in the heterogeneity analyses and are not required for inclusion in the baseline sample.

Solar incentives. We supplement the property-owner panel with measures of the private economic return to residential solar.

We measure solar rebates using information from the *Tracking the Sun* data compiled by Lawrence Berkeley National Laboratory. These data contain installation-level information on residential solar projects, including installation date, system size, installed price, rebates or grants, customer segment, installer, utility service territory, and geographic location. We aggregate rebate information geographically and over time and merge these measures to the owner-year panel. The resulting variables capture local and time-varying differences in subsidies that reduce the upfront cost of solar adoption.

Because the public-use *Tracking the Sun* data do not contain property addresses or Cotality property identifiers, they cannot be linked directly to individual Cotality properties. We therefore use these data to measure local solar market conditions and financial incentives rather than to define household-level adoption. Our adoption measure continues to come from Cotality building permits.

Construction of the owner-year hazard panel. We combine the solar permit, Owner Transfer, Tax, mortgage, and voter registration data into a property-owner-year hazard panel. The unit of observation is an owner-property-year. Ownership spells are defined using the Cotality *Owner Transfer* data rather than mortgage origination dates, so properties can enter the panel regardless of whether the owner financed the acquisition with a mortgage.

For each ownership spell, we determine whether the property had already adopted solar before the spell began. Spells beginning after the first solar adoption date are excluded because the new owner inherits an existing system and is not at risk of making the original adoption decision. For properties that have not previously adopted, the spell remains in the risk set until the first of three events: solar adoption, the next ownership transfer, or the end of the sample period.

We expand valid ownership spells into annual observations. For owner i of property p in year t, we define the discrete-time adoption hazard as

$$h_{ipt} = \Pr\left(\text{adopt in year } t \mid \text{no solar adoption before year } t\right) \tag{1}$$

The outcome $SolarAdoption_{ipt}$ equals zero in each year in which the owner remains at risk and equals one in the year of the property's first solar adoption. After adoption, the property exits the risk set.

This construction has two important advantages. First, it includes both adopting and non-adopting properties and therefore constructs the relevant counterfactual risk set rather than conditioning on eventual adoption. Second, because ownership changes are observed directly in the *Owner Transfer* data, we can compare successive Republican and Democratic owners of the same house. Specifications with property fixed effects therefore hold constant all permanent characteristics of the property and identify the partisan adoption gap from changes in the political affiliation of successive owners.

Starting from 8,203,538 unique properties in the raw *Owner Transfer* data, our ownership and sample construction restrictions yield 6,479,967 unique properties in the owner-year panel. Among the 1,320,194 properties in the final solar permit file, 1,008,200 are retained in the owner-year panel. We then match owners to the L2 voter file. Restricting the main estimation sample to matched Democratic and Republican owners yields 2,354,502 unique properties and 35,909,317 owner-year observations. Mortgage and detailed property-characteristic controls are introduced sequentially in the empirical analysis and therefore generate smaller estimation samples when those variables are required.

3.2 Descriptive Statistics

We begin with aggregate patterns that motivate the household-level analysis. Figure 1 ranks states by cumulative residential solar adoption relative to the size of their single-family housing stock. California has the highest adoption rate among the states covered by the Tracking the Sun data, making it a natural setting for studying household adoption decisions at scale. Figure 2 shows the rapid diffusion of residential solar in the United States, with adoption accelerating sharply after 2010. Figure 3 shows that, within California, solar adoption is higher in Democratic-leaning counties than in Republican-leaning counties, and that this gap widens over time. These aggregate patterns are suggestive, but they are not causal. Counties differ in electricity prices, incentives, permitting fee schedules, income, housing stock, installer presence, and political composition.

Table 1 reports summary statistics for the matched California owner-year panel, separately for Democratic and Republican homeowners. The panel contains 35.9 million owner-year observations and 2.35 million unique properties. The unconditional annual adoption hazard is 1.14 percent in the full sample, 1.15 percent for Democratic homeowners, and 1.12 percent for Republican homeowners. 17.33 percent of properties in the matched panel ever adopt solar; the corresponding figures are 17.66 percent for Democratic homeowners and 17.96 percent for Republican homeowners. Adoption during the observed owner spell is also similar across groups, at 15.65 percent for Democratic owners and 15.13 percent for Republican owners.

Republican and Democratic homeowners also appear similar on some ownership and mortgage characteristics, while differing on others. Average at-risk ownership-spell length is 27.90 years for Republican homeowners and 27.01 years for Democratic homeowners.[4] Among ownership spells for which we identify a purchase-linked mortgage, average mortgage amounts are lower for Republican homeowners in the matched sample, at about \$465,000 versus \$495,000 for Democratic homeowners, while average mortgage terms are nearly identical. As expected, Republican homeowners live in more Republican local political environments: the average county Republican share is 0.44 for Republican homeowners compared with 0.38 for Democratic homeowners; 31.75 percent of Republican owner-year observations are in red counties compared with 19.28 percent for Democratic owners.

Among observations with solar project characteristics, the average reported system size is 7.60 kW and the average permit-reported job value is approximately \$27,200.

[4] Note that at-risk housing tenure length can exceed the panel length because we observe the original date that the deed transacted, even if this date is before the starting year of our sample.

These magnitudes underscore that residential solar represents a substantial household capital investment. For comparison, the Consumer Expenditure Survey reports that, among households purchasing a vehicle in 2023, mean expenditures were $44,146 for a new car or truck and $18,052 for a used car or truck (Meyers et al., 2024). Thus, the average solar installation in our sample is of the same order of magnitude as an automobile purchase, one of the most consequential durable purchases made by households.

The unconditional means also differ across registered party groups. Average reported system size is 7.40 kW for Democrats and 7.92 kW for Republicans, while permit-reported job values are higher for Republican homeowners ($29,427) than for Democratic homeowners ($25,502). These raw differences should not be interpreted as conditional partisan effects: they reflect different mixes of locations, properties, and projects. Indeed, the fixed effect intensive margin regressions shrink the partisan gap in system size and permitted project job value to between 2–3%. The main empirical analysis therefore compares Republican and Democratic homeowners within much finer geographic and property-based risk sets.

4 Empirical Strategy

We estimate a high-dimensional fixed effects linear probability model of the solar adoption hazard,

$$Y_{ipt} = \beta Republican_{ip} + \alpha_p + \delta_{z(p)t} + \Lambda_{it} + \varepsilon_{ipt}, \tag{2}$$

where Y_{ipt} equals one if owner i of property p adopts solar in year t. The key coefficient, β, compares adoption under Republican versus Democratic ownership of the same house. Property fixed effects, α_p, absorb all time-invariant features of the house, including roof geometry, orientation, parcel characteristics, and micro-location. zip code-by-year fixed effects, $\delta_{z(p)t}$, absorb local housing market conditions that vary over time, including local demand, installer presence, permitting conditions, electricity prices, and incentive regimes common to the zip code-year. The vector Λ_{it} includes ownership-start-year-by-year, mortgage-amount-decile-by-year, and mortgage-term-decile-by-year fixed effects. Standard errors are clustered at the zip code level.

Identification comes from properties that are observed under successive owners of different parties. Because party is measured at the owner level and is fixed within an owner spell, the design does not rely on individuals changing political affiliation. It also does not hold all household characteristics fixed, since the owner changes. Its value is that it holds fixed the capital asset itself. The estimate therefore asks whether the same house is more or less likely to adopt solar when occupied by a Republican rather than a Democratic owner, conditional on local-year conditions and mortgage characteristics.

5 Main Results

We now turn to our main results on the magnitude of the partisan gap in solar adoption and present several dose-response tests to further highlight the role of political identity.

5.1 Partisan Gap in Solar Adoption

We begin by testing the model's first prediction: Democrats should be more likely than otherwise comparable Republicans to adopt solar. We therefore estimate whether political identity predicts the timing of first solar adoption. The outcome is an indicator equal to one in the year a property first receives a solar permit, and zero in earlier at-risk years.

Column (1) of Table 2 provides a narrow local-market benchmark by comparing Republican and Democratic owners on the same street in the same year. The estimate is -0.0011, implying a 0.11 percentage point lower annual adoption hazard under Republican ownership. This specification absorbs very local solar market conditions, including neighborhood demand, installer presence, permitting conditions, and contemporaneous policy or price conditions common to a street-year.

Columns (2)–(5) move to the within-house design. These specifications add property fixed effects and compare the same house when it is occupied by successive owners of different parties. Column (2), which includes property and zip code-by-year fixed effects, yields an estimate of -0.0100. Adding ownership-start-year-by-year fixed effects in column (3) attenuates the estimate to -0.0048. Column (4) instead combines the within-house design with zip code-by-street-by-year and ownership-start-year-by-year fixed effects and yields a similar estimate of -0.0045. Our preferred broad-sample specification is column (5), which adds mortgage-amount-decile-by-year and mortgage-term-decile-by-year fixed effects to the column (3) specification. The coefficient remains -0.0048, indicating that these mortgage controls do not explain the partisan gap. Relative to the 1.14 percent annual adoption hazard in the matched sample, this preferred estimate is about 42 percent of the mean.

Columns (6)–(7) add flexible controls for property characteristics interacted with year, including year built, building square footage, stories, and roof type. These specifications use much smaller samples because the property characteristics are not observed for all houses, but the Republican coefficients remain negative and of roughly the same magnitude, at -0.0042. Across all seven specifications, the sign of the Republican coefficient is therefore stable: solar adoption is lower under Republican ownership even after comparing within narrow local markets and within the same house.

5.2 Variation in Political Intensity

We next provide complementary dose-response tests of the political preference channel. In the cross-section, we ask both whether the partisan adoption gap is larger among households with stronger political engagement and whether solar adoption exhibits a broader gradient across party-registration categories. In the time series, we ask whether the gap widens when political identity becomes more salient following the 2016 presidential election.

Variation in Political Engagement. If political preferences directly shape solar adoption, the gap should be larger among households for whom political identity is more strongly expressed or salient. We therefore use voter file measures of political engagement and ideology to test whether the Republican adoption deficit increases with the intensity of political engagement.

We construct two measures of political engagement. The first is an extensive margin measure of participation: an indicator equal to one if the voter file records any political donation activity for the owner. The second is an intensity measure that classifies households as high- or low-engagement based on the frequency and amount of political donation activity. These measures capture whether the owner is politically active, and how intensely, rather than the ideological direction of the owner's beliefs.

Table 3 reports the results. Panel A splits the sample by donor status. The Republican coefficient is negative in both groups, but substantially larger among donors: -0.0130 among donors compared with -0.0030 among non-donors. With mortgage controls, the corresponding estimates are -0.0171 and -0.0034. Panel B shows the same ordering using political-engagement intensity. The coefficient is -0.0108 among high-engagement owners compared with -0.0035 among low-engagement owners, and -0.0179 versus -0.0039 with mortgage controls. Thus, the Republican adoption deficit is larger, not smaller, among more politically engaged owners.

This pattern is consistent with an identity-salience or expressive-political channel: the partisan difference in solar adoption is strongest among owners whose political engagement is more observable or intense. The results do not establish that expressive signaling is the unique mechanism, because political engagement may also proxy for stronger partisan beliefs, greater issue salience, or other correlated characteristics. But they no longer support an interpretation in which the gap is concentrated among politically disengaged households.

Partisan Gradient. As a complementary cross-sectional test, we broaden the baseline comparison beyond registered Democrats and Republicans. Table 4 adds unaffiliated and Green-registered owners, with Democrats as the omitted group, while retaining the same sequence of local-market and within-house specifications. In our preferred specification with mortgage controls, the coefficient is -0.0039 for unaffiliated owners and -0.0049 for Republicans relative to Democrats, while the coefficient for Green owners is 0.0007 and statistically insignificant. Thus, unaffiliated owners lie between Democrats and Republicans in adoption, whereas Green owners resemble Democrats.

This ordering is consistent with the political-preference channel rather than the partisan adoption gap arising solely from a binary Democratic vs. Republican contrast. Political science research emphasizes that unaffiliated and self-identified independent voters are a heterogeneous group, with many leaning toward one of the two major parties (Keith et al., 1992; Klar and Krupnikov, 2016). More importantly for our setting, survey evidence from California consistently places independent voters between Democrats and Republicans in their concern about climate change and support for renewable-energy policies.[5] If party registration proxies for the non-pecuniary environmental value households attach to adopting a politically salient clean-energy technology, this intermediate position maps naturally into an intermediate adoption deficit. The fact that Green owners are statistically indistinguishable from Democrats further reinforces this dose-response interpretation.

The 2016 Presidential Election. We next ask whether the partisan adoption gap exhibits a dose-response pattern over time with the political salience of environmental issues. If political preferences directly shape solar adoption, the gap should widen when climate and clean energy choices become more politically salient. We use the 2016 presidential election, which intensified partisan polarization around climate policy, as a time-series increase in the

[5] For example, the 2022 PPIC *Californians and the Environment* survey reports that 65 percent of Democrats, 45 percent of independents, and 20 percent of Republicans viewed climate change as a very serious threat to California's future economy and quality of life. In 2025, 85 percent of Democrats, 55 percent of independents, and approximately 28 percent of Republicans supported requiring California's electricity to come entirely from renewable sources by 2045 (Baldassare et al., 2022, 2025).

salience of political identity and examine whether the Republican adoption deficit becomes larger afterward. This interpretation is motivated by evidence that partisan differences in climate skepticism among Republicans increased following Donald Trump's rise to the presidency (Xia and Du, 2025).

Figure 4 estimates the dynamic Republican differential around the 2016 presidential election. The coefficients in the immediate pre-period do not show a clear differential trend. After 2016, the Republican differential becomes negative and remains persistently below zero. This timing is consistent with increasing political salience of climate and clean energy technologies.

Table 5 presents the difference-in-differences results. Across both specifications, Republican ownership is associated with lower solar adoption before 2016, and the gap becomes significantly larger afterward. In column (1), the Republican adoption deficit widens by 0.22 percentage points after 2016, while the more demanding street-by-year specification in column (2) yields a nearly identical increase of 0.24 percentage points. The stability of the estimates across specifications indicates that the post-2016 widening is not driven by changes in local solar market conditions. Viewed as an increase in the political salience of climate and clean energy choices, the 2016 election therefore generates a time-series dose-response pattern consistent with political preferences playing a greater role in solar adoption when partisan identity becomes more salient.

6 Mechanisms

We next turn to two tests that help distinguish the political preference channel from an alternative explanation based solely on partisan differences in expectations about future financial returns. First, we examine whether the adoption gap responds to financial incentives as predicted by the model, and second, whether political affiliation affects only the decision to adopt or also the scale of investment conditional on adoption.

6.1 Sensitivity to Financial Incentives

The model predicts that the partisan adoption gap should narrow as the private financial return to solar increases. Because Democrats derive a larger fixed non-pecuniary benefit from adoption, their decision is less sensitive to the investment's pecuniary return, while Republicans require a more favorable financial opportunity to adopt. We test this prediction using two sources of variation in the private economics of solar. The first is rebate generosity, which lowers the upfront cost of installation. The second is local solar irradiance. Holding system characteristics and electricity prices fixed, greater solar irradiance increases the electricity generated by a given amount of solar capacity and therefore increases the stream of bill savings and net-metering revenues generated by the investment. Prior work accordingly considers geographic variation in solar radiation as variation in solar generation potential and in the private benefits from adoption (Borenstein, 2017; Langer and Lemoine, 2022; Bollinger et al., 2025).

Panel A of Table 6 splits the within-house design by rebate generosity, as measured from the *Tracking the Sun* database. The Republican coefficient is essentially zero when rebates are at or above the median, but is −0.0101 when rebates are below the median; with mortgage controls, the corresponding estimates are approximately zero and −0.0094. Thus, the partisan adoption gap is sharply attenuated when subsidies make solar financially more attractive.

Panels B and C provide a complementary test using geographic variation in the solar resource. Panel B measures long-run Global Horizontal Irradiance (GHI) using the National Solar Radiation Database (NSRDB), while Panel C uses Surface Solar Radiation Downwards (SSRD) from ERA5-Land. The NSRDB combines satellite observations with a physical solar model and provides high-resolution measures of incident solar radiation, whereas ERA5-Land is a separately constructed meteorological reanalysis (Sengupta et al., 2018; Muñoz-Sabater et al., 2021). Both sources are widely used to characterize solar resources and photovoltaic generation potential (Ramirez Camargo and Schmidt, 2020). Despite their different construction, the two long-run zip code-level measures are highly correlated in our sample, and they produce nearly identical empirical patterns.[6]

Using NSRDB GHI, the Republican coefficient is -0.0037 in high-irradiance areas compared with -0.0066 in low-irradiance areas. The estimates are unchanged in magnitude after adding mortgage controls. Using ERA5-Land, the corresponding estimates are -0.0037 and -0.0064 without mortgage controls, and -0.0036 and -0.0065 with mortgage controls. Thus, across both measures, the Republican adoption deficit is roughly 40–45 percent smaller in areas with greater solar resources. Formal two-sided tests reject equality of the high- and low-irradiance coefficients in all four specifications.[7]

Taken together, the rebate and solar resource results deliver the same comparative static using economically distinct sources of variation. The partisan gap is largest when solar is financially less attractive—either because subsidies are less generous or because a given system produces less electricity—and narrows when the private return to adoption increases. The irradiance splits are not themselves a source of quasi-experimental variation, since high- and low-irradiance locations may differ along other dimensions. Nevertheless, their close correspondence across two independently constructed measures of the solar resource, together with the rebate results, provides additional evidence that conventional financial incentives moderate the partisan adoption gap in the direction predicted by the model.

6.2 Extensive vs. Intensive Margins of Adoption

Our baseline model described in Section 2 and presented in Appendix A predicts that political affiliation should affect whether households adopt solar, but not how much capacity they install conditional on adoption. Because the partisan wedge enters as a fixed non-

[6] The correlation between the long-run NSRDB GHI and ERA5-Land solar radiation measures across zip codes is 91.4%.

[7] For NSRDB GHI, the test statistics are 3.71 without mortgage controls and 3.42 with mortgage controls; for ERA5-Land, they are 3.74 and 3.37, respectively. All four two-sided p-values are below 0.001.

pecuniary benefit of becoming a solar adopter, it changes the extensive margin decision without altering the marginal financial tradeoff that determines system size. The model therefore predicts little or no partisan difference in investment scale among adopters.

An extension of our model delivers a different prediction if political affiliation instead reflects heterogeneous beliefs about future financial returns. Differences in expectations about electricity prices, net-metering compensation, tax incentives, or technology performance affect the perceived return to additional solar capacity and should therefore translate into differences in system size conditional on adoption. Comparing system size across Republican and Democratic adopters thus helps distinguish a fixed identity-based adoption wedge from a channel operating through beliefs about future financial returns.

As a result, we next examine whether the partisan gap extends to the scale of investment conditional on adoption. This margin cannot be estimated using the same within-house design as the adoption hazard. Each property adopts solar at most once, so property fixed effects mechanically absorb the adopter cross-section. We therefore study project characteristics among adopters using local-market specifications that compare Republican and Democratic adopters within the same zip code-by-street-by-year, with the same ownership-start-year and loan-characteristic controls used in the baseline. We estimate Poisson regressions for system size given the discrete nature of the outcome variable, following best practices outlined in Cohn et al. (2022).

Table 7 shows no evidence that Republican adopters install smaller systems. Without mortgage controls, Republican ownership is associated with a 0.0314 log-point larger system, or approximately 3.2 percent greater capacity. With mortgage controls, the estimate is 0.0246 log points, or about 2.5 percent, and remains statistically significant. The coefficients for permit-reported project value are of a similar magnitude: 0.0294 without mortgage controls and 0.0254 with mortgage controls.

A simple expectations channel that shifts perceived marginal financial returns would naturally predict partisan differences in both adoption and system size. In particular, systematically lower perceived returns among Republicans, due to differences in future regulation expectations, for instance, should reduce both their propensity to adopt solar and the optimal scale of investment conditional on adoption. In the data, however, the two margins move in opposite directions. Republicans are substantially less likely to adopt solar, yet conditional on adoption they install slightly larger systems.

The magnitude of this intensive margin difference is economically trivial. In our preferred specification, the difference is about 2.5 percent, or only 0.19 kW relative to the average solar system size of 7.6 kW. This additional capacity is roughly comparable to the power draw of a large television and, under typical California solar conditions, would generate only about four-fifths of the annual electricity consumed by a modern refrigerator.[8] We find a similarly small positive difference in permit-reported project value, about 2.6 percent, corresponding to only roughly $700 relative to the average system value. Its statistical significance should not be interpreted as evidence of a meaningful economic difference (McCloskey and Ziliak, 1996). With more than 2.5 million observations in our preferred specification, even very small differences can be estimated precisely.

The combination of a large negative extensive margin effect and economically negligible positive intensive margin effects is difficult to reconcile with a simple expectations-based explanation in which Republicans systematically perceive lower financial returns to solar. In the extension to our conceptual framework in Appendix A.1, we show that our intensive margin results can be rationalized by political identity having some effect on households' beliefs about future economic returns. Still, the clearest partisan difference lies on entry into the solar market rather than on the scale of investment after adoption.

[8] For comparison, ENERGY STAR reports average on-mode power consumption of 166 watts for a certified 85.6-inch television (ENERGY STAR, 2024). The U.S. Department of Energy estimates that a 1 kW solar system in California produces approximately 1,400–1,700 kWh annually, implying annual generation of roughly 266–323 kWh from 0.19 kW of capacity (U.S. Department of Energy, 2009). DOE estimates annual electricity use of approximately 364 kWh for an 18.1-cubic-foot ENERGY STAR refrigerator (U.S. Department of Energy, 2023).

7 Robustness Tests and Alternative Explanations

We present in this section several robustness checks and mechanism tests for our main results on the partisan gap in the extensive margin of residential solar adoption.

7.1 Local Political Environment

A natural alternative explanation is that the adoption gap reflects the local political environment rather than the owner's own political identity. Republican and Democratic homeowners may live in counties with different installer networks, peer effects, permitting practices, social norms, or local demand for solar. If this were the primary explanation, the Republican adoption gap should be concentrated in one type of county or disappear once we compare owners within the same local political environment.

Table 8 examines this possibility by estimating both same-street and within-house specifications separately in Republican- and Democratic-leaning counties. We classify counties using lagged presidential vote margins and report results for three thresholds: counties that lean Republican or Democratic by at least 10 percentage points, at least 5 percentage points, and by any positive margin. In the same-street specifications, the Republican coefficient is close to zero in Republican-leaning counties but about -0.0012 to -0.0016 in Democratic-leaning counties. The pattern remains after adding mortgage controls.

The within-house specifications show a negative Republican coefficient in both political environments, but the gap is consistently larger in Democratic-leaning counties. Under the strict 10-percentage-point threshold, Panel B1 reports estimates of -0.0028 in Republican-leaning counties and -0.0053 in Democratic-leaning counties; with mortgage controls in Panel B2, the estimates are -0.0022 and -0.0052. The same ordering appears under the 5-percentage-point and any-positive-margin definitions.

These results imply that local political environment does not by itself explain away the owner-level effect, because lower adoption under Republican ownership remains within the same house in both types of counties. At the same time, the surrounding political environment clearly moderates the magnitude of the gap: Republican ownership is associated with a larger adoption penalty in Democratic-leaning counties. This pattern is consistent with local norms, peer environments, or the political salience of solar interacting with owner identity.

8 Conclusion

Do households separate their political preferences from their investment decisions? We study this question using residential solar adoption, an investment with both private financial returns and salient environmental attributes. By linking over two million solar permits to property, mortgage, and voter registration records in California, we are able to compare solar adoption by successive Republican and Democratic owners of the same house. This design holds fixed permanent characteristics of the underlying asset and allows us to isolate the role of the homeowner's political affiliation from many differences in investment opportunities across locations and properties.

We find a large partisan gap in solar adoption. In our preferred within-house specification, Republican ownership reduces the annual probability of adoption by 0.48 percentage points, approximately 42 percent of the sample mean. A series of results points toward political preferences as an important component of this gap. The difference is substantially larger among households with greater political engagement and widens following the 2016 presidential election, when climate and clean energy choices became increasingly politically salient. At the same time, the gap narrows sharply when the private financial returns to solar improve through more generous rebates. In environments with sufficiently strong financial incentives, the partisan gap becomes economically small or disappears altogether.

The distinction between the extensive and intensive margins of investment further helps discipline the mechanism. Conditional on adopting solar, we find little evidence of economically meaningful partisan differences in investment scale. Republican adopters install systems which are only 2–3% larger and more expensive than those installed by Democrats. This combination of a large difference in whether households invest and little difference in how much they invest once they enter is consistent with our simple model in which political preferences affect the fixed non-pecuniary value of becoming a solar adopter. It is more difficult to reconcile with an explanation based solely on partisan differences in expectations about future financial returns, which should also affect the optimal scale of investment.

These findings have broader implications for household finance and sustainable investment. The classical separation between investment choices and non-pecuniary objectives need not hold when investment itself carries social, environmental, or political meaning. Political preferences can shape the adoption of real technologies even when households face similar physical investment opportunities and local economic conditions. At the same time, these preferences do not make households insensitive to prices. Rather, financial and non-financial motives interact. Stronger economic incentives can overcome differences in the non-pecuniary value households attach to an investment and substantially reduce the resulting partisan gap.

More broadly, our results suggest that the diffusion of technologies associated with the energy transition cannot be understood solely through their financial returns. When technologies acquire political or social meaning, otherwise comparable households may respond differently to the same investment opportunity. Understanding these non-pecuniary motives, and how they interact with conventional financial incentives, is therefore important for explaining household capital allocation and for designing policies intended to accelerate the adoption of socially valuable technologies.

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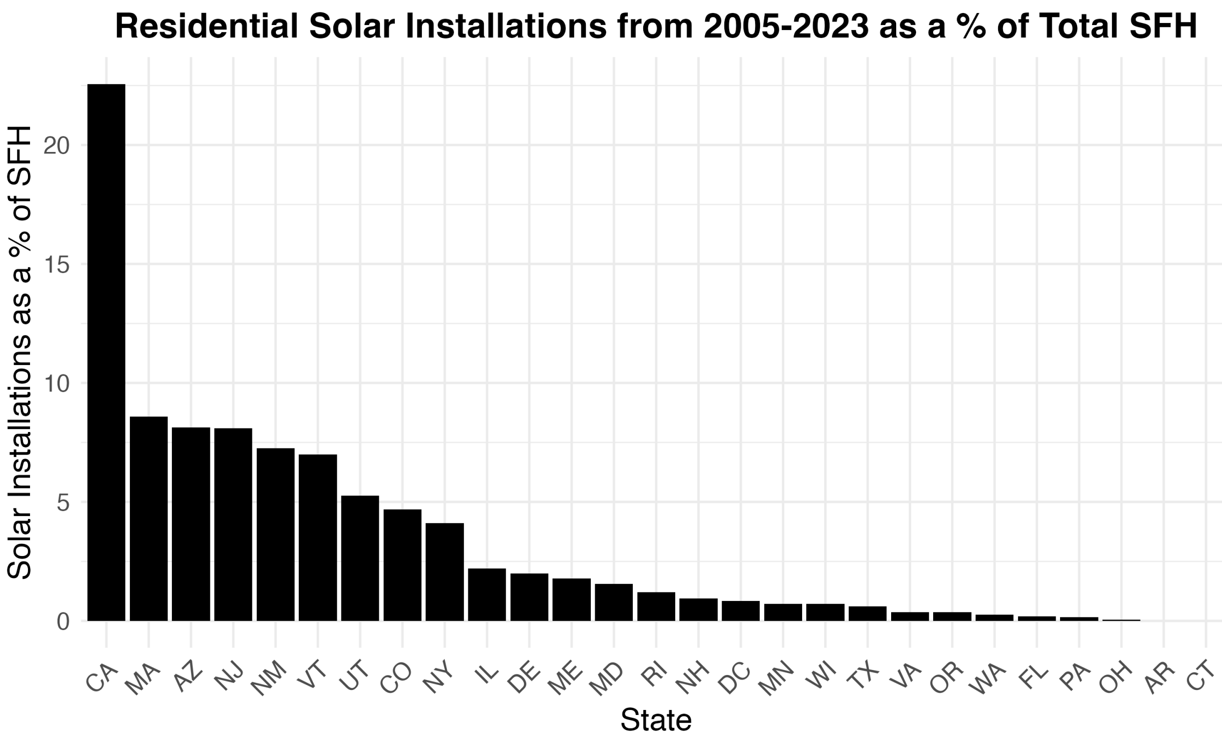
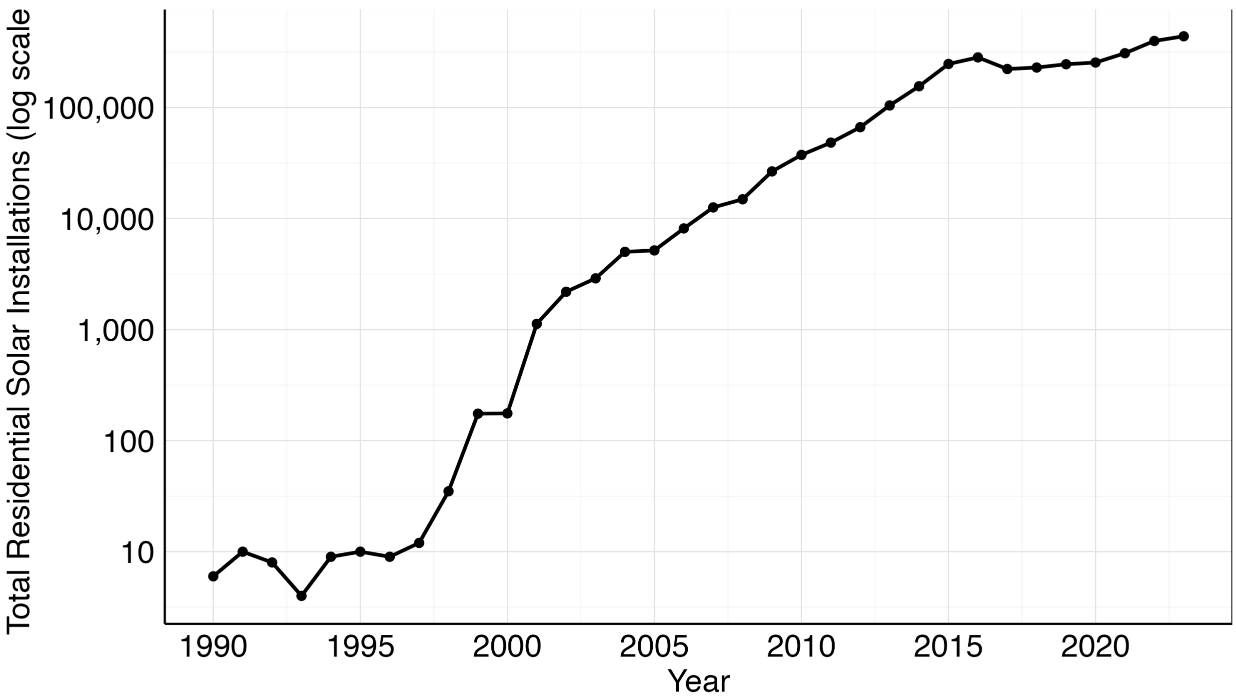
Tables and Figures

Figure 1. Residential Solar Adoption by State



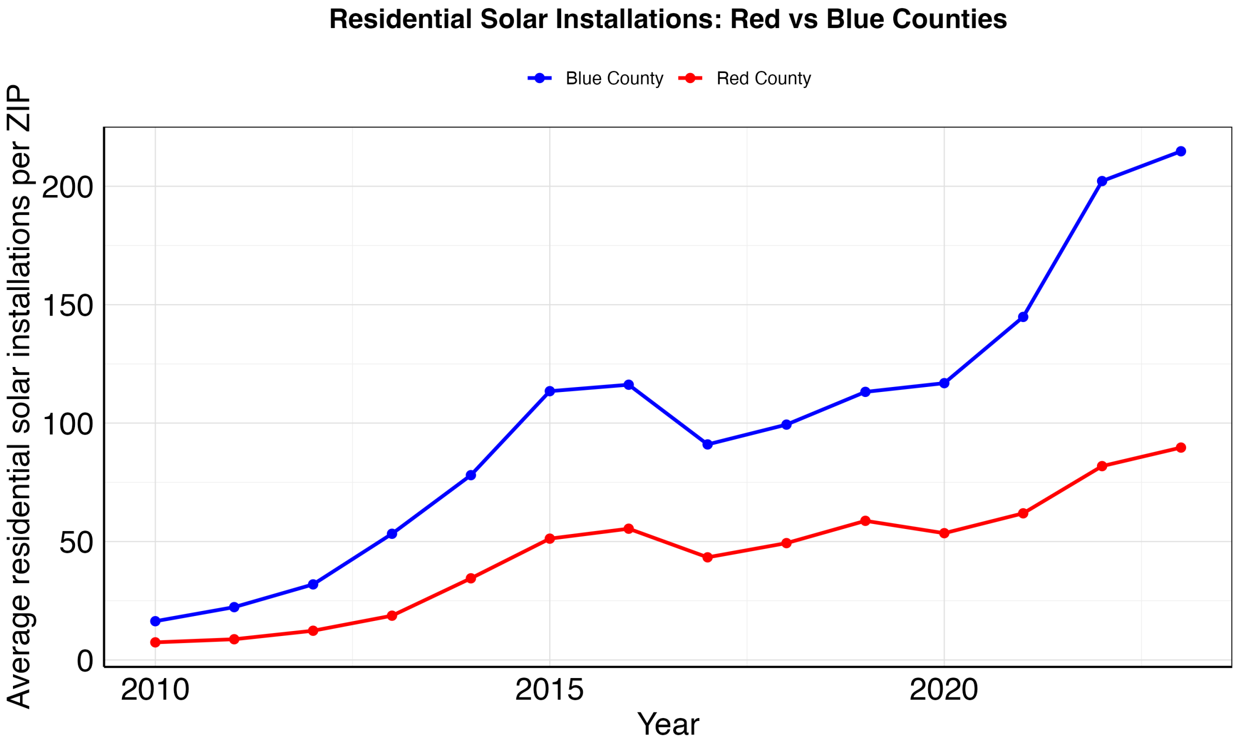
Notes: This figure ranks states by residential solar adoption relative to the size of their single-family housing stock. Each bar is the cumulative number of residential solar installations recorded in the state between 2005 and 2023, divided by the state's stock of single-family homes and expressed as a percentage; the 26 states and the District of Columbia covered by the data are ordered from the highest ratio to the lowest. Installations come from the Lawrence Berkeley National Laboratory *Tracking the Sun* data, an installation-level file of grid-connected distributed photovoltaic systems compiled from state agencies, utilities, and incentive program administrators, restricted to the residential customer segment. We measure the number of single-family homes for each state using the tax assessor's office count as of 2023, as tabulated from Cotality *Property Basic (Tax)*.

Figure 2. Residential Solar Adoption over Time



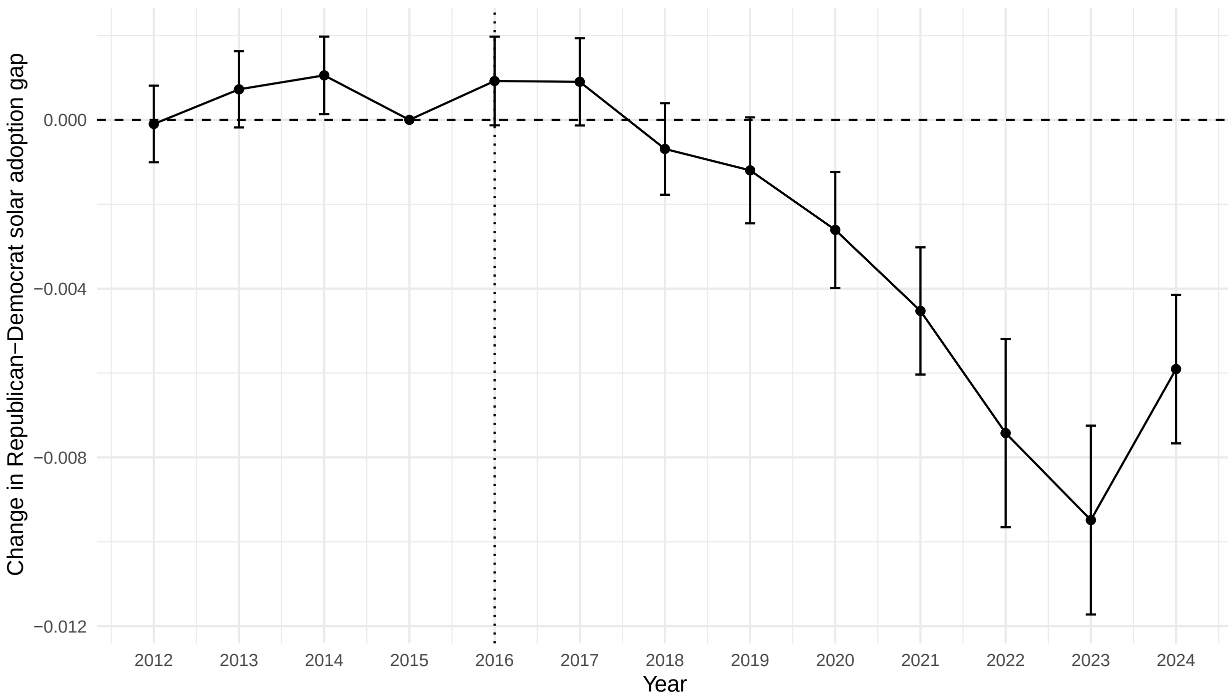
Notes: This figure plots the total number of residential solar installations recorded nationwide in each year from 1990 to 2023. A marker is the count of residential systems whose installation date falls in that year, pooled across every state in the data. Time on the horizontal axis is the calendar year of installation, and the vertical axis is drawn on a log scale, so a constant slope corresponds to a constant growth rate. Installations come from the Lawrence Berkeley National Laboratory *Tracking the Sun* data, restricted to the residential customer segment. The data are assembled from the state and utility programs that report to them, so the count in a given year reflects both installation activity and program coverage in that year.

Figure 3. Residential Solar Adoption in Democrat- and Republican-Leaning California Counties



Notes: This figure compares residential solar installations in Democratic- and Republican-leaning California counties. A marker is the average number of residential solar installations per zip code in a year, averaged across the zip codes of the counties in the group, and time on the horizontal axis is the calendar year of installation, from 2010 to 2024. A county is Democratic-leaning (blue) if the Democratic share of the two-party presidential vote exceeds the Republican share by at least 10 percentage points and Republican-leaning (red) if the Republican margin is at least 10 points. The figure plots only these two groups, and counties whose margin falls inside the 10-point window appear in neither series. County presidential returns come from the MIT Election Data and Science Lab county-level presidential election file, matched to the most recent presidential election preceding the year plotted, and installations come from the Lawrence Berkeley National Laboratory *Tracking the Sun* data restricted to California.

Figure 4. Dynamic Republican Adoption Gap around the 2016 Presidential Election.



Notes: This figure reports event-study estimates of the change in the Republican residential solar adoption gap around the 2016 presidential election, estimated by OLS with high-dimensional fixed effects. The dependent variable is an indicator equal to one in the year the property receives its first solar permit and zero in every other year its owner is at risk, and the unit of observation is an owner-property-year. The sample is the California owner panel matched to the L2 voter file and restricted to owners registered as Democratic, Republican, Green, or unaffiliated, over the years 2012 to 2024; the treatment group is owners registered as Republican, and the comparison group is every other registration in that sample. Each marker is the coefficient on the interaction of the Republican indicator with a calendar-year indicator, taken from a single regression that also includes the Republican main effect, with 2015 as the omitted year, so an estimate measures the Republican adoption gap in that year relative to 2015. Time on the horizontal axis is measured in calendar years, and the dotted vertical line marks 2016, the year of the election. The specification absorbs property, zip code $\times$ street $\times$ year, ownership-start-year $\times$ year, mortgage-amount-decile $\times$ year, and mortgage-term-decile $\times$ year fixed effects, so the Republican main effect is identified from changes in the registration of successive owners of the same house. Vertical bars are 95 percent confidence intervals built from standard errors clustered by property zip code.

Table 1. Summary Statistics by Registered Party (Matched California Panel)

Variables	All	Democratic	Republican
Owner-year observations	35,909,317	19,578,232	16,331,085
Unique properties	2,354,502	1,341,511	1,123,707
Unique owner spells	2,647,813	1,440,983	1,206,930
Adoption hazard (%)	1.14	1.15	1.12
At-risk ownership-spell duration (years)	27.42	27.01	27.90
Ever solar (%)	17.33	17.66	17.96
Adopted during owner spell (%)	15.41	15.65	15.13
Sale amount ($)	449,265.99	452,117.42	445,862.55
Owner spells with any mortgage (%)	63.65	62.58	64.93
Owner spells with purchase mortgage (%)	12.19	12.86	11.39
Purchase mortgage amount ($)	482,204.62	494,833.56	465,157.65
Purchase mortgage term (years)	29.62	29.64	29.58
County Republican share	0.41	0.38	0.44
County Republican margin	-0.18	-0.23	-0.13
Red county (%)	24.95	19.28	31.75
Top-decile Republican county (%)	10.06	7.35	13.32
Political donor (%)	13.56	13.14	14.13
Solar system size (kW)	7.60	7.40	7.92
Permit job value ($)	27198.61	25501.65	29426.52
Solar + storage at adoption (%)	11.89	13.17	11.09

Notes: This table reports summary statistics for the California owner-year panel used in the main analysis, for all owners and separately for owners registered as Democrats and Republicans in the L2 voter file. The panel covers 2000 to 2025; an ownership spell enters in the later of 2000 and the year of the ownership transfer and exits in the year of the property's first solar permit, the year before the next transfer, or 2025. Owners who acquire a property after it has adopted solar are excluded. The adoption hazard is the share of owner-years in which the property receives its first solar permit. Ownership spell length, sale amount, purchase mortgage, mortgage amount, mortgage term, adoption during the spell, and political donor status are averaged over one observation per ownership spell; a purchase mortgage is defined as the mortgage on the property closest in time to the ownership transfer, provided that it occurs within 90 days before or after the transfer. Mortgage amount and term refer to this purchase-linked mortgage and are averaged among ownership spells for which such a mortgage is identified. Ever solar and any mortgage are averaged over one observation per property, and solar system size, permit job value, and solar plus storage over one observation per adopting property. County Republican share and margin are the Republican share and the Republican minus Democratic share of the county two-party vote in the most recent presidential election held before the panel year; a red county has a positive margin, and a top-decile Republican county has a share at or above the 90th percentile of the owner-year distribution. Solar permits, ownership transfers, property characteristics, and mortgages come from Cotality, party registration and donor information from L2, and county presidential returns from the MIT Election Data and Science Lab.

Table 2. Political Identity and Residential Solar Adoption: Extensive Margin

	Solar Adoption Hazard $\{0,1\}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Republican	-0.0011^{***}	-0.0100^{***}	-0.0048^{***}	-0.0045^{***}	-0.0048^{***}	-0.0042^{***}	-0.0042^{***}
	(7.85×10^{-5})	(0.0004)	(0.0004)	(0.0005)	(0.0004)	(0.0005)	(0.0006)
ZIP × Street × Year FE	Yes	No	No	Yes	No	No	No
Property FE	No	Yes	Yes	Yes	Yes	Yes	Yes
ZIP × Year FE	No	Yes	Yes	No	Yes	Yes	Yes
Ownership-start-year × Year FE	No	No	Yes	Yes	Yes	Yes	Yes
Mortgage-amount-decile × Year FE	No	No	No	No	Yes	No	Yes
Mortgage-term-decile × Year FE	No	No	No	No	Yes	No	Yes
Year-built-bin × Year FE	No	No	No	No	No	Yes	Yes
Building-sq.-ft.-decile × Year FE	No	No	No	No	No	Yes	Yes
Stories-bin × Year FE	No	No	No	No	No	Yes	Yes
Roof-type × Year FE	No	No	No	No	No	Yes	Yes
Observations	35,909,317	35,909,317	35,909,317	35,909,317	18,709,936	11,206,716	6,709,432
R^2	0.3552	0.1713	0.1839	0.4664	0.2095	0.1929	0.2127

Notes: This table reports linear probability estimates of the annual solar adoption hazard using OLS with high-dimensional fixed effects. The unit of observation is an owner-property-year in the California owner-year panel, 2000 to 2025, restricted to owners matched to a Democratic or Republican registration in the L2 voter file. The dependent variable equals one in the year in which the property receives its first solar permit and zero in earlier years in which the owner is at risk; ownership spells that begin after the property has adopted are excluded. Republican is an indicator for the owner being registered as a Republican, so each coefficient is the difference in the annual adoption probability between Republican and Democratic owners. Column 1 compares owners within the same zip code, street, and year. Columns 2 to 7 add property fixed effects, so the coefficient is identified from successive owners of the same house. Column 2 includes zip code × year fixed effects, column 3 adds ownership-start-year × year fixed effects, and column 4 replaces zip code × year with zip code × street × year fixed effects. Column 5 adds mortgage-amount-decile × year and mortgage-term-decile × year fixed effects to column 3, column 6 instead adds year-built-bin × year, building-square-footage-decile × year, stories-bin × year, and roof-type × year fixed effects, and column 7 includes both sets. Mortgage deciles refer to the mortgage attached to the ownership spell, and property characteristics come from Cotality tax records; observations with a missing value of an interacted variable drop out of columns 5 to 7. Standard errors clustered by property zip code in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 3. Political Engagement, Ideology, and the Republican Adoption Gap

	Solar Adoption Hazard $\{0, 1\}$			
	Without Mortgage Controls		With Mortgage Controls	
	(1)	(2)	(3)	(4)
Panel A: Political donation status				
	Non-donor	Donor	Non-donor	Donor
Republican	-0.0030^{***}	-0.0130^{***}	-0.0034^{***}	-0.0171^{***}
	(0.0006)	(0.0034)	(0.0008)	(0.0046)
Observations	20,195,460	3,398,132	10,023,838	1,650,500
R^2	0.2159	0.2034	0.2469	0.2404
Panel B: Partisan engagement intensity				
	Low intensity	High intensity	Low intensity	High intensity
Republican	-0.0035^{***}	-0.0108^{*}	-0.0039^{***}	-0.0179^{**}
	(0.0006)	(0.0057)	(0.0008)	(0.0082)
Observations	21,568,795	2,024,797	10,699,840	974,498
R^2	0.2137	0.2076	0.2446	0.2504
Property FE	Yes	Yes	Yes	Yes
ZIP × Year FE	Yes	Yes	Yes	Yes
Ownership-start-year × Year FE	Yes	Yes	Yes	Yes
Mortgage-amount-decile × Year FE	No	No	Yes	Yes
Mortgage-term-decile × Year FE	No	No	Yes	Yes

Notes: This table reports linear probability estimates of the annual solar adoption hazard in subsamples split by the owner's political engagement. The unit of observation is an owner-property-year in the two-party California panel, the dependent variable equals one in the year of the property's first solar permit and zero in earlier at-risk years, and Republican is an indicator for the owner being registered as a Republican, with Democratic owners as the comparison group. Panel A splits owners by political donor status: an owner is a donor if the L2 consumer file flags a donation to conservative political causes, liberal political causes, or state-level political campaigns, or if the L2 file records a positive amount of federal contributions reported to the Federal Election Commission (FEC). Columns 1 and 3 use non-donors, and columns 2 and 4 use donors. Panel B splits owners by the intensity of engagement: low intensity comprises non-donors and donors without an FEC record, and high intensity comprises owners with FEC-reported federal contributions. Columns 1 and 3 use low-intensity owners, and columns 2 and 4 use high-intensity owners. Donor information is matched once per owner on zip code and name, and owners without a donor match are excluded. All columns include property, zip code × year, and ownership-start-year × year fixed effects; columns 3 and 4 add mortgage-amount-decile × year and mortgage-term-decile × year fixed effects. Coefficients are estimated on separate subsamples, so differences across columns are not formal tests of equality. Standard errors clustered by property zip code in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 4. Partisan Gradient in Residential Solar Adoption

	Solar Adoption Hazard $\{0,1\}$						
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Green	-0.0004	0.0001	0.0016	0.0020	0.0007	0.0007	-0.0008
	(0.0003)	(0.0014)	(0.0015)	(0.0021)	(0.0020)	(0.0026)	(0.0031)
Unaffiliated	-0.0002***	-0.0021***	-0.0035***	-0.0033***	-0.0039***	-0.0038***	-0.0043***
	(0.0001)	(0.0003)	(0.0003)	(0.0004)	(0.0004)	(0.0004)	(0.0005)
Republican	-0.0012***	-0.0097***	-0.0047***	-0.0042***	-0.0049***	-0.0043***	-0.0044***
	(0.0001)	(0.0004)	(0.0003)	(0.0004)	(0.0004)	(0.0005)	(0.0006)
Property FE	No	Yes	Yes	Yes	Yes	Yes	Yes
ZIP × Year FE	No	Yes	Yes	No	Yes	Yes	Yes
Street × ZIP × Year FE	Yes	No	No	Yes	No	No	No
Ownership cohort × Year FE	No	No	Yes	Yes	Yes	Yes	Yes
Mortgage controls	No	No	No	No	Yes	No	Yes
Property controls	No	No	No	No	No	Yes	Yes
Observations	46,543,188	46,543,188	46,543,188	46,543,188	24,490,689	14,468,043	8,724,642
R^2	0.305	0.165	0.178	0.420	0.202	0.185	0.203

Notes: This table reports linear probability estimates of the annual solar adoption hazard by party registration. The unit of observation is an owner-property-year in the California owner-year panel, 2000 to 2025, for owners matched to the L2 voter file and registered as Democratic, Republican, Green, or unaffiliated, where unaffiliated combines no party preference, declined to state, and registered independent. The dependent variable equals one in the year in which the property receives its first solar permit and zero in earlier at-risk years. The regressors are indicators for the owner's registration, with Democratic owners as the omitted group, so each coefficient is the difference in the annual adoption probability relative to a Democratic owner. Column 1 compares owners within the same zip code, street, and year. Columns 2 to 7 add property fixed effects: column 2 includes zip code × year fixed effects, column 3 adds ownership-start-year × year fixed effects, and column 4 replaces zip code × year with zip code × street × year fixed effects. Column 5 adds mortgage-amount-decile × year and mortgage-term-decile × year fixed effects to column 3, column 6 instead adds year-built-bin × year, building-square-footage-decile × year, stories-bin × year, and roof-type × year fixed effects, and column 7 includes both sets. Standard errors clustered by property zip code in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 5. Partisan Solar Adoption Gap Before and After the 2016 Election

	Solar Adoption Hazard $\{0, 1\}$	
	(1)	(2)
Republican	-0.0076^{***}	-0.0069^{***}
	(0.0007)	(0.0010)
Republican × Post-2016	-0.0022^{***}	-0.0024^{***}
	(0.0002)	(0.0002)
Property FE	Yes	Yes
ZIP × Year FE	Yes	No
ZIP × Street × Year FE	No	Yes
Ownership-start-year × Year FE	Yes	Yes
Observations	20,262,666	20,262,666
R^2	0.2538	0.5151

Notes: This table reports difference-in-differences estimates of the change in the partisan solar adoption gap after the 2016 presidential election using OLS with high-dimensional fixed effects. The unit of observation is an owner-property-year in the California two-party panel, and the dependent variable equals one in the year in which the property receives its first solar permit and zero in earlier at-risk years. Republican is an indicator for the owner being registered as a Republican, with Democratic owners as the comparison group. Post-2016 equals one for years after 2016. The coefficient on Republican therefore captures the Republican-Democratic adoption gap in the pre-2017 period, while the coefficient on Republican × Post-2016 captures the change in this gap after 2016. The main effect of Post-2016 is absorbed by the time-varying fixed effects. Column 1 includes property, zip code × year, and ownership-start-year × year fixed effects. Column 2 replaces zip code × year fixed effects with zip code × street × year fixed effects. Standard errors are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 6. Financial Incentives and the Partisan Adoption Gap

	Solar Adoption Hazard $\{0,1\}$			
Panel A: Heterogeneity by Solar Rebate				
	Without Mortgage Controls		With Mortgage Controls	
	(1) Rebate $\geq$ median	(2) Rebate $<$ median	(3) Rebate $\geq$ median	(4) Rebate $<$ median
Republican	7.93×10^{-5}	-0.0101^{***}	0.0001	-0.0094^{***}
	(0.0002)	(0.0008)	(0.0002)	(0.0009)
Observations	17,563,661	17,628,535	9,040,605	9,348,156
R^2	0.2027	0.3081	0.2132	0.3201
Panel B: Heterogeneity by Solar Irradiance (NSRDB GHI)				
	Without Mortgage Controls		With Mortgage Controls	
	(1) High GHI	(2) Low GHI	(3) High GHI	(4) Low GHI
Republican	-0.0037^{***}	-0.0066^{***}	-0.0037^{***}	-0.0066^{***}
	(0.0005)	(0.0006)	(0.0006)	(0.0006)
Observations	21,763,144	14,138,934	11,326,784	7,379,199
R^2	0.1869	0.1789	0.2134	0.2031
Panel C: Heterogeneity by Solar Irradiance (ERA5-Land)				
	Without Mortgage Controls		With Mortgage Controls	
	(1) High ERA5 Solar	(2) Low ERA5 Solar	(3) High ERA5 Solar	(4) Low ERA5 Solar
Republican	-0.0037^{***}	-0.0064^{***}	-0.0036^{***}	-0.0065^{***}
	(0.0004)	(0.0006)	(0.0005)	(0.0007)
Observations	21,226,795	14,675,283	11,084,722	7,621,261
R^2	0.1847	0.1827	0.2110	0.2075
Property FE	Yes	Yes	Yes	Yes
ZIP $\times$ Year FE	Yes	Yes	Yes	Yes
Ownership-start-year $\times$ Year FE	Yes	Yes	Yes	Yes
Mortgage-amount-decile $\times$ Year FE	No	No	Yes	Yes
Mortgage-term-decile $\times$ Year FE	No	No	Yes	Yes

Notes: This table reports linear probability estimates of the annual solar adoption hazard in subsamples split by financial incentives for solar adoption. The unit of observation is an owner-property-year in the two-party California panel, the dependent variable in each regression is a dummy equal to one in the year of the property's first solar permit and zero in earlier at-risk years, and Republican is an indicator for the owner being registered as a Republican, with Democratic owners as the comparison group. In Panel A, the sample is split at the median of the lagged average rebate per kilowatt of installed capacity: columns 1 and 3 include county-years with rebates at or above the median, while columns 2 and 4 include county-years with rebates below the median. Rebates are computed from Lawrence Berkeley National Laboratory's Tracking the Sun data for California systems, aggregated to the county-year from zip codes using 2020 ZCTA centroids, and measured in the year before the panel year. The median is taken over owner-year observations with a non-missing rebate, and observations without a rebate are excluded. In Panel B, solar exposure is measured using Global Horizontal Irradiance (GHI) from the National Solar Radiation Database (NSRDB). Each zip code is matched to the nearest 4-km NSRDB grid point, and GHI is averaged over 1998–2011. In Panel C, solar exposure is measured using Surface Solar Radiation Downwards (SSRD) from ERA5-Land. Monthly radiation over 1998–2011 is averaged to construct an alternative long-run zip code-level measure of solar resource availability. High and Low solar exposure groups are defined relative to the sample median of the respective measure. All columns include property, zip code $\times$ year, and ownership-start-year $\times$ year fixed effects. Columns 3 and 4 additionally include mortgage-amount-decile $\times$ year and mortgage-term-decile $\times$ year fixed effects. Coefficients are estimated on separate subsamples, so differences across columns are not formal tests of equality. Standard errors clustered by property zip code are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 7. Political Identity and Investment Intensity, Conditional on Adoption

	Without Mortgage Controls		With Mortgage Controls	
	(1) System size (kW)	(2) Log project value	(3) System size (kW)	(4) Log project value
Republican	0.0314***	0.0294***	0.0246***	0.0254***
	(0.0034)	(0.0045)	(0.0046)	(0.0057)
ZIP × Street × Year FE	Yes	Yes	Yes	Yes
Ownership-start-year × Year FE	Yes	Yes	Yes	Yes
Mortgage-amount-decile × Year FE	No	No	Yes	Yes
Mortgage-term-decile × Year FE	No	No	Yes	Yes
Observations	3,759,208	2,843,525	2,538,621	1,902,694
R^2	0.2769	0.6736	0.2884	0.7673

Notes: This table reports estimates of the relation between the owner's party registration and the size of the solar investment, conditional on adoption. The unit of observation is an owner-property-year, and the sample comprises owner-years of properties in the two-party panel that receive a solar permit with a non-missing value of the dependent variable. In columns 1 and 3, the dependent variable is system capacity in kilowatts reported on the property's solar permits, estimated using Poisson pseudo-maximum likelihood (PPMLE), following the best practices for count data outlined in Cohn et al. (2022) The PPMLE coefficients can be interpreted approximately as percentage differences in system capacity; the exact percentage effect is $100 \times [\exp(\beta) - 1]$. In columns 2 and 4, the dependent variable is the log of one plus the permit-reported job value summed over the property's solar permits, estimated by OLS. Both outcomes are constructed from Cotality building permits. Republican is an indicator for the owner being registered as a Republican, and the comparison group is Democratic owners. All columns include zip code × street × year and ownership-start-year × year fixed effects; columns 3 and 4 additionally include mortgage-amount-decile × year and mortgage-term-decile × year fixed effects for the mortgage attached to the ownership spell. Property fixed effects are not included because each property adopts at most once. Standard errors clustered by property zip code are reported in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Table 8. Heterogeneity in Adoption Rates by County Political Tilt

	(1)	(2)	(3)	(4)	(5)	(6)
Threshold	$\geq 10\%$		$\geq 5\%$		$> 0\%$	
County lean	Rep.	Dem.	Rep.	Dem.	Rep.	Dem.
Panel A1: Same-street specification						
Republican	5.93×10^{-5}	-0.0012^{***}	-7.80×10^{-5}	-0.0013^{***}	-7.39×10^{-5}	-0.0013^{***}
	(0.0001)	(8.48×10^{-5})	(0.0001)	(8.86×10^{-5})	(9.37×10^{-5})	(9.31×10^{-5})
ZIP × Street × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ownership-start-year × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,332,408	30,576,909	7,103,146	28,806,171	8,958,808	26,950,509
R^2	0.3806	0.3559	0.3788	0.3551	0.3797	0.3543
Panel A2: Same-street specification						
Republican	0.0001	-0.0014^{***}	-6.35×10^{-5}	-0.0015^{***}	-8.33×10^{-5}	-0.0016^{***}
	(0.0002)	(0.0001)	(0.0002)	(0.0001)	(0.0002)	(0.0001)
ZIP × Street × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ownership-start-year × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mortgage-amount-decile × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mortgage-term-decile × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,551,563	16,158,373	3,470,750	15,239,186	4,410,453	14,299,483
R^2	0.4964	0.4637	0.4949	0.4625	0.4964	0.4615
Panel B1: Within-dwelling specification						
Republican	-0.0028^{***}	-0.0053^{***}	-0.0042^{***}	-0.0055^{***}	-0.0035^{***}	-0.0060^{***}
	(0.0007)	(0.0004)	(0.0008)	(0.0004)	(0.0007)	(0.0005)
Property FE	Yes	Yes	Yes	Yes	Yes	Yes
ZIP × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ownership-start-year × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5,332,408	30,576,909	7,103,146	28,806,171	8,958,808	26,950,509
R^2	0.2176	0.1954	0.2171	0.1924	0.2227	0.2029
Panel B2: Within-dwelling specification						
Republican	-0.0022^{**}	-0.0052^{***}	-0.0044^{***}	-0.0054^{***}	-0.0036^{***}	-0.0058^{***}
	(0.0010)	(0.0005)	(0.0010)	(0.0005)	(0.0008)	(0.0005)
Property FE	Yes	Yes	Yes	Yes	Yes	Yes
ZIP × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Ownership-start-year × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mortgage-amount-decile × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Mortgage-term-decile × Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,551,563	16,158,373	3,470,750	15,239,186	4,410,453	14,299,483
R^2	0.2535	0.2187	0.2510	0.2156	0.2564	0.2249

Notes: This table reports linear probability estimates of the annual solar adoption hazard in subsamples defined by the political lean of the property's county. The unit of observation is an owner-property-year in the two-party California panel, the dependent variable equals one in the year of the property's first solar permit and zero in earlier at-risk years, and Republican is an indicator for the owner being registered as a Republican, with Democratic owners as the comparison group. County lean is the Republican minus Democratic share of the county two-party vote in the most recent presidential election held before the panel year. Columns 1, 3, and 5 use county-years in which this margin is at least 10 percentage points, at least 5 percentage points, and non-negative, respectively; columns 2, 4, and 6 use the remaining county-years, in which the margin is below the corresponding threshold. Panels A1 and A2 compare owners within the same zip code, street, and year, and Panels B1 and B2 include property fixed effects, so the coefficient is identified from successive owners of the same house, together with zip code × year fixed effects. All panels include ownership-start-year × year fixed effects, and Panels A2 and B2 add mortgage-amount-decile × year and mortgage-term-decile × year fixed effects. Coefficients are estimated on separate subsamples, so differences across columns are not formal tests of equality. Standard errors clustered by property zip code in parentheses. $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.

Online Appendix to

Do Households Separate Politics from Investment? Evidence from Residential Solar

by Aymeric Bellon (UNC–Chapel Hill), Cameron LaPoint (Yale SOM), *and* Avantika Pal (University of Illinois Urbana-Champaign)

A Conceptual Framework

Consider a household i deciding whether to install solar panels and, conditional on installation, how large a system to choose. A system of size s generates objective private surplus

$$\Pi_i(s, c) = CF_i(s) - C_i(s, c),$$

where $CF_i(s)$ is the present value of bill savings, tax credits, net-metering revenues, and other private cash flows, while $C_i(s, c)$ is the cost of installation. The parameter c captures exogenous variation in the cost of adopting solar, such as changes in tax incentives or installation costs.

Solar may also generate non-pecuniary utility. We model this component as a fixed benefit B_g associated with being a solar adopter, where $g \in \{D, R\}$ indexes political affiliation. We assume

$$B_D > B_R.$$

This assumption is motivated by a large literature documenting partisan differences in environmental preferences (Leiserowitz et al., 2023). Democrats express greater concern about climate change and attach greater value to the environmental benefits of energy conservation (Gromet et al., 2013; Costa and Kahn, 2013), while Republicans place greater weight on the economic costs and benefits of renewable energy (Gustafson et al., 2020).

Treating this benefit as primarily fixed rather than proportional to system size captures the idea that environmental, identity, or social-image benefits arise importantly from the act of adopting a salient green technology.

Let ε_{i1} and ε_{i0} be i.i.d. Type-I extreme-value utility shocks associated with adoption and non-adoption, respectively. Conditional on adopting, household i chooses

$$s_i^*(c) = \arg\max_s \Pi_i(s, c).$$

Because B_g is fixed with respect to system size, it does not enter this choice. The optimal system therefore satisfies

$$\frac{\partial CF_i(s_i^*)}{\partial s} = \frac{\partial C_i(s_i^*, c)}{\partial s},$$

and, for otherwise identical Democratic and Republican households,

$$s_D^*(c) = s_R^*(c).$$

Political preferences can consequently affect whether a household adopts without affecting how much capacity it installs conditional on adoption.

Define the optimized private value of solar as

$$V_i(c) = \max_s \Pi_i(s, c).$$

The household adopts whenever

$$V_i(c) + B_g + \varepsilon_{i1} > \varepsilon_{i0}.$$

The Type-I extreme-value assumption implies:

$$P_g(c) \equiv \Pr(\text{Adopt}_i = 1 \mid g) = \Lambda\left(V_i(c) + B_g\right).$$

The model delivers three predictions.

Prediction 1: Democrats adopt solar more frequently. Because $B_D > B_R$,

$$P_D(c) > P_R(c).$$

Thus, even when two households face the same objective costs and benefits of solar, the household attaching greater non-pecuniary value to adoption is more likely to invest.

Prediction 2: Political affiliation does not affect system size conditional on adoption. Because the partisan component B_g is a fixed benefit of adoption,

$$s_D^*(c) = s_R^*(c).$$

The model therefore predicts a partisan difference on the extensive margin but no difference on the intensive margin. In an extension, we show that differences in system size conditional on adoption are consistent with differences in expectations about future financial incentives of adopting solar panels.

Prediction 3: Republican adoption is more sensitive to economic incentives. Since a higher B_g makes adoption less dependent on its pecuniary return, households with weaker non-pecuniary preferences respond more strongly, in proportional terms, to changes in costs. The elasticity of adoption with respect to c is

$$\frac{\partial \log P_g(c)}{\partial \log c} = \left[1 - P_g(c)\right] \frac{\partial V_i(c)}{\partial c} c.$$

Since a higher cost lowers private investment value,

$$\frac{\partial V_i(c)}{\partial c} < 0.$$

Moreover, because $P_R < P_D$,

$$1 - P_R > 1 - P_D.$$

It follows that

$$\left| \frac{\partial \log P_R}{\partial \log c} \right| > \left| \frac{\partial \log P_D}{\partial \log c} \right|.$$

Republican adoption should therefore respond more strongly in percentage terms to a cost shifter. Equivalently, making solar economically more attractive raises the Republican-to-Democratic adoption ratio. Intuitively, households receiving substantial non-pecuniary benefits are willing to adopt even when the financial case is relatively weak, whereas households receiving smaller non-pecuniary benefits require stronger economic incentives. This prediction accords closely with evidence that Republicans place relatively greater weight on the personal economics of renewable energy and that the partisan gap in residential solar adoption diminishes as the economics of solar improve.

Our framework therefore provides a simple interpretation of the three empirical tests. Partisan differences in adoption identify differences in the fixed utility from solar, the absence of an economically meaningful partisan difference in system size in Table 7 indicates that this wedge operates primarily through the adoption decision rather than marginal investment returns, and a stronger Republican response to cost shifters shows that conventional financial incentives become relatively more important when the non-pecuniary value of adoption is weaker.

A.1 Extension: Beliefs About Future Returns and System Size

The baseline model assumes that political identity affects a fixed non-pecuniary benefit from adopting solar. Under this assumption, political affiliation affects the extensive margin but not optimal system size conditional on adoption. Political identity may instead affect beliefs about future economic returns. For example, households may hold different expectations about future electricity prices, the durability of net-metering rules, the continuation of tax incentives, or the reliability of solar technology.

To capture this possibility, let θ_i summarize household i's perceived return to solar generation and write expected cash flows as

$$E_i[CF_i(s)] = \theta_i Q_i(s),$$

where $Q_i(s)$ is increasing and concave in system size. Conditional on adoption, the household chooses

$$s_i^* = \arg\max_s \left\{\theta_i Q_i(s) - C_i(s) + B_i\right\}.$$

The first-order condition is

$$\theta_i Q_i'(s_i^*) = C_i'(s_i^*).$$

Differentiating with respect to θ_i yields:

$$\frac{\partial s_i^*}{\partial \theta_i} = \frac{Q_i'(s_i^*)}{C_i''(s_i^*) - \theta_i Q_i''(s_i^*)} > 0,$$

where the inequality follows from the second-order condition. Thus, households that expect larger future returns from solar choose larger systems conditional on adoption.

This extension provides a useful empirical distinction between two channels through which political identity may matter. If political identity affects primarily the fixed environmental, social-image, or identity value of solar, it should affect adoption but not system size conditional on adoption. If instead political identity affects beliefs about future electricity prices, policy durability, net-metering compensation, or other components of the marginal return to solar capacity, it should affect both adoption and system size. A partisan difference in system size conditional on adoption would therefore be consistent with heterogeneous expectations about future economic returns, whereas the absence of such a difference is more consistent with a fixed non-pecuniary adoption wedge. Our results in Table 7 suggest a quantitatively minor role for heterogeneous beliefs about future returns in the overall partisan adoption gap.