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Bridging Financing Gaps: Homeowners' Preferences for Solar PV Business Models

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The purchase of a residential solar photovoltaic (PV) system necessitates a substantial initial investment and a certain degree of planning and administration. These obstacles may be overcome by implementing rental models. Furthermore, there is a growing discourse surrounding alternative business models that have the potential to address the utilization of PV electricity that is not utilized within a household. This issue is addressed by the concept of electricity clouds, which aim to stabilize the fluctuations in individual electricity demand and the availability of PV electricity. The study seeks to ascertain whether a customer segment can be identified for which these innovative energy services are perceived as attractive. Drivers of solar PV adoption decisions have been widely studied in the literature (e.g., Best et al., 2019; Best and Chareunsky, 2022; Groote et al., 2016; Zhang et al., 2023). We implement drivers, namely investment costs and self-sufficiency as well as barriers such as investment cost and amortization time, into a discrete choice experiment (DCE) to elicit homeowners' general preferences for these attributes.

Purchasing a solar PV system involves a large upfront investment and potential recurring maintenance costs over the life of the system. Thus, rental models can potentially enable homeowners to adopt solar PV who were previously unable to do so. However, it is unclear whether homeowners are willing to adopt rental models when they are presented in combination with "classic" direct purchase models. Some studies in the area of electric vehicle adoption decisions find that when given the option of leasing or purchasing an electric vehicle, people generally prefer to purchase, although these results are ambiguous and depend on the exact type of vehicle (Huang et al., 2021; Liao et al., 2019). Findings from studies in the area of energy retrofit decisions also suggest a preference for purchasing over renting. Schleich et al. (2021) study UK homeowners' preferences for purchase models for new heating systems and find that respondents have a positive willingness-to-pay (WTP) for direct purchase rather than a rental option. To explore these preferences in the realm of residential solar PV systems, we differentiate between two purchase models: Respondents can choose to either outright purchase or rent their future solar PV system. In addition, empirical evidence demonstrates a prevalent preference among consumers for integrating their solar PV systems with batteries, thereby enhancing self-sufficiency (e.g., Priessner and Hampl, 2020; Uz and Mamkhezri, 2024). Thus, we also include the option to combine the purchased or rented solar PV system with a battery.

This paper presents the findings of the aforementioned DCE conducted among German homeowners to investigate their preferences regarding different purchase options for solar PV systems. To analyze the data, we employ flexible mixed logit models in preference space as well as in WTP space (Thiene and Scarpa, 2009; Train and Weeks, 2005). Furthermore, following, e.g., Ladenburg and Skotte (2022), Schleich et al. (2021), and Meyerhoff et al. (2019), we elicit heterogeneity in preferences by including interaction terms between the attributes and several individual-specific variables. For this study, to reduce hypothetical bias in our results, we limited our sample to homeowners who reported that they did not own a solar PV system and that installing one was at least a possibility. We did this by asking homeowners without a solar PV system about the likelihood of installing one in the next 5 years and excluding those who said it was very unlikely from the choice experiment. A total of 842 homeowners participated in the discrete choice experiment.

The results we find regarding innovative business models are ambiguous. First, our results suggest a general preference among homeowners for a direct purchase model when given the choice between it and a rent-to-own model. However, we find that this depends on household-specific characteristics, such as the age of the decision maker, the ability to invest 30,000 Euro and the ownership of electric vehicles. We find that homeowners who are older, who do not have the means to purchase a solar PV system outright, or who are

less advanced in their decision making process regarding the adoption of solar PV, are less likely to invest in a solar PV system via direct purchase. With respect to rent-to-own models, we find that homeowners who are younger and less certain about their investment decisions are more likely to engage in this business model. A comparison of our hypothetical rent-to-own models with real-world examples showed that the choices in our experiment were made under favorable economic conditions for the rent-to-own model, with lower total prices compared to real-world examples. This suggests that the demand for rent-to-own models may be overstated in our models. Thus, our results suggest that rent-to-own models are potentially able to increase the solar PV adoption intentions of the aforementioned target groups, albeit to a small extent compared to the standard direct purchase business model. Regarding the concept of energy sharing, we find that there seems to be a general interest in these business models. However, we find differences in preferences between the two types of energy sharing as well as between household characteristics. In general, people prefer regional energy sharing compared to a “family and friends” type of energy sharing, where households choose the respective recipient of their surplus electricity. Examining heterogeneity in preferences, we find that prior ownership of electric vehicles positively affects the preferences for energy sharing options. Overall, our results suggest that rent-to-own and energy sharing models are likely to have a small impact on solar PV adoption among homeowners.

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