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Incentive Pass-through for Residential Solar Systems in California

Overview

The deployment of solar photovoltaic (PV) systems has grown rapidly over the past decade, partly as a result of government incentives. In the United States, the California Solar Initiative (CSI) and its predecessor, the Emerging Renewables Program (ERP), have been promoting PV deployment since 1998. Collectively, they have been the nation's largest and longest-running state-level PV incentive programs for residential systems, offering California's PV customers upfront rebates, with the rebate level changing over time.

The degree to which these incentives have been passed on to PV customers has not been studied systematically. Specifically, if PV installers adjust their pre-incentive PV prices to account for available incentives—for example, increasing prices when incentives are higher—they would retain some of the incentives, resulting in a pass-through rate to PV customers of less than 100%. Incentive pass-through has implications for ongoing and future PV incentive programs, given that the goal of these programs is to improve the customer-economics of PV. Understanding incentive pass-through also illuminates the level of installer competition present in local PV markets and can suggest which types of policies or policy designs might be most effective in a given market.

Researchers from Lawrence Berkeley National Laboratory (LBNL) and The University of Texas at Austin analyzed incentive pass-through using data from the CSI and ERP, focusing on California's residential PV systems and excluding a certain class of third-party-owned (TPO) PV systems from the analysis. Because of the study's scope, the results presented here may not apply outside of California, to California's overall solar market (including other customer segments), to all TPO PV systems, or to all forms of financial incentives for solar (considering not only direct rebates, but also utility electric bill savings and federal tax incentives).

Data and Methods

The study relied on LBNL's sizable *Tracking the Sun* dataset of system-level PV prices, including data from both the CSI and ERP incentive programs. Only nominal system-level installation prices within $1.5/W and $20/W were retained, and system size was limited to below 10 kW. PV systems installed between 2001 and 2012 were included, with a focus on the 49 California counties with the longest PV-installation history. Appraised-value TPO PV systems were excluded whenever calculating price or net price as the dependent variable, because appraised-value prices do not reasonably reflect actual installation costs.

The study used both structural modeling and reduced-form regression analysis to estimate the extent of incentive pass-through. These are common methods for evaluating pass-through rates by controlling for numerous variables and isolating the effect of incentive levels on system prices. Structural modeling involves the simultaneous estimation of PV supply and demand, allowing an estimation of county-level incentive pass-through. Reduced-form regression directly estimates the relationship between PV system prices and a wide-variety of PV system and market characteristics, including incentive levels; pass-through rates can be estimated at the state and county levels.

Results and Conclusions

The results show a high historical pass-through rate for the California residential PV rebate programs, with variation among counties. The structural-modeling estimates county-level pass-through rates from 92% to 103%, with a mean value of 99%, suggesting incentives were almost entirely passed through to customers on average (Figure 1).

The reduced-form regression shows similar results, with pass-through rates ranging from 86% to 103% at the state-level depending on model specification (M1–M3), and a weighted-average, county-level pass-through rate of 95%.

Focusing on the inner 10th–90th percentiles for the county-level regressions, estimated pass-through rates range from 68% to 122% (Figure 2).

These two estimation approaches are complementary: while the structural-modeling approach has a strong theoretical basis and can produce reliable results for relatively small markets, the reduced-form regression analysis is straightforward, easy to interpret, and does not require as many structural assumptions. The similarity of results from these approaches to estimating pass-through rates lends credibility and robustness to those results.

Figure 1. Pass-through rates in 49 California counties: structural-modeling approach
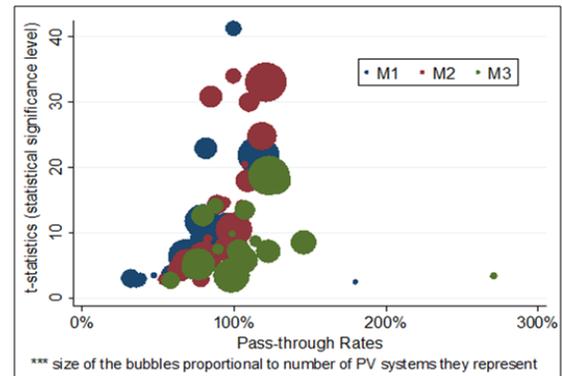
Figure 2. County-specific pass-through rates: reduced-form regression approach

These results suggest that PV installers in California considered CSI and ERP rebates as outside factors when making pricing decisions, and they suggest a reasonably competitive market and, at least from the perspective of incentive pass-through, a well-functioning subsidy program. In part, these results may be due to the fact that California's rebate changes over time have been somewhat gradual, especially under the CSI. They may also suggest that installers have been competing more on quantity than on price, taking rebate decreases as an opportunity to increase sales in advance of the decline. The high pass-through results found in this study contrast, however, with results from some other studies that employ different methods, data, and assumptions. In addition, caution should be exercised before making broad inferences based on the results of this study alone. The estimated pass-through rates do not apply outside of California or to all types of TPO PV systems. In addition, the results focus narrowly on the pass-through of direct solar incentives offered by the CSI and ERP. Broader "value-based pricing" is not evaluated, which would consider the combined impact of state incentives, electric utility bill savings, and tax incentives.
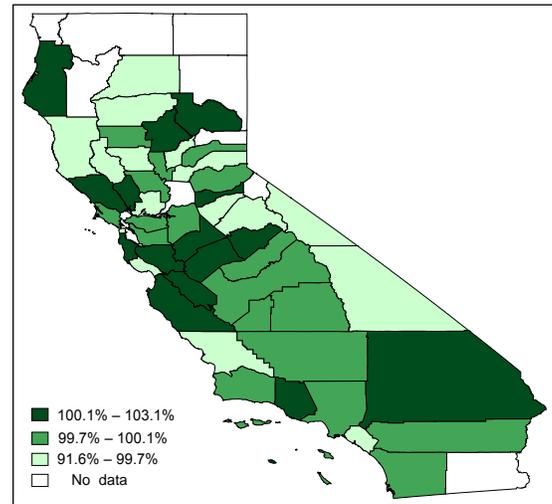
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