Self- and Social Signaling: Evidence from Solar Adoption in California*

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Abstract

Prosocial behavior plays a role in many economic contexts and has been explained by altruism, social pressure, signaling, and expectations of fairness and reciprocity. We examine prosocial behavior in a context that allows us to distinguish the role of self-signaling and social signaling from alternative explanations, including warm glow. Our context is residential solar, and self-signaling is separately identified from social signaling by the exogenous visibility of potential solar arrays. We show that the political affiliation of proximate peers influences the extent of self-signaling and is crowded out by the private benefits of installing solar.

Keywords: Prosocial behavior, self-signaling, social signaling, solar, public goods, energy policy, externalities, conformity, voter affiliation

JEL Codes: D64, H41, D83, Q40 , D91

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1 Introduction

Individuals often engage in prosocial behavior, contributing to a myriad of public goods, such as little free libraries, feeding the homeless, providing open source software tools, buying fair-trade coffee, and supporting downtown businesses and farmers markets over corporate chains. This behavior contributes billions of dollars to economic activity and has been explained through altruism (Bergstrom et al., 1986; Andreoni, 1989, 1990; Smith et al., 1995; Kotchen, 2005; Tonin and Vlassopoulos, 2010), identity and peer pressure (Akerlof and Kranton, 2000; Austen-Smith and Fryer, 2005; Kahn and Vaughn, 2009; Chen and Li, 2009; Fryer and Torelli, 2010; Bursztyn and Jensen, 2015; Cialdini and Goldstein, 2004), fairness and reciprocity (Fehr and Schmidt, 2006; Charness and Rabin, 2002; Frey and Meier, 2004), and social norms and reputation (Ostrom, 1990; Fehr and Fischbacher, 2004; Bernhard et al., 2006; List, 2006; Peattie, 2010). Furthermore, visible prosocial behavior acts as a social status signal by demonstrating to others that you are, or appear to be, a good person (Griskevicius et al., 2010; Brick et al., 2017; Perez-Truglia and Cruces, 2017; Bursztyn et al., 2020; Berger, 2019; Karing, 2024).[1]

In this paper, we study *self-signaling* in prosocial behavior: proving to yourself that you are the person you aspire to be, regardless of what others might think about you (Bodner and Prelec, 2003; Bénabou and Tirole, 2004, 2011), as well as social signaling, which is defined as prosocial behavior that is highly visible to others. The context we examine is rooftop solar adoption, to explore the role of neighbors in shaping self- and social signals for a household. Neighbors are those nearby with whom households likely regularly interact, e.g., attending cookouts or hosting playdates for children. We develop a theory of signaling that allows neighbor voter affiliation to influence households' beliefs about their own type. Neighbors of opposing type influence self-image, raising the question: "Though I value being an x, if I live around y, maybe I am a y?" Then, the value of taking an action that affirms one's desired type may be greater due to self-signaling, or may be negative due to costs of socially signaling non-conformity.

We find three key empirical results. First, we provide evidence that the self-signal value depends on neighbor political affiliation. A one standard deviation increase in the Republican share of a Democrat's neighborhood generates an equivalent willingness-to-pay to adopt solar on average of

[1] See Bursztyn and Jensen (2017) for a thorough review of social image literature.

$377, or 1.2% of the average cost of an installation. The public good provided by self-signaling in our setting—cleaner air and lower grid emissions–is increasing in the self-signal, because solar displaces fossil electricity generation. We find that the self-signal effect increases overall installed capacity by 13.5 megawatts (3.4%) in our sample, decreasing environmental externalities by $38.3 million in net present value (NPV).[2]

Second, we show that the effect of neighbor's political affiliation on the self-signal can be "crowded out" by the private benefits of adopting solar, as in Bénabou and Tirole (2006) and Dubé et al. (2017). Removing the effect of crowding out would increase total capacity by 0.67 MW (1.7%), decreasing externalities by $1.9 million in NPV.

Third, we show that visible installations carry an adoption penalty that increases with the Republican affiliation of the neighborhood, likely due to costs of non-conformity. We find that Democratic households have an average willingness-to-pay to avoid the non-conformity penalty of $124, separate from aesthetic values. The economic impacts of the social signal, which take the form of reducing the provision of a public good that reduces negative environmental externalities, exceed $7.05 million in our sample, even when not accounting for the fact that lower adoption rates of visible installations will also slow diffusion (Bollinger et al., 2022).

This paper contributes to a growing literature on self- and social signaling. Theoretical notions of self-signaling and altruism are well-established in the literature (Bem, 1972; Thaler and Shefrin, 1981; Andreoni, 1989; Bodner and Prelec, 2003; Bénabou and Tirole, 2011), as are broader notions examining consumer norms and identity (Akerlof and Kranton, 2000; Peattie, 2010; Perez-Truglia, 2018; Pryor et al., 2019; Yan et al., 2021). Empirical work has shown that individuals gain utility from self-signals, largely by modeling self-signaling as the component of impure altruism that can be crowded out through private incentives (Gneezy et al., 2012; Grossman, 2015; Dubé et al., 2017), the costs of engaging in the prosocial activity (Garcia-Rada et al., 2022), or satiation (Tonin and Vlassopoulos, 2013).[3]

[2]Our sample comprises 40% of California single-family detached households

[3]Specifically, this literature models impure altruism as an additive, independent private utility component. Changes in the pecuniary payoff of the action do not affect the impure altruism term by construction. Bénabou and Tirole (2006) note "the need to go beyond the standard dichotomy between "pure" and "impure" altruism and distinguish, within the latter, between fixed preferences... and motives that relate to what a person's behavior *says* about him or her, which will depend on the informational and economic context, including what others are doing" (p.1658).

Since prosocial behavior also signals social status and confers "warm glow" utility due to impure altruism (Andreoni, 1989, 1990), separate identification of the effects of self-signaling and impure altruism on utility is challenging; it requires detailed information about the individual's private benefits with plausibly exogenous variation in this payoff (in order to establish the crowding-out effect), as well as exogenous variation in inputs to the self-signal. Previous empirical evidence relies on experiential variation generated in a lab setting (Dixon and Mikolon, 2021; Gallus and Heikensten, 2020). Self- and social signals are also difficult to disentangle, since social recognition implies visibility and the effects of visibility need not be uniform in sign, as in social comparisons (Butera et al., 2022; Allcott and Kessler, 2019) or when facing a polarized "dual audience" (Perez-Truglia and Cruces, 2017). In a field experiment related to this work, Bursztyn et al. (2020) show that individuals are willing to forego significant benefits to maintain a particular self-image, but that visibility of the decision to other participants reduced their willingness to do so. In nearly all cases, research that seeks to measure the role of self- and social signaling focuses on low-stakes experiments with small monetary payoffs, limited audience size, low-cost effort, and short duration, all of which may lead to a lack of generalizability to real-world contexts (Levitt and List, 2007).

Solar adoption provides a particularly useful real-world context that allows us to separate the self-signaling value of prosocial behavior from 1) impure altruism, and 2) the social signaling value. This is because the economic value of adopting solar, neighborhood political affiliation, and the visibility of adopting solar all vary across households in an arguably exogenous manner after conditioning on observable characteristics. Our findings provide new insights into the motivations and conditions for prosocial behavior in general, especially in contexts where self-signals and social signals may be in opposition, as in settings subject to "virtue signaling" criticisms, and in light of increasing political polarization. Ignoring these motivations may confound estimates of willingness-to-pay for solar and may misattribute unresponsiveness to the private payoff stemming from the self-signal to irrationality or partisan bias.

This paper proceeds as follows. In Section 2, we describe key features of our model as an extension of Bénabou and Tirole (2011) and derive testable implications of the model. In Section 3, we describe our empirical setting, data, and methods. Results and discussion follow in Section 4, and Section 5 concludes.

2 A Signaling Model of Solar Adoption

Our model of solar adoption includes pecuniary and non-pecuniary sources of utility, the latter including outcome (Andreoni, 1989, 1990), self-signaling (Bodner and Prelec, 2003; Bénabou and Tirole, 2011; Dubé et al., 2017), and social signaling (Akerlof and Kranton, 2000; Griskevicius et al., 2010; Carpenter and Myers, 2010; Bursztyn et al., 2020) utility. The adoption decision is given by $x \in \{0, 1\}$, in which $x = 1$ indicates adoption. Key factors that affect the utility gained from adopting are the individual's ideological identity, given by their voter affiliation, $A \in \{D, R\}$ indicating Democratic or Republican, the individual's prosocial type, $\theta \in \{\theta^h, \theta^l\}$ indicating high or low, the lifetime expected pecuniary value of the installation net of installation costs, EV, the visibility of a (potential) solar installation, Vis, and the voter affiliation of their neighbors, $\bar{A}$, defined as the fraction of neighbors that are registered Republicans.[4]

Let:

$$
\begin{aligned}
U_x &= u_x(x, A, EV, Vis) + \kappa^s u^{self}(x, \theta, A, \bar{A}, EV) \\
&+ \underbrace{\kappa^p u^{prosocial}(x, \theta, A, \bar{A}, EV, Vis) + \kappa^n u^{non-conformity}(x, \theta, A, \bar{A}, EV, Vis)}_{u^{social}} + \varepsilon_x.
\end{aligned} \tag{1}
$$

where u_x is the outcome utility obtained from choice x. This includes the economic value of adopting (EV), impure altruism utility received by choosing to adopt solar based on the individual's type and voter affiliation, and the visibility of the potential solar installation (Vis), due to the household's aesthetic tastes.[5] The second term captures the self-signaling value of adopting: the utility gained by being more certain about being type θ^h. The third and fourth terms together comprise the social signal from visibly adopting solar: $u^{prosocial}$ is the non-pecuniary utility of the social signal transmitted by visibly adopting solar – the utility gained by showing others evidence of type. $u_{non-conformity}$ is a separate non-conformity penalty that reflects the desire for conformity with local norms and identity. $\kappa^s, \kappa^p, \kappa^n \geq 0$ govern the strength of each utility component relative to u_x.[6]

[4] In the empirical application we will also allow for unregistered and mixed affiliation households.

[5] We do not take a stand on whether EV crowds out impure altruism by increasing private pecuniary benefits of adopting.

[6] We do not impose this restriction in our empirics; rather, we test for the presence of these utility components.

The relative utility of adopting solar versus not adopting (using Δ to indicate the difference) is:

$$\begin{aligned} \Delta U &= \Delta u(A, EV, Vis) + \kappa^s \Delta u^{self}(\theta, A, \bar{A}, EV) \\ &+ \underbrace{\kappa^p \Delta u^{prosocial}(\theta, A, \bar{A}, EV, Vis) + \kappa^n \Delta u^{non-conformity}(\theta, A, \bar{A}, EV, Vis)}_{u^{social}} + \varepsilon_x. \end{aligned} \tag{2}$$

Let $V(\theta, A)$ be a meta-utility function representing the value of diagnosing oneself as being of type θ, or a "preference over preferences" (Bodner and Prelec, 2003). A person who aspires to be "green" has a high $V(\theta^h, A)$ relative to $V(\theta^l, A)$, while a person who does not care would have $V(\theta^h, A) = V(\theta^l, A)$. We expect that $V(\theta^h, A) \geq V(\theta^l, A)$ for all individuals, although our empirical model will not impose this. These terms depend on affiliation A; we expect that $V(\theta^h, A) - V(\theta^l, A)$ will be larger for Democratic households, and that A provides a signal about underlying type θ. Democratic households are more likely to be of type θ^h and Republican households are more likely to be of type θ^l.

2.1 Self Signaling

We incorporate the distinction of Bodner and Prelec (2003) and, more generally, Bénabou and Tirole (2011), between the *outcome utility* obtained directly from adoption, and *diagnostic utility* gained from learning one's type more precisely in light of the choice.[7] Type "exerts influence at the moment of choice, but cannot be deduced merely by imagining what one might do in a given situation" (Bodner and Prelec, 2003). Rather, beliefs about type can be informed by actions taken. Let $Pr(\theta = \theta^h) = \rho$. Then, self-signaling diagnostic utility is:

$$\begin{aligned} u^{self}(x, \theta, A, \bar{A}, EV) &= \hat{\rho}(x, EV, \bar{A}, A) \cdot V(\theta^h, A) + (1 - \hat{\rho}(x, EV, \bar{A}, A)) \cdot V(\theta^l, A) \\ &= V(\theta^l, A) + \hat{\rho}(x, EV, \bar{A}, A)[V(\theta^h, A) - V(\theta^l, A)] \end{aligned} \tag{3}$$

As in Bénabou and Tirole (2011) and consistent with Bayesian updating, households update their beliefs to $\hat{\rho}$ after the adoption decision such that $\hat{\rho} = \lambda \rho_0 + (1 - \lambda)\rho_x$, where ρ_0 is the prior

[7] The model in Bénabou and Tirole (2011) nests Bodner and Prelec (2003) as a limiting case, one where the individual "instantaneously forgets" their type, but refers to past actions (solar adoption) to diagnose their type using Bayesian updating of their "self-view".

belief, ρ_x is the new information which depends on the adoption decision $x \in \{0, 1\}$, and λ governs the malleability of beliefs or signal strength. We write ρ_x as:

$$\rho_x = \begin{cases} \rho_0 & \text{if } x = 0 \\ 1 & \text{if } x = 1 \end{cases} \tag{4}$$

where choosing $x = 0$ is identical to not yet choosing, and thus $\rho_x = \rho_0$. Without loss of generality, we set $\rho_x = 1$ for $x = 1$, assuming that adopting solar is associated with type θ^h. Note that $\Delta\hat{\rho} = (1 - \lambda)(\rho_x - \rho_0) \geq 0$, with strict inequality when $x = 1$. The self-signal when adopting vs. not adopting is:

$$\begin{aligned} \Delta u^{self}(\theta, A, \bar{A}, EV) &= u^{self}(x = 1, \theta, A, \bar{A}, EV) - u^{self}(x = 0, \theta, A, \bar{A}, EV) \\ &= \Delta\hat{\rho}(EV, \bar{A}, A)[V(\theta^h, A) - V(\theta^l, A)]. \end{aligned} \tag{5}$$

Adopting solar increases the belief of being type θ^h and the corresponding diagnostic utility.

A key feature of our model is that prior beliefs about one's type are influenced by the political affiliation of neighbors. Social psychology research shows that group interactions shape self-perception (Allport, 1954; Aron et al., 1991; Turner et al., 2008; Turner and Onorato, 1999; Aron et al., 2022; Pryor et al., 2019). Living amongst and interacting with neighbors perceived to be θ^l leads to a prior ρ_0 that places lower probability on being type θ^h. For example, joining a neighbor on a hunting trip results in a lower value of ρ_0 as one wonders "I am surrounded by a lot of θ^l, maybe I'm actually a θ^l?" Thus, we assume that $\frac{\partial \rho_0}{\partial \bar{A}} < 0$.[8] We also assume that $\frac{\partial \rho_0}{\partial A} < 0$, allowing one's own political identity to affect these initial beliefs.[9] This implies $\frac{\partial \Delta\hat{\rho}}{\partial \bar{A}} > 0$, as the signal carries greater meaning when adopting in a high-$\bar{A}$ (heavily Republican) neighborhood than it does in a low-$\bar{A}$ neighborhood.

The λ governs how much weight the action x is given in updating the prior ρ_0. Consistent with "crowding out" (Dubé et al., 2017), we allow λ to be a function of the economic value of adopting solar, since more economically valuable solar installations will have lower signaling value. Adopting

[8] Kaikati et al. (2017) notes the contrast between differing ideology (e.g. D vs. R) and shared social identity, e.g. neighbors in affecting charitable donations.

[9] For example, one potential functional form would be $\rho_0 = 1 - \frac{1\{A=R\}+\bar{A}}{2}$, which puts equal weight on one's own affiliation and the mean affiliation of the neighborhood.

low-EV solar indicates more willingness to be prosocial, while adopting high-EV solar is confounded by the higher energy bill savings, which would be desirable regardless of type, giving little reason to update the prior. We assume $\frac{\partial \lambda}{\partial EV} > 0$, and therefore $(1 - \lambda)$ is decreasing in EV. Therefore, $\frac{\partial \Delta \hat{\rho}^2}{\partial \bar{A} \partial EV} < 0$. The positive effect of $\bar{A}$ on $\Delta \hat{\rho}$ is attenuated by EV.

2.2 Social Signaling

Social signaling relies on the visibility of the decision x as well as the voter affiliation of the neighbors. Here, the neighborhood provides the context in which social status may be gained or lost through signaling (Bernheim, 1994; Akerlof and Kranton, 2000; Austen-Smith and Fryer, 2005; Bursztyn and Jensen, 2015; Brick et al., 2017; Pryor et al., 2019; Perez-Truglia, 2018). The $u^{prosocial}$ term includes the potential positive external signal about prosocial beliefs communicated to others when adopting a visible installation, while $u_{non-conformity}$ captures the negative effect of non-conformity. The net social signal depends on the average type in the neighborhood $\bar{A}$ and the household's voter affiliation A. We assume that all signaling value from non-visible installations is self-signaling.[10] We allow the main effects of visibility and interactions between visibility and A in u_x, which enters separately from the social signals.

We include both forces in the social signal as follows (dropping the arguments of $u^{prosocial}$ and $u^{non-conform}$ in a slight abuse of notation for readability):

$$\begin{aligned} u^{social}(x, \theta, A, \bar{A}, EV, Vis) &= \kappa^p u^{prosocial} + \kappa^n u^{non-conform} \qquad (6) \\ u^{prosocial} &\equiv \hat{s} V(\theta^h, A) + (1 - \hat{s}) V(\theta^l, A) \\ u^{non-conform} &\equiv (|\hat{s} - s_0|) V^{nc}. \end{aligned}$$

We model the social signal in a similar way to the self-signal with one key difference. We assume that the utility of the social signal is a weighted average of the external signal value and a valuation for non-conformity, $V^{nc} < 0$, multiplied by the degree to which the signal deviates from the mean affiliation in the neighborhood, separating prosocial signaling from non-conformity. Similar to $\hat{\rho}$, $\hat{s}$

[10] It is possible that non-visible installations are still socially relevant. If this were the case, some of the self-signal effect that we estimate would also capture a social signal that is not subject to the same conformity disutility that we find as visible solar panels.

is the posterior probability that one is signaling a high type to others, and $V(\theta^h, A), V(\theta^l, A)$ are the values of each type as before.[11]

Similar to the self-signal, we probabilistically update the posterior beliefs after the adoption decision is made, such that $\hat{s} = \lambda s_0 + (1-\lambda)s_x$, but only if the adoption were to be visible. As with the self-signal, we assume that $\frac{\partial s_0}{\partial A} < 0$ such that the more Republican the neighborhood is, the lower the prior belief is that one is type θ^h.[12] The social signal is set to $s_x = 1$ if and only if $x = 1$ and the installation would be visible to neighbors. Again, we allow for the updating to depend on the economic value of adoption since there is more signaling value in lower EV installations.[13] As with $\Delta\hat{\rho}$, our similarly defined $\Delta\hat{s} = (1-\lambda)(s_x - s_0) \geq 0$ is increasing in $\bar{A}$ if there is visible solar adoption (otherwise $\Delta\hat{s} = 0$) and this effect is attenuated by higher EV. As in the self-signal, $\Delta u^{prosocial} = \Delta\hat{s}(V(\theta^h, A) - V(\theta^l, A))$.

Prior to the adoption decision, our specification implies that the non-conformity term is equal to zero.[14] Adopting visible solar increases $\hat{s}$, incurring a non-conformity penalty proportional to $\Delta\hat{s}$ We expect the penalty to be higher in high-$\bar{A}$ (more Republican) neighborhoods as the visible installation reveals one to be further from s_0, which is itself decreasing in the neighborhood Republican affiliation. This provides a countervailing force to the social signal.

2.3 Testable implications

2.3.1 The self-signal is increasing in Republican affiliation of neighbors

First, we examine the effect of the neighborhood on the self-signal that results from increases in the Republican share of the neighborhood, $\bar{A}$, while holding EV fixed:

[11]This assumption is not restrictive – $u^{prosocial}$ is scaled by κ^p, which could also account for any difference in $V(\theta^h, A) - V(\theta^l, A)$ between the self-signal and the prosocial signal value of each type.

[12]One example would be $s_0 = 1 - \bar{A}$, which sets the prior belief to the mean affiliation of the neighborhood.

[13]See Bénabou and Tirole (2006) and Jee et al. (2025) on crowding out of reputational social signals, and Bollinger et al. (2022); Nauze (2023), showing peer effects are stronger for lower-EV solar.

[14]This implies that non-adoption is not subject to "shame" (Perez-Truglia and Troiano, 2018; Butera et al., 2022). In this respect, our model is "characteristic signaling" rather than "action signaling" in which households compare to a population average, as in the green nudge literature (Allcott, 2011; Allcott and Kessler, 2019; Yoeli et al., 2013; Carlsson et al., 2021)

$$
\begin{aligned}
\frac{\partial \Delta u^{self}}{\partial \bar{A}} &= (V(\theta^h, A) - V(\theta^l, A))\frac{\partial}{\partial \bar{A}}(\hat{\rho} - \rho_0) \\
&= -\frac{\partial \rho_0}{\partial \bar{A}}(V(\theta^h, A) - V(\theta^l, A))(1-\lambda) > 0. \qquad (7)
\end{aligned}
$$

Increases in $\bar{A}$ will increase individual adoptions due to the self-signaling value, which increases relative to non-adoption when the "fallback" self-signal from non-adoption is that of the neighbors. Higher $\bar{A}$ indicates a "fallback" of lower type, with the magnitude of the effect determined by $V(\theta^h, A) - V(\theta^l, A)$. Given our expectation that Democratic households will have a higher net value of being type θ^h, we expect the neighborhood effect on the self-signal to be stronger for Democratic households relative to Republicans.

2.3.2 The effect of Republican neighbors on the self-signal is diminishing in EV

We also examine the role of EV in attenuating the effect of Republican neighbors on the self-signal:

$$
\frac{\partial^2 \Delta u^{self}}{\partial EV \partial \bar{A}} = \frac{\partial \lambda}{\partial EV} \cdot \frac{\partial \rho_0}{\partial \bar{A}}(V(\theta^h, A) - V(\theta^l, A)) < 0 \qquad (8)
$$

As EV increases, the neighborhood effect on the self-signal attenuates, offsetting the positive effect of increasing $\bar{A}$. We consider this a type of crowding-out effect. As with the neighborhood effect on the self-signal, we expect the effect to be stronger among Democratic households than Republican households. Because higher EV systems provide higher outcome utility, u_1, the sign of the combined effect of EV is ambiguous, although we would expect its effect on outcome utility to be larger than the crowding out effect.

An interesting ramification of this crowding-out effect is that lower-EV adoptions are more likely to occur relative to high-EV adoptions when the effect on self-signaling is especially strong (i.e., in higher $\bar{A}$ neighborhoods), providing a counter-effect to the neighborhood effect on the self-signal. To make this more concrete, the implication is that while a Democratic household in a more Republican neighborhood may be more likely to adopt than if they lived in a more Democratic neighborhood, the adoptions that occur are more likely to be of lower EV.

2.3.3 The net social signal is decreasing in Republican affiliation of neighbors

The neighborhood effect on the social signal affects both components of the social signal. We first examine the effect of $\bar{A}$ on the prosocial signal utility:

$$\frac{\partial \Delta u^{prosocial}}{\partial \bar{A}} = -\frac{\partial s_0}{\partial \bar{A}}(V(\theta^h, A) - V(\theta^l, A))(1-\lambda) \cdot Vis \geq 0. \tag{9}$$

For visible installations, increases in $\bar{A}$ result in an increase in the value of the prosocial signal utility.

The neighborhood effect on the non-conformity term simplifies to:

$$\frac{\partial \Delta u^{non-conformity}}{\partial \bar{A}} = (1-\lambda)V^{nc} \cdot Vis \leq 0, \tag{10}$$

where the inequality follows from $V^{nc} < 0$.

The neighborhood effect on the prosocial signal is positive in $\bar{A}$, while the non-conformity penalty is negative. For a visible installation and as $\bar{A}$ increases, the *net* social signal depends on the relative strength of the prosocial and the non-conformity terms, which we hypothesize is dominated by the non-conformity penalty, i.e., $\kappa^p << \kappa^n$.[15]

As EV increases ($\lambda \to 1$), the net neighborhood effects on both the self- and social signal attenuate to zero.

3 Empirical Approach

3.1 Data

To identify parameters that test the implications of our model, we assemble a dataset that includes data on home location, home characteristics, voter affiliation, solar potential, and solar adoption. CoreLogic, which compiles county assessor data on homes, provides the primary dataset we use. We extract all single-family detached, owner-occupied households built prior to 2014 in seven counties

[15] This may reflect a difference in identity group. Signaling prosocial behavior to others of an opposite group is of lesser value (Akerlof and Kranton, 2000), and thus more likely dominated by the non-conformity penalty κ^n

Table 1: **Summary Statistics**: Summary statistics for variables used in analysis.

	All			Non-adopter			Adopter		
	Median	Mean	SD	Median	Mean	SD	Median	Mean	SD
Voter Registration									
Registered Democrat/Mixed hh	1.00	0.57	0.50	1.00	0.56	0.50	1.00	0.57	0.50
Registered Republican hh	0.00	0.21	0.40	0.00	0.20	0.40	0.00	0.25	0.43
Unregistered Voter hh	0.00	0.23	0.42	0.00	0.23	0.42	0.00	0.18	0.38
Neighborhood									
Republican block-by-street	0.17	0.20	0.19	0.17	0.20	0.19	0.21	0.24	0.21
Republican block	0.18	0.20	0.14	0.18	0.20	0.14	0.23	0.24	0.15
Republican blockgroup-by-street	0.18	0.20	0.16	0.17	0.20	0.16	0.22	0.24	0.17
Household and House Characteristics									
Children	0.00	0.31	0.60	0.00	0.30	0.59	0.00	0.40	0.69
Expected Value ($1,000)	5.61	5.53	0.89	5.59	5.51	0.90	5.77	5.73	0.79
Home Size (1,000 sq. ft)	1.61	1.81	10.31	1.58	1.77	10.81	2.03	2.22	0.99
Bedrooms	3.00	3.30	1.00	3.00	3.27	1.00	4.00	3.62	0.97
Lot size (1,000 sq. ft)†	6.51	12.37	55.45	6.48	11.69	53.15	7.42	19.19	74.24
1(Year built > 1990)	0.00	0.10	0.30	0.00	0.10	0.29	0.00	0.15	0.36
1(Stories > 1)	0.00	0.23	0.42	0.00	0.22	0.42	0.00	0.27	0.44
Assessor value ($100k)†	3.19	4.16	4.27	3.10	4.05	4.18	4.15	5.33	4.88
Visibility									
Visible (degrees from closest street)	0.39	0.41	0.29	0.39	0.41	0.29	0.38	0.40	0.29
Visible (side of street)	0.00	0.24	0.43	0.00	0.25	0.43	0.00	0.23	0.42

†Winsorized at .1%

in California, totaling $N = 994,454$ households.[16] For each household, we observe the year built, lot size, home size (in square feet), assessor value, number of bedrooms, and number of stories. We winsorize lot size and assessor value at 0.1% to avoid fitting to outliers.

We merge our data with voter registration records from the California Secretary of State, which include party affiliation, voting history, and birthdate for each registrant. For households with multiple voters, we identify the two most active between 2010–2014, breaking ties by selecting the eldest. We classify households as unregistered (no registrants), Republican (both voters registered Republican), or Democratic/mixed (all others, including mixed affiliations). We measure the political affiliation of the local neighborhood at the block-by-street, block, and blockgroup-by-street (excluding the household of interest in the calculation of the share of Republican affiliations).

We measure household-level variation in the expected return to rooftop solar using data from Google Project Sunroof, which estimates irradiance and system performance based on satellite imagery. Assuming a $150 monthly bill, the platform reports the 2016 NPV of a 15-year investment,

[16]These counties are Alameda, Contra Costa, Orange, San Diego, San Luis Obispo, Solano, and Yolo.

net of installation costs.[17] To avoid confounding from post-2016 policy changes (e.g., NEM 2.0), we restrict the study period to 1999–2016.[18] We spatially merge the Sunroof coordinates to households, excluding the top 5% of matches by distance. Adoption outcomes are drawn from the Lawrence Berkeley National Laboratory's Tracking the Sun database, which provides near-universal coverage of solar installations through 2016. We merge installation records at the address level.

Visibility is a continuous measure of the extent to which solar panels would be visible from the roadway. For each house, we draw a set of 360 radii of length 65 meters from the center of the roof outward. Each radius is first checked for intersection with the nearest street line. The intersection points represent potential degrees of visibility. Each point is then checked to see if the panel orientation (pitch and azimuth, as reported by Google Project Sunroof) would render it visible from that point. Each visible point counts as a degree of visibility. We censor this measure at 180 degrees and scale to range from 0 (not visible) to 1 (fully visible). As a robustness check, we also define a binary visibility proxy equal to 1 for homes on the north side of the street and 0 otherwise. See Appendix C for a full description and visual examples. Our final sample consists of $N = 905,028$, of which 74,663 (8.2%) are solar adopters. Summary statistics are shown in Table 1.

3.2 Estimation

We estimate a parameterized version of the difference in adoption utility and non-adoption utility given in Equation (2):

$$\Delta U_i \quad = \quad \Delta u_i + \Delta u_i^{self} + \Delta u_i^{social} + X_i \cdot \omega_1 + \sum_{a \in \{R,U\}} X_i \cdot 1\{A_i = a\} \cdot \omega_{2a} + \psi_{b(i)g(i)} + \varepsilon_i, \quad (11)$$

in which we define:

[17] Public data available at http://sunroof.withgoogle.com.

[18] NEM 2.0 was announced in 2016 and implemented in mid-2017.

$$
\begin{aligned}
\Delta u_i &\equiv \alpha_0 + \sum_{a\in\{R,U\}} \alpha_{1t} 1\{A_i = a\} + \alpha_2 EV_i + \sum_{a\in\{R,U\}} \alpha_{3a} EV_i \cdot 1\{A_i = a\} \\
&+ \alpha_4 Vis_i + \sum_{a\in\{R,U\}} \alpha_{5a} Vis_i \cdot 1\{A_i = a\} + \alpha_6 Vis_i \cdot EV_i, \\
\Delta u_i^{self} &\equiv \beta_1 \bar{A}_i + \sum_{a\in\{R,U\}} \beta_{2a} \bar{A}_i \cdot 1\{A_i = a\} + \beta_3 \bar{A}_i \cdot EV_i + \sum_{a\in\{R,U\}} \beta_{4a} \bar{A}_i \cdot EV_i \cdot 1\{A_i = a\}, \\
\Delta u_i^{social} &\equiv \gamma_1 Vis_i \cdot \bar{A}_i + \sum_{a\in\{R,U\}} \gamma_{2a} Vis_i \cdot \bar{A}_i \cdot 1\{A_i = a\} + \gamma_3 Vis_i \cdot \bar{A}_i \cdot EV_i.
\end{aligned}
\tag{12}
$$

We re-center $\bar{A}_i$ (the fraction of all other households in the neighborhood in our sample that are registered Republican) and EV_i (the Google Project Sunroof-derived expected value of adopting solar) on the sample means for ease of interpretation. We combine Democratic and mixed-affiliation households such that affiliation a can take values of D/m, R, or U; indicating the household head(s) are Democratic/mixed, Republican, or unregistered, respectively. The omitted category is D/m and interaction terms are relative to a Democratic/mixed affiliation household.

Vis_i is the $[0,1]$ visibility measure. We include it in outcome utility since there can be a dis-amenity for visible solar due to aesthetic concerns. The interactions allow it to differ by voter registration and the economic value of installing. The X_i consists of controls for the number of children, lot square footage, lot square footage squared, house square footage, an indicator for post-1990 construction, assessor value, number of stories, and number of bedrooms; we allow these controls to have different effects for households of different political affiliation. The $\psi_{b(i)g(i)}$ are fixed effects at the census blockgroup level that differ by whether a household is registered to vote. This controls for potentially heterogeneous correlated unobservables for unregistered status (e.g., non-citizens). We assume ε_i is distributed logistic. Let $\Delta\tilde{U}_i = \Delta U_i - \varepsilon_i$. Thus, adoption probabilities take the familiar logit closed form $\Lambda(\Delta\tilde{U}_i)$ and we estimate the model using maximum likelihood.

We connect our testable implications to our empirical specification by noting that for Democratic/mixed affiliation households:

- **There is a positive self-signal if** $\beta_1 > 0$, indicating that adoption is increasing with Republican affiliation of neighbors.
- **The self-signal is crowded out by** EV **if** $\beta_3 < 0$.

- **There is a positive net social signal if** $\gamma_1 < 0$, indicating that adoption of visible installations increases less than non-visible installations with Republican affiliation of neighbors.
- **The net social signal is crowded out by** EV **if** $\gamma_3 > 0$.

The β_{2a} and γ_{2a} terms for $a \in \{R, U\}$ allow us to test whether the Republican and unregistered households differ in the size of these effects, relative to Democratic/mixed households; $\beta_1 + \beta_{2a}$ is the self-signaling effect and $\gamma_1 + \gamma_{2a}$ is the net social signaling effect for Republican and unregistered houses for $a \in \{R, U\}$, respectively.[19]

3.3 Identification

It is well known that the spatial composition of households is endogenous due to sorting (Manski, 1993; Bayer et al., 2007). To obtain causal estimates of the effect of neighbors' voter affiliations, we construct "hyper-local" measures of neighborhood voter affiliation $\bar{A}$, based on the fraction of neighbors that are registered Republican. We define "neighborhood" at the census block-by-street, the census block (our preferred measure), and the census blockgroup-by-street.[20] We include larger (but still fine-grain) spatial fixed effects at the census blockgroup level. This is akin to the 'nearest-neighbor research design' common in the neighborhood effects literature (Bayer et al., 2008) and has been used to identify spatial spillovers in myriad contexts (Linden and Rockoff, 2008; McCartney and Shah, 2022; Bayer et al., 2021; Blume et al., 2011; Bayer et al., 2025). This hyper-local control strategy controls for selection on unobservables from (endogenous) sorting as well as unobserved local permitting constraints that may be correlated with neighbors' voter affiliations.[21] Our identifying assumption is that there is no within-blockgroup neighborhood-level correlation within the unobservable attributes among households (Bayer et al., 2008, 2021).[22]

In Appendix A, we show that when conditioning on blockgroup, both household voter affiliation and the number of children in a household are *uncorrelated* with other households in the neighborhood,

[19]We allow the crowding out effect of self-signaling to differ by political affiliation as well. Although we don't include the quadruple interaction that allows the social signaling crowding out effect to differ by political affiliation in the main specification, we did include it in a robustness check and found to it be insignificant and close to zero.

[20]This definition of neighborhood is finer than the colloquial usage of neighborhood, but intends to capture immediate neighbors with whom one is most likely to interact. We provide a robustness check in which we measure neighborhood as the four spatially nearest neighbors as well.

[21]The California Solar Rights Act of 1978 and 2014 preclude unreasonable HOA restrictions on solar and HOAs are unlikely to exist at the sub-blockgroup scale.

[22]In our setting (California), housing markets preclude sorting beyond a census blockgroup (McCartney and Shah, 2022).

and that household voter affiliation is uncorrelated with the rest of the neighborhood's voter affiliation. We also calculate the ratio of selection on unobservables to selection on observables (Altonji et al., 2005, 2008, 2025) that would be necessary to overturn our results on the effect of the neighborhood $\bar{A}$, often called the *breakdown point*. We report the breakdown points of Oster (2019) and Diegert et al. (2025) and argue that, in our setting, the potential for confounding by selection on unobservables is low.

Although observable characteristics of the household do not correlate within neighborhood (conditional on census blockgroup fixed effects), characteristics of the home can (such as year built). Similarly, EV can be correlated within neighborhood, potentially due to local natural features like hills. Thus, we control for observables that affect these variables mechanically that may be correlated with unobserved tastes for solar: home size and number of stories (which determine breadth of roof available for solar), lot size, number of bedrooms, year built, assessor value, and lot size. Selection by households with tastes for solar into houses with greater irradiance is possible. We address this by including a robustness check using only homes sold in or before 2005, when solar irradiance would not be a consideration.

We use a source of plausibly exogenous variation in the visibility of a solar installation to identify social influences that operate through signaling. At northern latitudes, the midday sun is always in the southern sky, leading to the placement of panels on the southern side of a roof, and visibility, key to social signals, is largely a function of the roof profile and the side of street. We use proprietary Google Sunroof data that provides the placement, pitch, and azimuth of potential solar installations to robustly measure a potential solar installation's visibility. To address potential sorting by side-of-street, which is highly correlated with visibility, we show in a hedonic regression that the side of street is uncorrelated with home value, indicating that sorting by potential solar visibility is unlikely.

4 Results

In Table 2, we present our main results estimated over three definitions of neighborhood, suppressing controls.[23] Throughout, our preferred estimates define neighborhood at the census block level shown

[23]See Appendix B for the full regression results with all controls, and for a range of robustness checks which show similar effects (Appendix B).

in column (2). Some blockgroups have zero observed installations, which results in dropping 86,942 observations. For robustness, we estimate a linear probability model as well which preserves the complete sample.

Outcome utility: We find that Republican registered households have a lower baseline utility for solar, likely through smaller net valuation of being type θ^h. The main effect of visibility is negative for registered voting households and is not significantly stronger among Republicans. Unregistered voters appear to be an exception, with no negative utility from adopting visible solar. While our results do not allow us to disentangle mechanisms, aesthetic concerns (separate from social signals) are one likely explanation, even among individuals who wish to signal environmental *bona fides*. We calculate the equivalent willingness-to-pay (WTP) using the visibility result and the coefficient on EV (in \$1,000's). The equivalent WTP to avoid fully visible panels for a Democratic/mixed household in an average neighborhood is $\frac{-0.095}{-0.193} \times \$1,000 = \$491.93$, which is approximately 1.5% of the average system cost.

The self-signal: The self-signal is increasing in Republican affiliation of neighbors if $\beta_1 > 0$ in Equation 11. For Democratic/mixed households with average EV and zero visibility, the estimated effect is positive and statistically-significant at 0.502. Republican households ($\beta_1 + \beta_{2R}$) receive significantly less utility from self-signaling, but with a point estimate of $0.502 - 0.330 = 0.172$. We fail to reject the null of no self-signaling effect for Republican households with a p-value of 0.127. The same result holds in alternative specifications in (1) and (3). We interpret this as causal evidence that the self-signal is affected by the voter affiliation of neighbors.

We calculate an equivalent WTP of \$377 for Democratic/mixed households per one standard deviation increase (0.145) from the mean (0.200) in the Republican composition of the neighborhood, representing 1.2% of the average system cost and 6.8% of the average EV. This WTP is three times that of Republican WTP for a similar increase. In aggregate, the effect of Republican neighbors on the self-signal has a significant effect on the overall provision of the public good.

To provide context, we set the neighborhood effect on the self-signal to zero for all voter affiliations and predict the change in the number of installations. Overall adoption declines by 4,711 installations representing 13.5 megawatts of capacity (3.4%). To calculate impacts on emissions,

Table 2: Main Results

Dependent Variable:		Adopt	
Model:	(1)	(2)	(3)
Neighborhood definition:	Block x Street	Block	Blockgroup x Street
Outcome utility α			
Republican hh	-0.171***	-0.165***	-0.170***
	(0.050)	(0.050)	(0.050)
Expected value	0.189***	0.193***	0.191***
	(0.015)	(0.015)	(0.014)
Expected value × Republican hh	0.002	0.007	0.003
	(0.015)	(0.015)	(0.015)
Expected value × Unregistered voter hh	-0.040	-0.042+	-0.040+
	(0.024)	(0.024)	(0.024)
Visible (frac of degrees from closest street)	-0.097***	-0.095***	-0.096***
	(0.020)	(0.020)	(0.020)
Visible (frac of degrees from closest street) × Republican hh	-0.007	-0.022	-0.008
	(0.035)	(0.037)	(0.036)
Visible (frac of degrees from closest street) × Unregistered voter hh	0.080*	0.084*	0.079*
	(0.039)	(0.039)	(0.039)
Visible (frac of degrees from closest street) × Expected value	-0.003	-0.003	-0.005
	(0.019)	(0.019)	(0.019)
Self-signal utility β			
Republican nbhd	0.233***	0.502***	0.343***
	(0.051)	(0.089)	(0.068)
Republican nbhd × Republican hh	-0.183*	-0.330**	-0.253*
	(0.081)	(0.122)	(0.101)
Republican nbhd × Unregistered voter hh	-0.068	-0.038	-0.162
	(0.108)	(0.177)	(0.135)
Republican nbhd × Expected value	-0.172***	-0.296***	-0.254***
	(0.048)	(0.072)	(0.063)
Republican nbhd × Expected value × Republican hh	0.037	0.029	0.051
	(0.060)	(0.085)	(0.077)
Republican nbhd × Expected value × Unregistered voter hh	0.064	0.146	0.063
	(0.085)	(0.124)	(0.103)
Social signal utility γ			
Visible (frac of degrees from closest street) × Republican nbhd	-0.202*	-0.339**	-0.262*
	(0.096)	(0.131)	(0.118)
Visible (frac of degrees from closest street) × Republican nbhd × Republican hh	0.161	0.429+	0.207
	(0.163)	(0.236)	(0.205)
Visible (frac of degrees from closest street) × Republican nbhd × Unregistered voter hh	0.189	0.031	0.277
	(0.196)	(0.268)	(0.237)
Visible (frac of degrees from closest street) × Republican nbhd × Expected value	0.177*	0.189+	0.249*
	(0.085)	(0.110)	(0.107)
Fixed-effects			
Blockgroup-Registered voter	Yes	Yes	Yes
Fit statistics			
Observations	818,086	818,086	818,086
Pseudo R^2	0.10003	0.10010	0.10005
Log-Likelihood	-224,590.5	-224,573.3	-224,585.7

EV and the Republican neighborhood measure $\bar{A}$ are demeaned.
Clustered (Blockgroup-Registered voter) standard-errors in parentheses. "nbhd" refers to "neighborhood."
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

we merge the change in solar adoptions with marginal emissions factors from Sexton et al. (2021), which are expressed in dollars of reduced environmental externalities per 1kW of solar capacity in a given zip code. Eliminating the self-signal results in a decrease in emissions valued at \$2.4 million per year, equivalent to \$38.3 million over the 25-year lifespan of the panels (discounted at 4%).[24]

The effect of Republican neighbors on the self-signal is diminishing in EV if $\beta_3 < 0$, indicating "crowding out" of the self-signal. Results in Table 2 show that the self-signal is attenuated by the privately-captured payoff with a point estimate of -0.296. In a somewhat surprising finding, we find no significant difference in the crowding out effect for Republican (β_{4R}) and unregistered households (β_{4U}) relative to Democratic and mixed households. Under a scenario where the crowding-out effect is set to the mean EV for all voter affiliations, installations would increase by 305 and capacity by 0.67 megawatts (0.17%), reducing negative externalities by \$117,646 per year, with a NPV of \$1.91 million. Our results elucidate previous research that shows Republican households respond more to the financial payoff of adopting solar relative to Democrats (Dokshin and Gherghina, 2024) – we find that this empirical fact results from the crowding out of the self-signal, not from differences in the valuation of the financial benefits.

Social signal The net social signal is decreasing in Republican affiliation of neighbors if $\gamma_1 < 0$, controlling for the effect of visibility on the outcome utility (α_4). Our estimate for Democratic/mixed households, γ_1, is -0.339 and is statistically significant at the 1% level. The effect on the social signal for Republicans is $\gamma_1 + \gamma_{2R} = 0.091$ and is not statistically significant (p-value 0.66). A similar result applies for unregistered households. We interpret this as evidence for a social signaling effect for Democratic/mixed households – as they are surrounded by increasingly Republican households, visible panels suffer an additional penalty for adoption.

The penalty is substantial: the equivalent WTP to avoid the net social signal from a one standard deviation increase in Republican neighborhood affiliation for a Democratic/mixed household with an average-visibility and average-EV is $-0.145 \times \frac{-0.339}{(0.193-.003)} = \$259$. For each Democratic/mixed household we calculate the equivalent value of the change in utility for each observation that would result from zeroing out the neighborhood effect on the net social signal. The average dollar equivalent for Democratic/mixed households is \$124. Eliminating the neighborhood effect on the social signal

[24] Of this, nearly all is due to reduced CO2 emissions, 12,965 tons per year valued at \$174/ton in 2017 dollars (Rennert et al., 2022)

would result in 871 (+1.2%) additional adoptions, reducing "dollarized" emissions by \$433,907 per year with a NPV of \$7.05 million. This represents foregone benefits from solar adoption resulting from the neighborhood non-conformity effect on the social signal. We also find that as EV increases, the net social signal becomes less negative, since $\gamma_3 > 0$, demonstrating the crowding out effect.

5 Conclusion

We find empirical evidence that clarifies the role of the local social context in both the self-signal and the social signal. Furthermore, we find that the private payoff of adopting is an important component of the self- and social signal. The model grounds the concept of "crowding out" in the local context, and provides predictions for behavior that are consistent with experimental empirical evidence. Furthermore, the moderating effect of the private benefit of solar on the neighborhood effect of non-visible installations allows us to separate self-signaling from warm glow that results from altruistic behavior.

The economic magnitude of each of these effects are notable. The self-signal provides positive utility when the local social context is dominated by a type less likely to adopt a prosocial behavior, constituting a substantial component of the utility for those who value being a prosocial type. Most notable is the countervailing effects of visibility – while a more Republican neighborhood provides greater self-signaling utility from adopting for Democratic/mixed households, if the potential solar installation would be visible, the effect is attenuated by the non-conformity penalty. Since the crowding out of the self-signal effect is of smaller magnitude than is the social signal, an increase in the emphasis on privately-captured benefits likely would yield positive effects on adoption.

As policy moves away from explicit subsidies on renewables, prosocial behavior will gain in importance in achieving climate goals. Results in this study can inform where, and under what conditions, prosocial behavior is most likely, and helps to inform the effects of increased polarization. Better understanding of the channels by which adopters update their priors may help point to effective policies.

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Supplemental Appendix

A Testing Exogeneity and Selection

A key identifying assumption in our empirical strategy is that, conditional on blockgroup fixed effects, an individual's characteristics are uncorrelated with the neighborhood's characteristics, which rules out confounding by selection or sorting. For instance, while a larger neighborhood may have unobserved reasons for attracting households that are registered Republican (and any unobserved characteristics that are correlated with Republican registration), conditional on census blockgroup fixed effects, neighborhood voter affiliation $\bar{A}$ is as-good-as-randomly assigned.[25]

We address the potential confounding in two ways. First, we follow Bayer et al. (2008) and test this assumption on observable household characteristics. Intuitively, if households select into neighborhoods within a blockgroup based on observed and unobserved characteristics, correlations between observables should persist even when conditioning on blockgroup. We describe our method below, and find that conditioning on blockgroup eliminates within-neighborhood correlations in observable characteristics. Second, under the notion that selection on observables tells us something about potential selection on observables (Altonji et al., 2005, 2008, 2025), we calculate the breakdown points of Oster (2019) and Diegert et al. (2025) for a key result, where the breakdown point "characterizes the magnitude of selection on unobservables relative to selection on observables needed to overturn one's baseline findings" (Diegert et al., 2025). We find that selection on unobservables would have to be of unreasonable size relative to selection on observables to overturn a key portion of our findings.

A.1 As-good-as-random assignment conditional on blockgroup fixed effects

First, we follow Bayer et al. (2008) to test this assumption on observables. As they note, testing on observables does not directly rule out unobserved correlations that may persist, but selection (or neighborhood sorting) on unobservables is, in some sense, proprotional (Altonji et al., 2005). In essence, if observables show no correlation within neighborhood conditional on neighborhood, it is unlikely that unobservables carry such a condition. Within-neighborhood correlation between neighborhood voter affiliation and a household's voter affiliation is mechanically induced by the leave-one-out average of the neighborhood and blockgroup means. As such, we expand on Bayer et

[25] As before, we refer to the "hyper-local" measure of voter affiliation $\bar{A}$ as the "neighborhood".

al. (2008) and test for correlation between a neighborhood's voter affiliation and an individual's voter affiliation by first sampling a single pair of households randomly selected from each neighborhood, then estimate the correlation between them conditional on the blockgroup fixed effects. The blockgroups capture the larger effect of sorting as households are unlikely to be able to sort into neighborhoods due to thinness of the housing market (McCartney and Shah, 2022). If blockgroup fixed effects are sufficient controls, then ccorrelations in household characteristics within neighborhood will not remain after conditioning on neighborhood. We estimate the following regression equations on our two-households-per-neighborhood sample, dropping blocks with 2 or fewer observations:

$$Rep_i = \beta_0 + \beta_1 \bar{A}_{l(i),-i} + \Xi_{n(i)} + \nu_i$$

$$Rep_i = \gamma_0 + \gamma_1 Rep_{i,-i} + \Gamma_{n(i)} + \eta_i$$

and

$$Children_i = \delta_0 + \delta_1 Children_{i,-i} + \Delta_{n(i)} + \iota_i$$

Where $\bar{A}_{l(i),-i}$ is the randomly sampled household's neighborhood voter affiliation measure measured over all other neighborhood households $-i$, and $Rep_{i,-i}$ and $Children_{i,-i}$ are the randomly sampled second household voter affiliation and count of children in a neighborhood. We estimate each equation without and with blockgroup fixed effects.

Table A.1: **Tests of orthogonality of household characteristics**: Regression results from a regression of household characteristics on a randomly selected second household from within neighborhood (block). (1-2) tests for correlation between household voter affiliation and leave-one-out measure of neighborhood Republican affiliation; (3-4) tests for correlation between household 1 and household 2 voter affiliation, (5-6) tests for correlation between household 1 and household 2 number of children.

Dependent Variables:		Voter affiliation			Children in Hh	
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Variables						
Own nbhd ($\bar{A}$)	0.6999***	0.0173				
	(0.0150)	(0.0222)				
Other Household voter affiliation			0.1172***	0.0069		
			(0.0054)	(0.0057)		
Children in other Hh					0.0347***	0.0044
					(0.0051)	(0.0054)
Fixed-effects						
Blockgroup FE		Yes		Yes		Yes
Fit statistics						
Observations	41,636	41,636	41,636	41,636	41,636	41,636
R^2	0.06039	0.22497	0.01380	0.22499	0.00123	0.14885

Clustered (Blockgroup FE) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

Results in Table A.1 show that, conditional on the blockgroup fixed effects in (2), (4), and (6), there is no significant correlation between key household characteristics within neighborhood. Results in column (2) show that a neighborhood's leave-one-out measure of voter affiliation and the individual's affiliation is uncorrelated when conditioning on the blockgroup fixed effects. Results in (4) and (6) show that characteristics of household i are uncorrelated with household $-i$, conditional on blockgroup fixed effects. The lack of significant correlation provides support for (but not evidence of) the identifying assumption that no unobservable characteristics correlated with voter affiliation are driving sorting at the neighborhood level.

Physical properties of the house are correlated within the neighborhood, conditional on blockgroup, especially in "tract" style housing common in our sample. Furthermore, visibility may be correlated – a neighborhood located along a north-south oriented street is less likely to have visible installations than those located along an east-west street (where half the homes are directly north). Thus, these characteristics are correlated, even conditional on blockgroup, and may be correlated with unobserved variables correlated with tastes for solar. We include in controls measures of square footage, lot size (2nd degree polynomial), an indicator for year built after 1990, number of stories, assessor value, and number of bedrooms, all of which may be correlated with unobserved preferences for solar. We maintain the assumption that it is infeasible to sort (within a blockgroup) on EV, and test for robustness to this by estimating on a sample of homes sold in 2005 or earlier, well before solar would have been a concern for any adopter, regardless of unobserved tastes for solar. These results are in Table B.6. Results show little change qualitatively or statistically from the main results.

A.2 Stability and Breakdown Point Analysis

We further address the potential for selection into neighborhood on unobservables. Specifically, we may worry that household tastes for more Republican neighborhoods (conditional on census blockgroup) may be correlated with an unobserved preference for solar. For example, households who value self-reliance and household production of food and/or energy may sort into neighborhoods that are more conducive to household production (larger lots, relaxed rules on animal husbandry, or better soil), which may also be unobserved and correlated with $\bar{A}$.[26] This threat to identification can

[26]We control for lot size, but do not observe the latter.

be framed as selection into treatment, where the treatment is defined as a Republican neighborhood, which would bias estimates involving $\bar{A}_i$. Altonji et al. (2005) notes that, though the extent of selection on unobservables cannot be directly observed, assumptions regarding the relative ratio of selection on observed (which is observable) and selection on unobserved can provide intuition for the extent of the selection problem.

We first present stability results showing the change in estimates as we add controls, a common method in the literature. If adding observed controls does not significantly change results, then adding unobserved controls would likely not do so as well. Results are shown in Table A.2, where column (1) shows our main results specification without census blockgroup-by-registered voter fixed effects nor our controls, (2) shows main results with fixed effects but no controls, and (3) repeats our main results for comparison. Results are wildly different absent the fixed effects, as expected given results in Table A.1. However, the difference in coefficients between (2) and our main results repeated in (3) is minimal.[27] The pseudo-R^2 increases between (2) and (3), indicating that observed controls have explanatory power. Taken together, we see that the observable controls explain solar adoption, but do not shift our main findings.

[27]The interaction between EV and Republican affiliation is significant in (2), reflecting the results of Dokshin and Gherghina (2024) which showed that Republican households are more responsive to the intrinsic, pecuniary benefits of solar (Sheldon and Nichols, 2009). However, the result is no longer significant when controls are included in (3), though the main effect on Republican affiliation becomes more negative and significant. In Dokshin and Gherghina (2024), variation in EV comes from regional irradiance, incentives, and system cost variation, rather than household roof profile as in our data, and no information on household characteristics, i.e. number of children, are used. Thus, we interpret our finding relative to theirs as due to visibility and household-level EV confounding with Republican affiliation.

Table A.2: Results showing stability over (1) no fixed effects and no controls; (2) fixed effects and no controls; and (3) Main results

Dependent Variable:		Adopt	
Model:	(1)	(2)	(3)
Variables			
Republican hh	0.068***	-0.006	-0.165***
	(0.018)	(0.019)	(0.050)
Unregistered voter hh	-0.292***		
	(0.018)		
Expected value	0.333***	0.208***	0.193***
	(0.011)	(0.015)	(0.015)
Expected value × Republican hh	0.109***	0.039*	0.007
	(0.017)	(0.016)	(0.015)
Expected value × Unregistered voter hh	0.027+	-0.021	-0.042+
	(0.016)	(0.026)	(0.024)
Visible (frac of degrees from closest street)	-0.136***	-0.106***	-0.095***
	(0.018)	(0.019)	(0.020)
Visible (frac of degrees from closest street) × Republican hh	-0.038	-0.031	-0.022
	(0.036)	(0.037)	(0.037)
Visible (frac of degrees from closest street) × Unregistered voter hh	0.037	0.066+	0.084*
	(0.036)	(0.039)	(0.039)
Visible (frac of degrees from closest street) × Expected value	-0.025	0.0002	-0.003
	(0.020)	(0.019)	(0.019)
Republican nbhd	1.92***	0.627***	0.502***
	(0.061)	(0.088)	(0.089)
Republican nbhd × Republican hh	-0.342**	-0.043	-0.330**
	(0.108)	(0.117)	(0.122)
Republican nbhd × Expected value	0.155*	-0.363***	-0.296***
	(0.071)	(0.073)	(0.072)
Republican nbhd × Expected value × Republican hh	-0.116	0.019	0.029
	(0.096)	(0.087)	(0.085)
Republican nbhd × Expected value × Unregistered voter hh	-0.248*	0.150	0.146
	(0.099)	(0.124)	(0.124)
Visible (frac of degrees from closest street) × Republican nbhd	-0.472***	-0.411**	-0.339**
	(0.122)	(0.130)	(0.131)
Visible (frac of degrees from closest street) × Republican nbhd × Republican hh	0.188	0.411+	0.429+
	(0.216)	(0.233)	(0.236)
Visible (frac of degrees from closest street) × Republican nbhd × Unregistered voter hh	-0.045	0.010	0.031
	(0.237)	(0.262)	(0.268)
Visible (frac of degrees from closest street) × Republican nbhd × Expected value	0.164	0.187+	0.189+
	(0.127)	(0.112)	(0.110)
Home Size			3.61×10^{-7}+
			(2.13×10^{-7})
Republican hh × Home Size			0.0003***
			(1.72×10^{-5})
Unregistered voter hh × Home Size			0.0003***
			(2.63×10^{-5})
Lot size			0.002***
			(0.0004)
Republican hh × Lot size			-0.001***
			(0.0003)
Unregistered voter hh × Lot size			-0.003***
			(0.0008)
Squared lot size			-1.44×10^{-6}***
			(2.66×10^{-7})
Republican hh × Squared lot size			9.35×10^{-7}***
			(2.48×10^{-7})
Unregistered voter hh × Squared lot size			1.93×10^{-6}***
			(4.95×10^{-7})
1(Year Built 1990)			0.061+
			(0.035)
Republican hh × 1(Year Built 1990)			-0.084*
			(0.034)
Unregistered voter hh × 1(Year Built 1990)			0.057
			(0.070)
Number of bedrooms			0.170***
			(0.011)
Republican hh × Number of bedrooms			-0.063***
			(0.015)
Unregistered voter hh × Number of bedrooms			-0.093***
			(0.017)
Number of Children			0.114***
			(0.008)
Republican hh × Number of Children			0.056***
			(0.013)
Unregistered voter hh × Number of Children			0.101***
			(0.018)
Assessor value			0.071***
			(0.003)
Republican hh × Assessor value			-0.048***
			(0.003)
Unregistered voter hh × Assessor value			-0.023***
			(0.006)
2+ stories			0.121***
			(0.018)
Republican hh × 2+ stories			-0.144***
			(0.026)
Unregistered voter hh × 2+ stories			-0.052
			(0.039)
Constant	-2.29***		
	(0.009)		
Republican nbhd × Unregistered voter hh	-0.223+	0.090	-0.038
	(0.119)	(0.173)	(0.177)
Fixed-effects			
Blockgroup-Registered voter		Yes	Yes
Fit statistics			
Observations	818,086	818,086	818,086
Pseudo R^2	0.02208	0.08391	0.10010
Log-Likelihood	-244,043.6	-228,613.0	-224,573.3

*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

A.2.1 Breakdown Point Analysis

Stability exhibitions do not provide the full information necessary to eliminate concerns regarding selection on observables. To do so, we perform a breakdown point analysis. The breakdown point is a scalar measure of the ratio of selection on unobservables relative to selection on observables at which point our baseline findings are overturned (Diegert et al., 2025). We calculate the breakdown point for each of our models (1)-(3) using four methods. The first two follow Oster (2019), which requires an assumption regarding the R^2 of a full regression, inclusive of the unobservables. We first report δ^O for the assumption that all variation in adoption can be explained by observed and unobserved variables ($R^2_{max} = 1$). An implication of this assumption is that no further variation in solar adoption occurs after observables and unobservables are determined. In our setting, this is a strong assumption – given that most individuals purchased before solar was widely available, it is unlikely that no further variation in adoption is determined post-purchase.

The second, more common assumption is that the R^2_{max} is proportional to the R^2 obtained from a regression of adoption on the full suite of controls and variables of interest. Oster (2019) establishes a factor of 1.3 by examining a battery of randomized control trials and calculating the ratio of R^2, but even this rule-of-thumb is context dependent. Including fewer observable controls would reduce the reference R^2 and, thus, R^2_{max}, which in turn would increase the breakdown point arbitrarily. In our setting, this regression, after residualizing outcome, treatment, and observed covariates to the blockgroup by registered voter fixed effects, has a relatively low R^2 of approximately around .010 across our specifications.[28] Even with observed political and demographic controls chosen to maximize explanation of outcome variance, this R^2 indicates very little variation is explained and the remaining "irreducible" error is substantial. This suggests that a lower value of R^2_{max} is appropriate. We use $R^2_{max} = 1.3 \times R^2_{overall} = .013$), which we report in table A.3.

Additionally, we report the breakdown points of Diegert et al. (2025), which does not require that unobserved controls be orthogonal to observed controls, and does not require an assumption on R^2_{max}. In our setting, it is unlikely that the unobserved and observed variables are orthogonal, and the choice of R^2_{max} is pivotal. Calculating $\bar{r}_x^{DMP}$ requires no assumption on the ratio of outcome (solar adoption) variation explained by the unobserved variables relative to the observed variables

[28] The R^2 of the regression including census blockgroup FEs is over .10

$(\bar{r}_y)$. Thus, it represents a conservative estimate of the breakdown point. We also calculate the breakdown point under the common assumption that $\bar{r}_X = \bar{r}_y$, which restricts the ratio of the unobserved variables' impact on outcome relative to the observed variables' impact on outcome to be equal to the the ratio of the unobserved variables' impact on treatment relative to the observed variables' impact on treatment. This breakdown point, $\bar{r}^{DMP}$, is our preferred breakdown point measure, though we report the more conservative $\bar{r}_x^{DMP}$ as well.

For each method, we assess a main effects version of our main results. While methods for assessing selection on unobservables with multiple, interacted treatments (e.g. $EV \times \bar{A}$) exist, the breakdown point becomes an identified set of dimension equal to the number of main and interactive effects, which is difficult to interpret given our large number of interactions. Furthermore, non-linear models may not have well-defined breakdown points when interactions are present. For tractability and interpretation, we use a linear probability model (LPM) main effects regression for this analysis, dropping all interactions from the main results.

The results are shown in Table A.3. In the main effects regression, the point estimate on our preferred measure of neighborhood, Republican block, is similar to the main LPM results at a statistically-significant 0.028 (the main results interact affiliation with neighborhood, producing an estimate of .04 for Democratic/mixed and $0.04 - 0.03 = .01$ for Republican households, see table B.4). δ^O varies a great deal based on the assumption of R^2_{max}, but the preferred Oster measure indicates that selection into treatment for unobservables would have to be 7.00 times as strong as selection on observables to reduce the coefficient on Republican block to 0. The breakdown point of our preferred breakdown point $\bar{r}^{DMP}$ of 0.733 indicates that unobservables would have to explain at least 73.3% of selection into a Republican block relative to the amount of selection explained by observables in order to overturn the results. This level of selection is highly unlikely. Observables include lot size, home size, assessor value, and number of stories. It would be very unlikely for an unobservable to have even a small fraction of explanatory power after conditioning on observables.

Interpretation of a breakdown point is improved with calibration through context. Following Diegert et al. (2025), we explore the relative impact of each observable control in order to better calibrate a reasonable threshold of $\bar{r}_X$. In table A.4, we present $\hat{\rho}_k$, the ratio of selection on control k relative to all other controls, for each control. This provides a range of values of $\bar{r}_X$ for observed controls *as if* each one were unobserved. Only lot size and lot size squared exceed the estimated breakdown point of 73.3%. If this control was, in fact, unobserved, it would exceed the breakdown point. However, selection into Republican neighborhoods is driven largely by lot size, assessor value, number of bedrooms, and age of home. Notably, even home size has a value of $\hat{\rho}_k = 3.2\%$, far lower than the breakdown point threshold of 73.3%. Unobservables of any nature are highly unlikely to match the relative impact of observed lot size controls.

Table A.3: Sensitivity to Selection on Unobservables Results

Dependent Variable:	Adopt		
Model:	(1)	(2)	(3)
Nbhd definition:	Block x Street	Block	Blockgroup x Street
Variables			
Republican block-by-street	0.011***		
	(0.002)		
Republican block		0.028***	
		(0.005)	
Republican blockgroup-by-street			0.017***
			(0.004)
Expected value	0.011***	0.011***	0.011***
	(0.0005)	(0.0005)	(0.0005)
Visible (frac of degrees from closest street)	-0.007***	-0.007***	-0.007***
	(0.001)	(0.001)	(0.001)
Home Size	8.65×10^{-8}	8.63×10^{-8}	8.65×10^{-8}
	(8.76×10^{-8})	(8.73×10^{-8})	(8.75×10^{-8})
Lot size	0.0003***	0.0002***	0.0003***
	(4.39×10^{-5})	(4.38×10^{-5})	(4.38×10^{-5})
Squared lot size	-1.56×10^{-7}***	-1.55×10^{-7}***	-1.56×10^{-7}***
	(2.77×10^{-8})	(2.76×10^{-8})	(2.76×10^{-8})
1(Year Built 1990)	0.009***	0.010***	0.009***
	(0.003)	(0.003)	(0.003)
Number of bedrooms	0.015***	0.015***	0.015***
	(0.0006)	(0.0006)	(0.0006)
Number of Children	0.013***	0.013***	0.013***
	(0.0006)	(0.0006)	(0.0006)
Assessor value	0.006***	0.006***	0.006***
	(0.0002)	(0.0002)	(0.0002)
2+ stories	0.008***	0.008***	0.008***
	(0.001)	(0.001)	(0.001)
Republican Hh	0.0007	0.0007	0.0007
	(0.0009)	(0.0009)	(0.0009)
Fixed-effects			
Blockgroup-Registered voter	Yes	Yes	Yes
Sensitivity:			
$\delta^O_{r_{max}=1}$	0.023	0.023	0.020
$\delta^O_{r_{max}=1.3\times\text{overall}}$	7.22	7.00	6.35
$\bar{r}_X^{DMP}$	0.173	0.159	0.151
$\bar{r}^{DMP}$	.810	.733	.785
Fit statistics			
Observations	818,086	818,086	818,086
R^2	0.06772	0.06775	0.06773
Within R^2	0.01048	0.01052	0.01049

Clustered (Blockgroup-Registered voter) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

Table A.4: Calibrating $\bar{r}_X$: Relative Impact of Each Observed Covariate on Republican neighborhood

	$\hat{\rho}_k$ (%)
W_{1k}	Republican nbhd
Expected value	8.3
Home Size	3.7
Lot size	100.1
Squared lot size	86.0
1(Year Built 1990)	22.4
Number of bedrooms	59.0
Number of Children	2.5
Assessor value	45.7
2+ stories	8.0
Visible (frac of degrees from closest street)	0.7
Republican Hh	21.7

Based on the orthogonality tests, stability results, and breakdown points calculated, selection into Republican neighborhood on unobservables is unlikely to overturn the main results.

A.3 Hedonic Regression of Home Price on Visibility

If households with unobserved utility for solar also have unobserved utility for a specific side of street, then estimates of the effect of visibility may be confounded. The motivating example for this may be that people who are environmentally-minded may also prefer backyards that lie to the north of their home, and thus prefer the north side of the street. Our setting suggests that yard orientation relative to a home is not particularly predictive of shading or sun exposure – in "tract" style housing which predominates our sample, shading from the home is similar to shading from perimeter trees behind a home, and thus there would be little difference in backyard sunlight or aesthetics between sides of street. Nonetheless, we examine whether or not prices reflect the side of street under the assumption that correlated preferences for such an orientation would result in higher sale prices. Approximately half ($N = 485,719$) of sample homes have sold in the last 30 years. We specify the sale price in logs, include all home characteristics used in our main specification, and allow a 4th degree polynomial in sale year to flexibly control for changes in price over time. We find a distinct lack of correlation between visibility and sale price:

Table A.5: **Regression of Sale Price on north side of street**: Results from regression of logged sale price on included house characteristics and a polynomial in sale year.

Model:	(1)	(2)	(3)
Variables			
North side of street (visible)	-0.0008	-0.0020	-0.0014
	(0.0019)	(0.0014)	(0.0014)
Sq. ft.		1.39×10^{-7}	4.23×10^{-8}
		(1.89×10^{-7})	(9.27×10^{-8})
Lot size (sq. ft.)		0.0010***	0.0006***
		(0.0001)	(6.4×10^{-5})
Lot size squared		$-6.34 \times 10^{-7***}$	$-3.99 \times 10^{-7***}$
		(7.17×10^{-8})	(4.03×10^{-8})
Number of Bedrooms		0.0692***	0.0495***
		(0.0023)	(0.0014)
2+ Stories		0.0768***	0.0651***
		(0.0033)	(0.0019)
poly(Saleyear)1		270.5***	271.4***
		(1.108)	(0.5687)
poly(Saleyear)2		-38.98***	-38.02***
		(1.101)	(1.018)
poly(Saleyear)3		-69.26***	-68.52***
		(1.050)	(0.9797)
poly(Saleyear)4		1.642	1.272
		(1.676)	(1.642)
Fixed-effects			
Census blockgroup	Yes	Yes	
Census blockgroup-Street			Yes
Fit statistics			
Observations	485,719	485,719	485,719
Pseudo R^2	0.22914	0.64911	0.76318
Log-Likelihood	-360,624.3	-164,155.9	-110,791.4

*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

Results in column (2) show that side-of-street is uncorrelated with sale price conditional on controls and census blockgroup effects. Column (3) shows the same conditional on blockgroup x street fixed effects. We interpret this as evidence that side of street is uncorrelated with unobservable preferences. Furthermore, if solar-minded individuals were able to sort to the north side of the street when purchasing a home, our estimate of visibility would be biased upwards. However, our main results find a negative and significant effect of visibility, including among Democratic/mixed households who would be most likely to sort on visibility.

B Additional Results and Robustness

B.1 Additional Results

Table B.1 shows the full results of our main specification, including covariates.

Table B.1: Main Results including all covariates

Dependent Variable:		Adopt	
Model:	(1)	(2)	(3)
Neighborhood definition:	Block x Street	Block	Blockgroup x Street
Variables			
Republican hh	-0.171***	-0.165***	-0.170***
	(0.050)	(0.050)	(0.050)
Expected value	0.189***	0.193***	0.191***
	(0.015)	(0.015)	(0.014)
Expected value × Republican hh	0.002	0.007	0.003
	(0.015)	(0.015)	(0.015)
Expected value × Unregistered voter hh	-0.040	-0.042^{+}	-0.040^{+}
	(0.024)	(0.024)	(0.024)
Visible (frac of degrees from closest street)	-0.097***	-0.095***	-0.096***
	(0.020)	(0.020)	(0.020)
Visible (frac of degrees from closest street) × Republican hh	-0.007	-0.022	-0.008
	(0.035)	(0.037)	(0.036)
Visible (frac of degrees from closest street) × Unregistered voter hh	0.080*	0.084*	0.079*
	(0.039)	(0.039)	(0.039)
Visible (frac of degrees from closest street) × Expected value	-0.003	-0.003	-0.005
	(0.019)	(0.019)	(0.019)
Republican nbhd	0.233***	0.502***	0.343***
	(0.051)	(0.089)	(0.068)
Republican nbhd × Republican hh	-0.183*	-0.330**	-0.253*
	(0.081)	(0.122)	(0.101)
Republican nbhd × Unregistered voter hh	-0.068	-0.038	-0.162
	(0.108)	(0.177)	(0.135)
Republican nbhd × Expected value	-0.172***	-0.296***	-0.254***
	(0.048)	(0.072)	(0.063)
Republican nbhd × Expected value × Republican hh	0.037	0.029	0.051
	(0.060)	(0.085)	(0.077)
Republican nbhd × Expected value × Unregistered voter hh	0.064	0.146	0.063
	(0.085)	(0.124)	(0.103)
Visible (frac of degrees from closest street) × Republican nbhd	-0.202*	-0.339**	-0.262*
	(0.096)	(0.131)	(0.118)
Visible (frac of degrees from closest street) × Republican nbhd × Republican hh	0.161	0.429^{+}	0.207
	(0.163)	(0.236)	(0.205)
Visible (frac of degrees from closest street) × Republican nbhd × Unregistered voter hh	0.189	0.031	0.277
	(0.196)	(0.268)	(0.237)
Visible (frac of degrees from closest street) × Republican nbhd × Expected value	0.177*	0.189^{+}	0.249*
	(0.085)	(0.110)	(0.107)
Home Size	$3.6 \times 10^{-7+}$	$3.61 \times 10^{-7+}$	$3.6 \times 10^{-7+}$
	(2.14×10^{-7})	(2.13×10^{-7})	(2.14×10^{-7})
Republican hh × Home Size	0.0003***	0.0003***	0.0003***
	(1.71×10^{-5})	(1.72×10^{-5})	(1.71×10^{-5})
Unregistered voter hh × Home Size	0.0003***	0.0003***	0.0003***
	(2.63×10^{-5})	(2.63×10^{-5})	(2.63×10^{-5})
Lot size	0.002***	0.002***	0.002***
	(0.0004)	(0.0004)	(0.0004)
Republican hh × Lot size	-0.001***	-0.001***	-0.001***
	(0.0003)	(0.0003)	(0.0003)
Unregistered voter hh × Lot size	-0.003***	-0.003***	-0.003***
	(0.0008)	(0.0008)	(0.0008)
Squared lot size	$-1.47 \times 10^{-6***}$	$-1.44 \times 10^{-6***}$	$-1.45 \times 10^{-6***}$
	(2.68×10^{-7})	(2.66×10^{-7})	(2.68×10^{-7})
Republican hh × Squared lot size	$9.71 \times 10^{-7***}$	$9.35 \times 10^{-7***}$	$9.45 \times 10^{-7***}$
	(2.48×10^{-7})	(2.48×10^{-7})	(2.48×10^{-7})
Unregistered voter hh × Squared lot size	$1.95 \times 10^{-6***}$	$1.93 \times 10^{-6***}$	$1.93 \times 10^{-6***}$
	(4.97×10^{-7})	(4.95×10^{-7})	(4.97×10^{-7})
1(Year Built 1990)	0.059^{+}	0.061^{+}	0.059^{+}
	(0.035)	(0.035)	(0.035)
Republican hh × 1(Year Built 1990)	-0.081*	-0.084*	-0.083*
	(0.034)	(0.034)	(0.034)
Unregistered voter hh × 1(Year Built 1990)	0.057	0.057	0.057
	(0.070)	(0.070)	(0.070)
Number of bedrooms	0.170***	0.170***	0.170***
	(0.011)	(0.011)	(0.011)
Republican hh × Number of bedrooms	-0.063***	-0.063***	-0.063***
	(0.015)	(0.015)	(0.015)
Unregistered voter hh × Number of bedrooms	-0.093***	-0.093***	-0.093***
	(0.017)	(0.017)	(0.017)
Number of Children	0.114***	0.114***	0.114***
	(0.008)	(0.008)	(0.008)
Republican hh × Number of Children	0.056***	0.056***	0.056***
	(0.013)	(0.013)	(0.013)
Unregistered voter hh × Number of Children	0.101***	0.101***	0.101***
	(0.018)	(0.018)	(0.018)
Assessor value	0.071***	0.071***	0.071***
	(0.003)	(0.003)	(0.003)
Republican hh × Assessor value	-0.048***	-0.048***	-0.048***
	(0.003)	(0.003)	(0.003)
Unregistered voter hh × Assessor value	-0.023***	-0.023***	-0.023***
	(0.006)	(0.006)	(0.006)
2+ stories	0.121***	0.121***	0.121***
	(0.018)	(0.018)	(0.018)
Republican hh × 2+ stories	-0.145***	-0.144***	-0.145***
	(0.026)	(0.026)	(0.026)
Unregistered voter hh × 2+ stories	-0.052	-0.052	-0.052
	(0.039)	(0.039)	(0.039)
Fixed-effects			
Blockgroup-Registered voter	Yes	Yes	Yes
Fit statistics			
Observations	818,086	818,086	818,086
Pseudo R^2	0.10003	0.10010	0.10005
Log-Likelihood	-224,590.5	-224,573.3	-224,585.7

Clustered (Blockgroup-Registered voter) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

B.2 Alternative Definition of Neighborhood

We further check robustness to the definition of neighborhood by defining the neighborhood as the four nearest neighbors for each household. We calculate our neighborhood affiliation as the fraction of those households that are registered Republican. To account for rural areas where the nearest neighbors may be entirely unseen or even unknown, we also calculate this measure using only those homes under 200m from the focal home.

Results in Table B.2 are very similar to our main results that define neighborhood as "block-by-street" in column (1) of Table 2. Only the interaction of Republican neighborhood with Republican voter affiliation changes in significance, even then it remains significant at 10% and changes only when defining neighborhood as the four nearest houses regardless of distance.

All of our different specifications capture alternative "audiences" to a potential installation that may influence social signaling utility. The models implicitly assume that households of different political affiliations consider the same population to be the relevant audience. It is possible that this would not hold, e.g., Republicans might consider the whole block while Democrats consider only their immediate contiguous neighbors. However, if this were the case, we would expect the relative sizes of the signaling coefficients for households of different political affiliations to vary as we change the definition of the peer group. Since the estimates are fairly stable, we find asymmetric audience sizes as a function of political affiliation to be unlikely.

B.3 Visibility Measure

To check robustness to our definition of "visible", we substitute our measure of visibility with a binary indicator for the north side of the street. We generate this measure for each household by first finding the point on the street that is closest to the centroid of each home, then taking the angular measure of the ray from that point to the home. We divide possible angles into four quadrants, and give those in the north quadrant, those wwhich would have a southern exposure to the street, a value of 1, with all others receiving a value of 0. North is defined as lying between -45 and +45 degrees, with 0 being north.

Results are shown above in Table B.3. Main effects are identical in sign and significance to our primary specification with one exception: Visibility x Registered Republican maintains a negative

Table B.2: Robustness Results: Neighborhood measured as 4 nearest neighbors.

Dependent Variable:	Adopt	
Model:	(1)	(2)
Neighborhood definition:	4NN under 200m	4NN
Variables		
Republican hh	-0.172***	-0.168***
	(0.050)	(0.050)
Expected value	0.193***	0.188***
	(0.014)	(0.014)
Expected value × Republican hh	0.005	0.001
	(0.014)	(0.014)
Expected value × Unregistered voter hh	-0.039	-0.040
	(0.024)	(0.024)
Visible (frac of degrees from closest street)	-0.098***	-0.097***
	(0.019)	(0.019)
Visible (frac of degrees from closest street) × Republican hh	-0.014	-0.012
	(0.035)	(0.035)
Visible (frac of degrees from closest street) × Unregistered voter hh	0.084*	0.083*
	(0.039)	(0.039)
Visible (frac of degrees from closest street) × Expected value	-0.005	-0.002
	(0.019)	(0.019)
Republican nbhd	0.212***	0.216***
	(0.044)	(0.044)
Republican nbhd × Republican hh	-0.146*	-0.134+
	(0.069)	(0.069)
Republican nbhd × Unregistered voter hh	-0.108	-0.116
	(0.091)	(0.092)
Republican nbhd × Expected value	-0.134**	-0.147**
	(0.044)	(0.046)
Republican nbhd × Expected value × Republican hh	-0.013	0.023
	(0.056)	(0.055)
Republican nbhd × Expected value × Unregistered voter hh	0.066	0.072
	(0.069)	(0.070)
Visible (frac of degrees from closest street) × Republican nbhd	-0.193*	-0.191*
	(0.082)	(0.083)
Visible (frac of degrees from closest street) × Republican nbhd × Republican hh	0.253+	0.219
	(0.138)	(0.139)
Visible (frac of degrees from closest street) × Republican nbhd × Unregistered voter hh	0.060	0.072
	(0.167)	(0.168)
Visible (frac of degrees from closest street) × Republican nbhd × Expected value	0.176*	0.168*
	(0.073)	(0.075)
Fixed-effects		
Blockgroup-Registered voter	Yes	Yes
Fit statistics		
Observations	817,378	818,086
Pseudo R^2	0.10000	0.10003
Log-Likelihood	-224,259.5	-224,590.3

Clustered (Blockgroup-Registered voter) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

sign, but is no longer significant. We interpret this as imprecision in the measure of visiblity imposed by the continuous measure of visibility. It is unlikely that households consider visibility in such a manner, especially in the context of neighborhood visibility.

B.4 Linear Probability Model

To ensure robustness to functional form, we estimate our model using OLS in a linear probability model. Results in Table B.4 are unchanged qualitatively and statistically. Around 8% of the sample predictions from the estimates in column (2) are less than zero.

B.5 Split Samples

We split the sample between household political affiliation. Qualitatively, results in Table B.5 are similar to the pooled sample, unregistered households generally fall between Democratic/mixed and Republican, with the exception of the main effect of visiblity.

B.6 Homes transacted in 2005 or earlier

Results may be biased if households with unobserved taste for solar sort into homes with higher expected value of solar (e.g. better irradiance, etc.) To ensure results are robust to this, we re-estimate our main results using only those homes that were sold in 2010 or earlier. Prior to 2005, solar was extremely rare and sorting on EV is highly unlikely.

Results in B.6 show little change qualitatively or statistically from the main results. The statistical significance of the interaction between Visibility and Republican neighborhood drops from significant at the 5% level in the main results to the 10% level here. The point estimate of the former is only slightly smaller, which we interpret as a case of increased noise, as the sample size drops from over 818k to 512k. The interaction of visibility, neighborhood, and Republican affiliation is significant and positive here, suggesting that the effect of visibility interacted with neighborhood is different and more positive for Republican affiliated households relative to Democratic/mixed.

B.7 Including Interaction of Vis, Neighborhood, EV, and Household Affiliation

Our main results in Table 2 have only one term for the crowding out of the social signal, the interaction of Vis, neighborhood, and EV, and do not interact this with household voter affiliation.

Table B.3: Robustness Results: Visibility measured by side-of-street.

Dependent Variable:	Adopt		
Model:	(1)	(2)	(3)
Neighborhood definition:	Block x Street	Block	Blockgroup x Street
Variables			
Republican hh	-0.169***	-0.168***	-0.170***
	(0.048)	(0.048)	(0.048)
Expected value	0.190***	0.193***	0.191***
	(0.013)	(0.013)	(0.013)
Expected value × Republican hh	0.002	0.007	0.003
	(0.015)	(0.015)	(0.015)
Expected value × Unregistered voter hh	-0.041+	-0.043+	-0.041+
	(0.024)	(0.024)	(0.024)
Visible (side of street)	-0.069***	-0.068***	-0.069***
	(0.014)	(0.014)	(0.014)
Visible (side of street) × Republican hh	-0.022	-0.024	-0.015
	(0.024)	(0.026)	(0.025)
Visible (side of street) × Unregistered voter hh	0.036	0.037	0.037
	(0.027)	(0.027)	(0.027)
Visible (side of street) × Expected value	-0.004	-0.004	-0.004
	(0.013)	(0.013)	(0.013)
Republican nbhd	0.182***	0.424***	0.288***
	(0.039)	(0.073)	(0.055)
Republican nbhd × Republican hh	-0.142*	-0.211*	-0.190*
	(0.060)	(0.088)	(0.076)
Republican nbhd × Unregistered voter hh	-0.011	-0.036	-0.073
	(0.082)	(0.146)	(0.111)
Republican nbhd × Expected value	-0.116**	-0.248***	-0.181***
	(0.040)	(0.061)	(0.053)
Republican nbhd × Expected value × Republican hh	0.029	0.021	0.043
	(0.060)	(0.085)	(0.077)
Republican nbhd × Expected value × Unregistered voter hh	0.062	0.151	0.058
	(0.085)	(0.124)	(0.103)
Visible (side of street) × Republican nbhd	-0.116+	-0.248**	-0.187*
	(0.069)	(0.092)	(0.083)
Visible (side of street) × Republican nbhd × Republican hh	0.101	0.223	0.073
	(0.114)	(0.158)	(0.141)
Visible (side of street) × Republican nbhd × Unregistered voter hh	0.068	0.041	0.057
	(0.132)	(0.186)	(0.160)
Visible (side of street) × Republican nbhd × Expected value	0.073	0.131	0.110
	(0.062)	(0.085)	(0.074)
Fixed-effects			
Blockgroup-Registered voter	Yes	Yes	Yes
Fit statistics			
Observations	818,086	818,086	818,086
Pseudo R^2	0.10005	0.10012	0.10007
Log-Likelihood	-224,586.1	-224,567.0	-224,580.3

Clustered (Blockgroup-Registered voter) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

Table B.4: Robustness Results: Estimation using linear probability model.

Dependent Variable:	Adopt		
Model:	(1)	(2)	(3)
Neighborhood definition:	Block x Street	Block	Blockgroup x Street
Variables			
Republican hh	-0.024***	-0.024***	-0.025***
	(0.004)	(0.004)	(0.004)
Expected value	0.012***	0.011***	0.011***
	(0.0008)	(0.0008)	(0.0008)
Expected value × Republican hh	0.0007	0.0006	0.0007
	(0.0009)	(0.0008)	(0.0008)
Expected value × Unregistered voter hh	-0.006***	-0.006***	-0.006***
	(0.0010)	(0.0010)	(0.0010)
Visible (frac of degrees from closest street)	-0.008***	-0.008***	-0.008***
	(0.001)	(0.001)	(0.001)
Visible (frac of degrees from closest street) × Republican hh	-0.0008	-0.0009	-0.0005
	(0.003)	(0.003)	(0.003)
Visible (frac of degrees from closest street) × Unregistered voter hh	0.007**	0.006**	0.007**
	(0.002)	(0.002)	(0.002)
Visible (frac of degrees from closest street) × Expected value	-0.002+	-0.002	-0.001
	(0.0010)	(0.0010)	(0.0010)
Republican nbhd	0.021***	0.044***	0.031***
	(0.004)	(0.008)	(0.006)
Republican nbhd × Republican hh	-0.020**	-0.035***	-0.028**
	(0.007)	(0.011)	(0.009)
Republican nbhd × Unregistered voter hh	-0.013+	-0.019+	-0.023*
	(0.007)	(0.011)	(0.009)
Republican nbhd × Expected value	0.0004	0.004	0.0007
	(0.003)	(0.005)	(0.005)
Republican nbhd × Expected value × Republican hh	0.004	0.006	0.005
	(0.004)	(0.006)	(0.006)
Republican nbhd × Expected value × Unregistered voter hh	0.002	0.005	0.0004
	(0.004)	(0.006)	(0.006)
Visible (frac of degrees from closest street) × Republican nbhd	-0.021**	-0.037***	-0.028**
	(0.008)	(0.011)	(0.010)
Visible (frac of degrees from closest street) × Republican nbhd × Republican hh	0.014	0.034+	0.017
	(0.014)	(0.020)	(0.018)
Visible (frac of degrees from closest street) × Republican nbhd × Unregistered voter hh	0.021+	0.018	0.029+
	(0.012)	(0.017)	(0.015)
Visible (frac of degrees from closest street) × Republican nbhd × Expected value	0.005	0.001	0.009
	(0.005)	(0.007)	(0.007)
Fixed-effects			
Blockgroup-Registered voter	Yes	Yes	Yes
Fit statistics			
Observations	905,028	905,028	905,028
Pseudo R^2	0.31914	0.31929	0.31920
Log-Likelihood	-78,626.1	-78,609.6	-78,619.4

EV and the Republican neighborhood measure $\bar{A}$ are demeaned.
Clustered (Blockgroup-Registered voter) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

Table B.5: Robustness Results: Sample split by registration.

Nbhd definition:	Block x Street			Block			Blockgroup x Street		
Sample split:	Dem	Rep	Unreg	Dem	Rep	Unreg	Dem	Rep	Unreg
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Variables									
Expected value	0.202***	0.161***	0.136***	0.205***	0.180***	0.134***	0.205***	0.164***	0.137***
	(0.018)	(0.026)	(0.027)	(0.018)	(0.028)	(0.027)	(0.018)	(0.026)	(0.027)
Republican nbhd	0.197***	0.077	0.199*	0.398***	0.283*	0.477**	0.289***	0.126	0.206+
	(0.052)	(0.075)	(0.096)	(0.095)	(0.131)	(0.154)	(0.071)	(0.098)	(0.118)
Republican nbhd × Expected value	-0.177**	-0.010	-0.246*	-0.335***	-0.183	-0.177	-0.300***	-0.034	-0.282*
	(0.058)	(0.085)	(0.105)	(0.086)	(0.135)	(0.157)	(0.074)	(0.115)	(0.121)
Visible (frac of degrees from closest street)	-0.091***	-0.107**	-0.028	-0.090***	-0.115**	-0.020	-0.092***	-0.109**	-0.028
	(0.020)	(0.034)	(0.035)	(0.020)	(0.037)	(0.035)	(0.020)	(0.035)	(0.035)
Visible (frac of degrees from closest street) × Republican nbhd	-0.188+	-0.019	-0.099	-0.309*	0.062	-0.344	-0.251*	-0.001	-0.057
	(0.098)	(0.147)	(0.178)	(0.134)	(0.222)	(0.242)	(0.121)	(0.188)	(0.213)
Visible (frac of degrees from closest street) × Expected value	-0.010	0.005	0.034	-0.011	-0.018	0.040	-0.012	0.005	0.033
	(0.025)	(0.041)	(0.042)	(0.025)	(0.043)	(0.042)	(0.025)	(0.041)	(0.042)
Visible (frac of degrees from closest street) × Republican nbhd × Expected value	0.159	-0.080	0.548**	0.204	0.156	0.268	0.320*	-0.081	0.511*
	(0.117)	(0.158)	(0.197)	(0.148)	(0.243)	(0.276)	(0.142)	(0.207)	(0.238)
Fixed-effects									
Blockgroup-Registered voter	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fit statistics									
Observations	457,138	152,609	186,976	457,138	152,609	186,976	457,138	152,609	186,976
Pseudo R^2	0.09259	0.10328	0.11281	0.09265	0.10338	0.11279	0.09262	0.10330	0.11276
Log-Likelihood	-127,682.3	-51,186.8	-42,858.8	-127,674.0	-51,181.5	-42,859.9	-127,677.9	-51,186.0	-42,861.3

Clustered (Blockgroup-Registered voter) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

This is akin to restricting the crowding out of the social signal to be identical for all political affiliations. Although this is consistent with our theory since the crowding out attenuates non-conformity penalty, we estimate a version of equation 11 that allows the crowding out of the social signal to be different for each voter affiliation $\{D/m, R, U\}$. Results of this quadruple-interaction are in Table B.7.

Results in Table B.7 show little change in the main estimates and testable implications. The added interactions, shown in the last three rows, are not statistically significant for any of the political affiliations except column (1) (neighborhood defined as census block-by-street), for unregistered households at the 10% level. Effects for unregistered households are statistically significant at the 5% level for columns (1) and (3), but not significant in column (2) (p-value 0.29). Effects for Democratic/mixed affiliation households are significant in column (3) only, suggesting some Democratic/mixed affiliation-specific crowding out of the social signal. For Republican households, none of the effects are statistically significant. We interpret these results to be suggestive evidence that Democratic/mixed households with visible installations in more Republican neighborhoods face an attenuated non-conformity penalty (Vis x Republican nbhd) when the installation is of higher EV.

Table B.6: Robustness Results: Sample limited to houses sold in 2005 or earlier only.

Dependent Variable:	Adopt		
Model:	(1)	(2)	(3)
Neighborhood definition:	Block x Street	Block	Blockgroup x Street
Variables			
Republican hh	-0.250***	-0.243***	-0.248***
	(0.062)	(0.062)	(0.062)
Expected value	0.194***	0.198***	0.197***
	(0.017)	(0.017)	(0.017)
Expected value × Republican hh	0.040*	0.039*	0.042*
	(0.019)	(0.020)	(0.019)
Expected value × Unregistered voter hh	-0.039	-0.039	-0.040
	(0.032)	(0.032)	(0.032)
Visible (frac of degrees from closest street)	-0.087***	-0.085***	-0.087***
	(0.024)	(0.024)	(0.024)
Visible (frac of degrees from closest street) × Republican hh	-0.034	-0.052	-0.040
	(0.044)	(0.047)	(0.045)
Visible (frac of degrees from closest street) × Unregistered voter hh	0.121*	0.123*	0.122*
	(0.055)	(0.055)	(0.055)
Visible (frac of degrees from closest street) × Expected value	-0.013	-0.012	-0.016
	(0.023)	(0.024)	(0.024)
Republican nbhd	0.239***	0.456***	0.356***
	(0.064)	(0.103)	(0.082)
Republican nbhd × Republican hh	-0.240*	-0.380*	-0.356**
	(0.102)	(0.151)	(0.126)
Republican nbhd × Unregistered voter hh	-0.262+	-0.213	-0.321+
	(0.148)	(0.236)	(0.185)
Republican nbhd × Expected value	-0.196**	-0.333***	-0.307***
	(0.060)	(0.087)	(0.076)
Republican nbhd × Expected value × Republican hh	0.019	0.092	0.032
	(0.077)	(0.107)	(0.101)
Republican nbhd × Expected value × Unregistered voter hh	0.012	0.061	0.073
	(0.118)	(0.166)	(0.138)
Visible (frac of degrees from closest street) × Republican nbhd	-0.207+	-0.284+	-0.287+
	(0.122)	(0.167)	(0.150)
Visible (frac of degrees from closest street) × Republican nbhd × Republican hh	0.347+	0.612*	0.454+
	(0.204)	(0.289)	(0.250)
Visible (frac of degrees from closest street) × Republican nbhd × Unregistered voter hh	0.375	0.256	0.290
	(0.271)	(0.373)	(0.331)
Visible (frac of degrees from closest street) × Republican nbhd × Expected value	0.210+	0.153	0.355**
	(0.109)	(0.137)	(0.131)
Fixed-effects			
Blockgroup-Registered voter	Yes	Yes	Yes
Fit statistics			
Observations	512,166	512,166	512,166
Pseudo R^2	0.08819	0.08824	0.08822
Log-Likelihood	-134,788.6	-134,780.7	-134,784.6

Clustered (Blockgroup-Registered voter) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

Table B.7: Robustness Results: Include quadruple interaction of Vis x EV x Nbhd x Own affiliation.

Dependent Variable:	Adopt		
Model:	(1)	(2)	(3)
Neighborhood definition:	Block x Street	Block	Blockgroup x Street
Variables			
Republican hh	-0.171***	-0.165***	-0.171***
	(0.050)	(0.050)	(0.050)
Expected value	0.187***	0.192***	0.189***
	(0.015)	(0.015)	(0.015)
Expected value × Republican hh	0.001	0.007	0.003
	(0.015)	(0.015)	(0.015)
Expected value × Unregistered voter hh	-0.037	-0.042+	-0.039
	(0.024)	(0.024)	(0.025)
Visible (frac of degrees from closest street)	-0.098***	-0.095***	-0.098***
	(0.020)	(0.020)	(0.020)
Visible (frac of degrees from closest street) × Republican hh	-0.006	-0.022	-0.006
	(0.035)	(0.037)	(0.036)
Visible (frac of degrees from closest street) × Unregistered voter hh	0.076+	0.083*	0.077+
	(0.039)	(0.040)	(0.039)
Visible (frac of degrees from closest street) × Expected value	0.0008	-0.002	-0.0001
	(0.019)	(0.019)	(0.019)
Republican nbhd	0.232***	0.502***	0.348***
	(0.051)	(0.089)	(0.068)
Republican nbhd × Republican hh	-0.199*	-0.334**	-0.280**
	(0.084)	(0.124)	(0.104)
Republican nbhd × Unregistered voter hh	-0.034	-0.029	-0.144
	(0.109)	(0.178)	(0.137)
Republican nbhd × Expected value	-0.161**	-0.292***	-0.274***
	(0.056)	(0.081)	(0.071)
Republican nbhd × Expected value × Republican hh	0.096	0.043	0.166
	(0.092)	(0.126)	(0.117)
Republican nbhd × Expected value × Unregistered voter hh	-0.091	0.100	-0.015
	(0.119)	(0.179)	(0.141)
Visible (frac of degrees from closest street) × Republican nbhd	-0.198*	-0.338*	-0.275*
	(0.097)	(0.133)	(0.119)
Visible (frac of degrees from closest street) × Republican nbhd × Republican hh	0.202	0.439+	0.280
	(0.170)	(0.245)	(0.213)
Visible (frac of degrees from closest street) × Republican nbhd × Unregistered voter hh	0.107	0.009	0.228
	(0.202)	(0.275)	(0.244)
Visible (frac of degrees from closest street) × Republican nbhd × Expected value	0.148	0.178	0.302*
	(0.115)	(0.145)	(0.139)
Visible (frac of degrees from closest street) × Republican nbhd × Expected value × Republican hh	-0.165	-0.039	-0.320
	(0.177)	(0.255)	(0.225)
Visible (frac of degrees from closest street) × Republican nbhd × Expected value × Unregistered voter hh	0.406+	0.115	0.218
	(0.226)	(0.311)	(0.275)
Fixed-effects			
Blockgroup-Registered voter	Yes	Yes	Yes
Fit statistics			
Observations	818,086	818,086	818,086
Pseudo R^2	0.10004	0.10010	0.10006
Log-Likelihood	-224,587.8	-224,573.2	-224,583.9

Clustered (Blockgroup-Registered voter) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

B.8 Dropping Interaction of Vis, Neighborhood, and EV

Results on the interaction of visibility, neighborhood, and EV are of mixed significance as Table 2, column (2) is significant at the 10% level, while (1) and (3) are significant at the 5% level. To ensure that other results are not sensitive to the inclusion of this interaction, we estimate the model with a simpler specification, omitting the visibility, neighborhood, and EV interaction. Results are shown here.

Table B.8: Robustness Results: Drop EV x Visibility x Nbhd interactions.

Dependent Variable:	Adopt		
Model:	(1)	(2)	(3)
Neighborhood definition:	Block x Street	Block	Blockgroup x Street
Variables			
Republican hh	-0.170***	-0.165**	-0.169***
	(0.050)	(0.050)	(0.050)
Expected value	0.187***	0.191***	0.188***
	(0.012)	(0.012)	(0.012)
Expected value × Republican hh	0.002	0.007	0.003
	(0.015)	(0.015)	(0.015)
Expected value × Unregistered voter hh	-0.040	-0.042+	-0.040
	(0.024)	(0.024)	(0.024)
Visible (frac of degrees from closest street)	-0.096***	-0.093***	-0.094***
	(0.019)	(0.019)	(0.019)
Visible (frac of degrees from closest street) × Republican hh	-0.008	-0.023	-0.010
	(0.035)	(0.037)	(0.036)
Visible (frac of degrees from closest street) × Unregistered voter hh	0.080*	0.084*	0.078*
	(0.039)	(0.039)	(0.039)
Republican nbhd	0.220***	0.491***	0.325***
	(0.051)	(0.088)	(0.067)
Republican nbhd × Republican hh	-0.185*	-0.334**	-0.256*
	(0.081)	(0.122)	(0.101)
Republican nbhd × Unregistered voter hh	-0.070	-0.043	-0.166
	(0.108)	(0.177)	(0.135)
Republican nbhd × Expected value	-0.102**	-0.223***	-0.159**
	(0.038)	(0.057)	(0.050)
Republican nbhd × Expected value × Republican hh	0.031	0.026	0.045
	(0.060)	(0.085)	(0.077)
Republican nbhd × Expected value × Unregistered voter hh	0.064	0.148	0.061
	(0.085)	(0.124)	(0.103)
Visible (frac of degrees from closest street) × Republican nbhd	-0.172+	-0.311*	-0.219+
	(0.094)	(0.130)	(0.117)
Visible (frac of degrees from closest street) × Republican nbhd × Republican hh	0.171	0.441+	0.219
	(0.163)	(0.236)	(0.204)
Visible (frac of degrees from closest street) × Republican nbhd × Unregistered voter hh	0.195	0.037	0.287
	(0.196)	(0.268)	(0.237)
Fixed-effects			
Blockgroup-Registered voter	Yes	Yes	Yes
Fit statistics			
Observations	818,086	818,086	818,086
Pseudo R^2	0.10002	0.10009	0.10004
Log-Likelihood	-224,592.8	-224,574.7	-224,588.8

Clustered (Blockgroup-Registered voter) standard-errors in parentheses
*Signif. Codes: ***: 0.001, **: 0.01, *: 0.05, +: 0.1*

Results in B.8 show little change qualitatively or statistically from the main results, though the interaction between visibility and neighborhood is statistically significant only at the 10% level in columns (1) and (3).

C Construction of Visibility Measures

Our primary visibility measure quantifies the angular degree of visibility of a potential solar installation from the nearest public roadway. The underlying data are drawn from the confidential Google Project Sunroof dataset, obtained directly from Google. For each residential structure, Project Sunroof provides the rooftop centroid and a set of roof segments, defined as planar, contiguous roof areas with uniform orientation. For each segment, the data include the azimuth (degrees clockwise from north), pitch (degrees relative to horizontal), and the maximum number of standard-sized solar panels that can be accommodated. The dataset further reports the optimal system size, the distribution of panels across roof segments under this configuration, and the rank ordering of segments by cumulative solar insolation.

Our algorithmic visibility measure is similar to that of Bollinger et al. (2022), proceeding as follows:

- First, we find the number of roof segments necessary for an optimal installation. To do so, we take either the first (sunniest) roof segment or, if the first roof segment does not hold more than 75% of the optimal number of panels, the first two sunniest roof segments.

- Second, from the single reported centroid of the roof, we draw 360 evenly-spaced radii 65m long, each representing a single "degree of visibility".

- Third, we construct a visibility semi-circle 65m in diameter that represents the 180 degrees of orientation over which a solar panel would be visible. We rotate the semi-circle around the rooftop centroid based on the reported roof segment orientation (azimuth) such that the semi-circle represents the visible range for a panel on that roof segment.

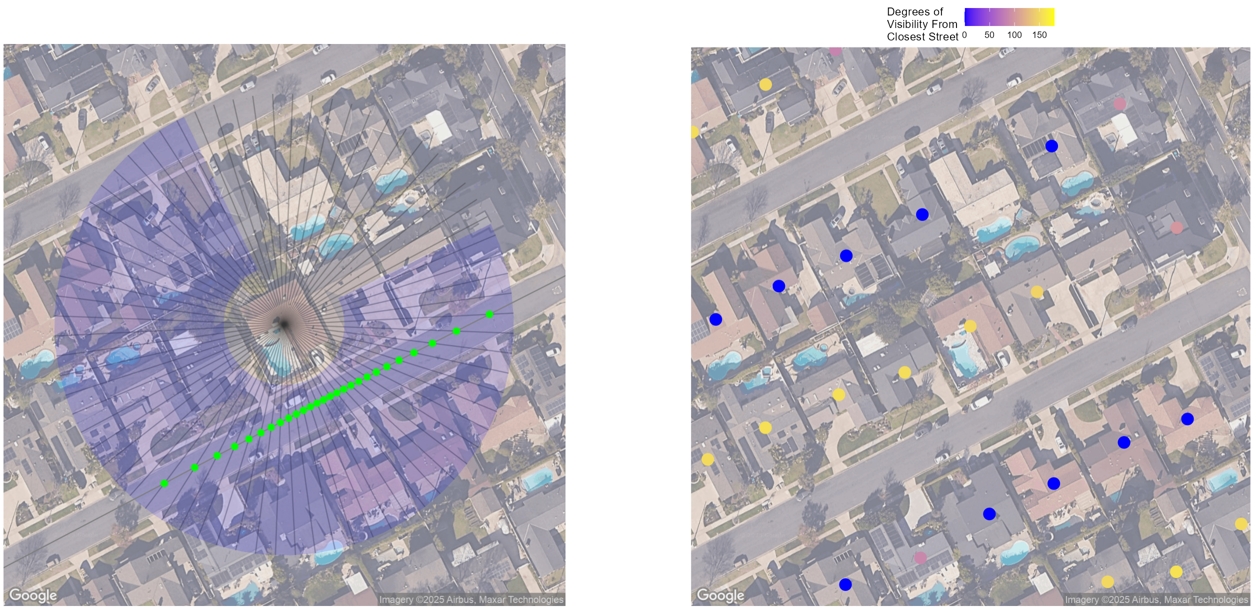
- Fourth, we calculate the distance from the rooftop centroid at which the pitch of the roof segment would render the panel non-visible and remove that area from the semi-circle, making a "semi-donut".

- Fifth, we find the nearest street to the roof centroid on the CalTrans All Public Road shapefile.[29]

Each point in the intersection of the the visibility "semi-donut", the nearest public road, and the 360 drawn radii is counted as a degree of visibility. We show an example in Figure B.1a, which shows the "semi-donut", the drawn radii, and the intersection points (in green). Because a house may have east-west facing panels, it is possible for the measure to exceed 180 degrees, especially if the house is located on a sharp bend in the nearest street. This occurs in 0.15% of observations. Therefore, we censor the visibility measure at 180 degrees, and re-scale such that our visibility measure is bounded between 0 and 1 for analysis.

We also calculate a simpler binary visibility measure based on side-of-street for robustness. We calculate this visibility measure in the following manner: First, we calculate the angle of a line drawn from a rooftop centroid to the nearest point on the nearest street. This angle represents the side-of-street, where 0 indicates that the home is due north of the nearest street point, and 180 indicates that the home is due south of the nearest street point. Houses located at an angle greater than 315 degrees or less than 45 lie in the northern quadrant and are designated as "visible." All others are designated as non-visible. We report results using this measure of visibility in Section B.

[29] Available at https://caltrans-gis.dot.ca.gov/portal/home/item.html?id=836c3a3e2e7f40b8b36b24addf01cf14.



(a) **House visibility measure example**. Each radial line from the focal house represents a potential degree of visibility. The blue circle represents the direction of visibility of the panel(s) and is/are oriented in the direction (azimuth) of the optimal installation's roof segment(s). Households with more than one roof segment for an optimal installation, as is the case here, are the union of two semicircles, each oriented in the roof segment's directions. Areas in blue are areas for which the potential solar installation would be visible. The concentric circle in the middle represents areas where rooftop panels would not be visible due to the ground angle. The radius of this "donut hole" is a function of the roof segment pitch. Green points represent the intersection of a degree of visibility (black lines), the nearest street, and the blue visibility area. Each point is a degree of visibility. For simplicity, each line represents 5 degrees of visibility, while in practice, our measure uses 360 lines representing one degree each.

(b) **Visibility.** Each home's visibility measure is shown in color. Houses on the south side of the street are largely zero-visibility as the optimal panel orientation is on the back side of the roof. However, one household in the lower left corner is partially visible despite being located on the south side of the street. In this case, the orientation of the roof line is such that one optimal location for a panel is on the street side facing west-southwest, resulting in a visibility measure of approximately 55 degrees due to the street's SW-NE orientation.