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Institute for Future Energy Consumer Needs and Behavior (FCN)

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Authors' addresses:

Tugba Atasoy, Reinhard Madlener
Chair of Energy Economics and Management
Institute for Future Energy Consumer Needs and Behavior (FCN)
School of Business and Economics / E.ON Energy Research Center
RWTH Aachen University
Mathieustraße 10, 52074 Aachen, Germany
E-Mail: TAtasoy@eonerc.rwth-aachen.de, RMadlener@eonerc.rwth-aachen.de

Publisher: Prof. Dr. Reinhard Madlener
Chair of Energy Economics and Management
Director, Institute for Future Energy Consumer Needs and Behavior (FCN)
E.ON Energy Research Center (E.ON ERC)
RWTH Aachen University
Mathieustraße 10, 52074 Aachen, Germany
Phone: +49 (0) 241-80 49820
Web: www.fcn.eonerc.rwth-aachen.de
E-mail: post_fcn@eonerc.rwth-aachen.de

Structural and Financial Constraints Driving Residential Solar PV Adoption: Empirical Evidence from Austria

Ayse Tugba Atasoy[*,‡] Reinhard Madlener[*]

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Abstract

Residential solar photovoltaic systems play a key role in decentralized energy transitions. Despite declining technology costs and growing policy support, household adoption remains uneven and below technical potential. This paper investigates whether PV adoption is primarily driven by preferences and motivations or constrained by structural and economic feasibility. Using a representative survey of Austrian households, we compare adopters and non-adopters by examining structural housing conditions, socio-economic characteristics and environmental attitudes, as well as the co-adoption of complementary technologies, complemented by evidence on perceived motivations and barriers. The results show that adoption is strongly associated with structural feasibility and technology co-adoption. Higher income, single-family housing, and ownership of heat pumps and electric vehicles significantly increase adoption likelihood, while the effect of homeownership becomes statistically insignificant once income and other socio-economic factors are controlled for. Environmental awareness does not significantly predict adoption once structural factors are taken into account. Reported barriers among non-adopters closely mirror these patterns: financial constraints, building limitations, and administrative hurdles dominate. Overall, the findings suggest that structural and financial constraints play a more prominent role than preference-based factors in shaping residential PV adoption, highlighting the importance of addressing feasibility barriers in policy design. Policies should therefore prioritize reducing structural and financial constraints, particularly for households in multi-family housing.

JEL Classification: Q42, Q48, D12, R20

Keywords: Residential Solar Photovoltaics; Energy Policy; Household Adoption; Structural Barriers; Financial Constraints; Energy Transition; Austria

[*]Chair of Energy Economics and Management, Institute for Future Energy Consumer Needs and Behavior (FCN), E.ON Energy Research Center / School of Business and Economics, RWTH Aachen University, Aachen, Germany.

[‡]Corresponding author. Email: TAtasoy@eonerc.rwth-aachen.de.

1 Introduction

Residential solar photovoltaic (PV) systems have become a central technology in the transition toward decentralized and low-carbon energy systems. By enabling on-site electricity generation, they contribute to decarbonization, reduce reliance on fossil fuels, and increase electricity system flexibility by giving households the option to use generated electricity for self-consumption, store it for flexible use, or feed it into the grid. In many countries, declining technology costs, rising retail electricity prices, and extensive policy support have significantly improved the economic attractiveness of residential PV investments. In contrast to other building-related energy investments, PV systems often offer relatively transparent and predictable payback periods (Fowlie et al., 2018; Galvin, 2024).

Despite these favorable conditions, adoption remains uneven and well below the technical potential. While some households invest early and extensively, many others do not adopt even when the economic case appears favorable. This pattern raises an important question. If residential PV has become a financially attractive and widely known technology, limited diffusion may no longer primarily reflect insufficient willingness to adopt. Instead, adoption may increasingly depend on whether households face the financial, structural, and institutional conditions required to invest in residential PV systems, such as sufficient upfront capital, suitable roof and housing characteristics and home ownership, and access to supportive policies and regulatory frameworks.

Residential PV adoption therefore reflects the interaction between household preferences and feasibility constraints. Understanding the relative importance of these factors is essential for designing effective policy measures. If non-adoption is primarily driven by limited motivation or information gaps, awareness campaigns or behavioral interventions may be appropriate. If, however, adoption is constrained by financial, housing-related, or institutional barriers, policies need to focus on improving access and feasibility. Identifying which of these mechanisms dominates is therefore central for both research and policy.

The literature identifies several groups of factors that may shape residential PV adoption. Broadly, these can be grouped into three categories: (i) behavioral and preference-related drivers, such as environmental concern, technology attitudes, and social influence; (ii) financial feasibility conditions, including household income, liquidity constraints, and investment costs; and (iii) structural and institutional constraints related to housing characteristics, ownership structures, and regulatory frameworks.

A first strand of literature focuses on behavioral and preference-related drivers of adoption. One line of research attributes timing of adoption differences and thus diffusion dynamics to heterogeneity in preferences and behavioral factors. Environmental concern, technology affinity, and social influence (e.g., imitation, bandwagoning) shape investment decisions, particularly in early market phases (Gillingham and Bollinger, 2021; Palm, 2020). From this perspective, limited diffusion is often interpreted as the result of information asymmetry, uncertainty, or insufficient perceived benefits.

Qualitative evidence further suggests that homeowners may hold ambivalent beliefs about low-carbon technologies, perceiving them as unfamiliar or risky despite recognizing their environmental or economic advantages (Terenzi et al., 2025). This strand of literature implies that increasing awareness or strengthening environmental motivation could accelerate adoption.

The importance of behavioral drivers may also evolve as markets mature. Early adopters are often characterized by strong environmental commitment and a high level of technology interest, whereas later adopters may place greater emphasis on economic considerations as information improves and investment conditions become more favorable (Palm, 2020). This suggests that the relative importance of environmental motivations may decline as technologies become more established, while economic considerations and feasibility conditions become more prominent in adoption decisions.

At the same time, a growing body of research emphasizes the role of financial feasibility. Even when long-term expected returns are positive, residential PV systems require a substantial upfront investment. Liquidity constraints, limited access to debt capital, and concerns about payback periods may therefore restrict adoption, particularly among lower-income households (Karakaya and Sriwannawit, 2015). Cross-country evidence further indicates that the perceived affordability of PV remains an important determinant of adoption and that supportive financing schemes and policy incentives continue to play a central role.

These findings suggest that improving the economic attractiveness of PV alone may not be sufficient to achieve broad diffusion. Even under favorable economic conditions, households may face binding financial constraints that prevent investment.

Beyond financial aspects, residential PV adoption also depends on structural and institutional feasibility. Installation requires suitable housing conditions, including sufficient roof space, adequate building orientation, and technical compatibility. Homeownership and decision authority are often prerequisites, while coordination problems in multi-family buildings can prevent adoption even when investments are economically attractive.

In addition, the broader institutional environment shapes households' ability to invest. Market design, administrative procedures, financing conditions, and policy incentives influence both the complexity and the attractiveness of PV investments (Kyere et al., 2024). These structural and institutional factors determine not only whether adoption is profitable, but whether it is practically feasible.

Consistent with this perspective, empirical evidence shows that PV adoption remains strongly concentrated among homeowners and higher-income households, pointing to unequal access to the benefits of distributed solar (Sovacool et al., 2022). Uneven diffusion may therefore reflect differences in feasibility rather than differences in willingness to adopt.

More recently, the literature has highlighted that PV adoption is increasingly embedded in broader household energy and investment strategies. Complementarities with electricity-based technologies such as electric vehicles and heat pumps can increase the value of self-generated electricity and lead to positively correlated adoption decisions (Cohen et al., 2019). These complementarities strengthen the economic case for PV and may influence both the timing and the profitability of investments.

At the same time, evidence on joint adoption shows that such investment strategies remain strongly conditioned by structural factors, particularly dwelling ownership, housing characteristics, and access to capital (Hajhashemi et al., 2024). Thus, even as the economic value of PV increases through technological complementarities, the ability to realize these benefits remains unevenly distributed across households.

The policy environment further shapes adoption by affecting both economic incentives and behavioral responses. Regulatory provisions such as the tax treatment of feed-in revenues influence effective investment returns and installled capacity choices (Fleiter et al., 2023). Changes in the relative economic incentives for self-consumption and grid feed-in affect prosumer behavior and electricity use patterns (Atasoy et al., 2023). Pricing structures and regulatory design can also generate unintended or undesired behavioral responses, underlining the importance of institutional design for achieving policy objectives (Galvin et al., 2022). More broadly, governance quality and political support influence deployment dynamics and long-term adoption trends (Aparasi-Cerdá et al., 2024).

Thus, the literature points to multiple explanations for uneven diffusion, including heterogeneous preferences, financial constraints, structural barriers, technological complementarities, and institutional conditions. However, the relative importance of these factors remains unclear. Many studies focus on specific mechanisms or selected subpopulations, making it difficult to assess whether non-adoption primarily reflects limited willingness or binding feasibility constraints within the general population. In mature market contexts in particular, it remains an open question whether the remaining adoption gap reflects heterogeneous motivation or the limits imposed by financial and structural feasibility.

This paper contributes to the literature in three ways. First, it provides an integrated empirical assessment of the main determinants of residential PV adoption by jointly measuring behavioral factors, financial conditions, housing characteristics, and complementary technologies within a single survey framework. While existing studies typically focus on individual mechanisms or specific aspects of the adoption decision, this approach allows us to quantify the relative importance of competing explanations within a representative population.

Second, the analysis is based on a quota-based sample of Austrian households that is representative in terms of key socio-demographic characteristics (age, gender, and region), while intentionally oversampling PV adopters to ensure sufficient variation in adoption status. This enables us to assess the extent to which the remaining adoption gap reflects limited willingness to invest as opposed to binding feasibility constraints, and to characterize the segment of households for whom adoption is currently not feasible.

Third, the study provides evidence from a mature PV market characterized by broad public support for climate and energy transition policies (Eckert et al., 2025; Eurobarometer 565, 2025). Austria also features a comparatively supportive regulatory framework for renewable energy deployment, including ambitious national targets for renewable electricity expansion and dedicated policy instruments such as the Renewable Expansion Act (EAG, 2021; International Energy Agency, 2020). In such a context, households with favorable structural and financial conditions have largely already adopted, so that remaining diffusion potential primarily depends on the characteristics and constraints of the remaining non-adopters.

The results reveal a clear pattern. PV adoption is strongly associated with housing conditions, household income, and the presence of complementary technologies such as heat pumps and electric vehicles. In contrast, environmental awareness does not significantly predict adoption once these factors are taken into account. Survey responses further indicate that non-adopters primarily report financial and structural barriers rather than a lack of interest. Overall, the findings suggest that limited feasibility – rather than insufficient willingness – represents the central constraint for further residential PV diffusion in Austria.

The remainder of the paper is organized as follows. Section 2 describes the data and survey design. Section 3 outlines the empirical approach. Section 4 presents the results, beginning with descriptive evidence on adoption patterns across household characteristics and technology portfolios, followed by econometric estimates of the determinants of PV adoption and descriptive evidence on reported motivations and barriers. Section 5 discusses the findings and concludes.

2 Data and Survey Design

To examine how household preferences and feasibility conditions jointly shape residential PV adoption, this study uses data from a web-based survey of private households in Austria. The survey covers both households with and without a PV system, allowing adoption outcomes to be analyzed through a direct comparison between adopters and non-adopters. It was structured to capture both potential adoption and the conditions that enable or constrain investment. The questionnaire therefore includes three dimensions that are central to household adoption decisions: (i) socio-economic and financial characteristics, (ii) the household's energy context and physical housing environment – such as dwelling ownership, building characteristics, and existing energy systems – which capture the structural feasibility of PV installation, and (iii) environmental attitudes, awareness, as well as reported motivations and barriers related to residential PV. This structure allows adoption outcomes to be examined in relation to both structural conditions and perceived decision drivers.

The web-based survey was conducted between December 2024 and January 2025 and administered through a professional online panel and sampled to approximate the population distribution. Quotas were applied for age, gender, and region to approximate the socio-demographic structure of the Austrian population. A total of 1,001 respondents completed the questionnaire.

Within this quota framework, the distribution of PV adopters and non-adopters was monitored during data collection to ensure sufficient variation in adoption status for statistical analysis. As a result, the share of households reporting a residential PV system in the sample (36%) exceeds national deployment levels. For example, Austria had approximately 639,500 residential PV installations by the end of 2022 (PVknowhow, 2023), which – relative to roughly four million households – corresponds to a substantially lower penetration rate. While the sample therefore overrepresents PV adopters, the quota design ensures that the overall socio-demographic composition remains broadly aligned with the population. Accordingly, the analysis focuses on identifying structural and behavioral correlates of adoption rather than estimating population-level adoption rates.

Respondents were screened for involvement in household energy decision-making, since the installation of a residential PV system typically requires decision authority within the households. Individuals who reported no participation in such decisions were excluded from the sample.

The questionnaire distinguishes between PV adopters and non-adopters and collects detailed information for both groups. Respondents reported whether a PV system is installed at their residence and, if applicable, provided additional information on system characteristics and complementary technologies. For non-adopters, the survey included a set of items on perceived barriers and reasons for not installing a system.

The core of the survey captures factors that the literature identifies as potentially relevant for PV adoption:

Socio-economic and financial conditions.

Respondents provided information on household income, employment status, household size, and education. To assess potential financial constraints, the questionnaire also includes items on perceived affordability, investment considerations, and access to financial resources.

Energy context and technology environment.

Participants reported their electricity use and the presence of electricity-based technologies such as heat pumps, electric vehicles, battery storage, and other major appliances. These technologies increase the potential value of self-generated electricity and are therefore expected to be closely linked to adoption decisions.

Attitudes, awareness, and motivations.

The survey includes measures of environmental concern, perceived importance of renewable energy, and general attitudes toward the energy transition. In addition, respondents evaluated a range of potential motivations and perceived barriers related to PV adoption, including financial risks, administrative complexity, information gaps, and technical feasibility.

For non-adopters, a dedicated question block asked respondents to indicate the relevance of different reasons for non-adoption (e.g., high upfront costs, unsuitable building conditions, regulatory or ownership constraints, uncertainty about profitability). This allows us to assess whether non-adoption reflects a lack of interest or binding feasibility constraints.

The final dataset combines information on adoption status with detailed household characteristics, technology ownership, attitudes, and perceived barriers. This structure enables a systematic comparison between adopters and non-adopters and allows us to examine whether differences in adoption are primarily associated with preferences or with structural and economic conditions.

3 Empirical Strategy

To examine the determinants of residential PV adoption, we estimate binary choice models in which the dependent variable indicates whether a household owns a PV system. Let PV_i be a binary variable equal to one if household i has installed a PV system and zero otherwise. The probability of adoption is modeled using a logit specification:

$$P(PV_i = 1 \mid X_i) = \Lambda(X_i \beta), \tag{1}$$

where X_i is a vector of explanatory variables including socio-economic characteristics, housing conditions, ownership of complementary technologies, and environmental awareness, β is a vector of parameters, and $\Lambda(\cdot)$ denotes the logistic cumulative distribution function.

Our baseline specification focuses on a parsimonious set of feasibility-related correlates. In subsequent specifications, we additionally include region fixed effects.

$$P(PV_i = 1) = \Lambda\left(\beta_0 + \beta_1 \text{HeatPump}_i + \beta_2 \text{EV}_i + \beta_3 \text{MultiFamily}_i + \beta_4 \text{OwnerOcc}_i + \delta_r\right), \tag{2}$$

where δ_r denotes region fixed effects. In subsequent specifications, additional controls for socio-economic characteristics and environmental awareness are included to assess whether the baseline associations remain robust to observable household heterogeneity.

To facilitate interpretation, results are reported as average marginal effects (AMEs), which measure the change in the probability of PV ownership associated with each explanatory variable, holding other factors constant. For binary explanatory variables, AMEs represent the discrete change in the predicted probability when the variable changes from 0 to 1.

This approach allows the relative importance of structural conditions, financial resources, and environmental preferences to be assessed in terms of their impact on the probability of PV adoption.

4 Results

4.1 Descriptive Evidence

Table 1 provides summary statistics for the main variables used in the analysis. The sample consists of 1,001 respondents who are involved in household energy decision-making. Overall, 36% of households report owning a residential PV system, a share that is substantially higher than national adoption rates, indicating an over-representation of PV adopters in the sample.

Education and household income are measured as ordered categorical variables, with higher values indicating higher levels of educational attainment and net monthly household income, respectively. Environmental awareness is captured using a composite index based on self-reported pro-environmental behaviors measured on a five-point Likert scale (1 = never, 5 = always), constructed as the mean across items.

While Table 1 describes the overall composition of the sample, the key question for the analysis is how PV adoption is distributed across key household characteristics that shape the residential and energy context of PV investment. The following figures therefore examine differences in adoption rates across housing conditions, tenure status, and the presence of electricity-based technologies and provide a first indication of the household environments in which PV installation is prevalent. The descriptive evidence allows us to assess whether adoption is broadly distributed across households or concentrated among specific structural and technological contexts.

To evaluate whether the observed differences reflect systematic variation, we compare mean adoption rates across groups and test whether these differences are statistically significant. The following figures illustrate the magnitude and direction of these differences across the main household characteristics considered.

Figure 1 shows that the PV adoption varies strongly across housing types. Adoption rates are highest among households living in detached houses (around 55%), followed by semi-detached houses (about 45%), while adoption remains substantially lower among residents of multi-family buildings (below 20%). The differences between detached and multi-family housing, as well as between semi-detached and multi-family housing, are statistically significant (p = 0.01 and p = 0.02, respectively). These results highlight the importance of structural feasibility, as detached housing typically provides suitable roof space and decision autonomy, whereas residents of multi-family buildings often face physical and coordination constraints (Balcombe et al., 2013).

Table 1: Summary statistics

Variable	**Mean**	**Std. Dev.**	**N**
Outcome			
PV owner (=1)	0.358	0.480	1001
Socio-demographics			
Age (years)	49.428	15.168	1001
Female (=1)	0.446	0.497	1001
Education (ordinal)	4.558	1.267	1001
Net monthly disposable household income (ordinal)	4.579	1.601	1001
Housing and feasibility conditions			
Homeowner (=1)	0.606	0.489	1001
Detached house (=1)	0.420	0.494	1001
Semi-detached house (=1)	0.110	0.313	1001
Multi-family building (=1)	0.457	0.498	1001
Living area (m^2)	117.428	67.976	1001
Technology portfolio			
Heat pump (any use) (=1)	0.301	0.459	1001
Electric vehicle ownership (=1)	0.062	0.241	988
Hybrid electric vehicle ownership (=1)	0.051	0.220	982
Smart meter (=1)	0.748	0.435	903
Environmental attitudes			
Environmental awareness (mean index)	3.195	0.846	1001

Notes: The table reports means, standard deviations, and the number of non-missing observations. Income and education are measured in ordered categories as collected in the survey. Housing-type indicators are mutually exclusive. EV and hybrid EV ownership have slightly smaller N due to item non-response.

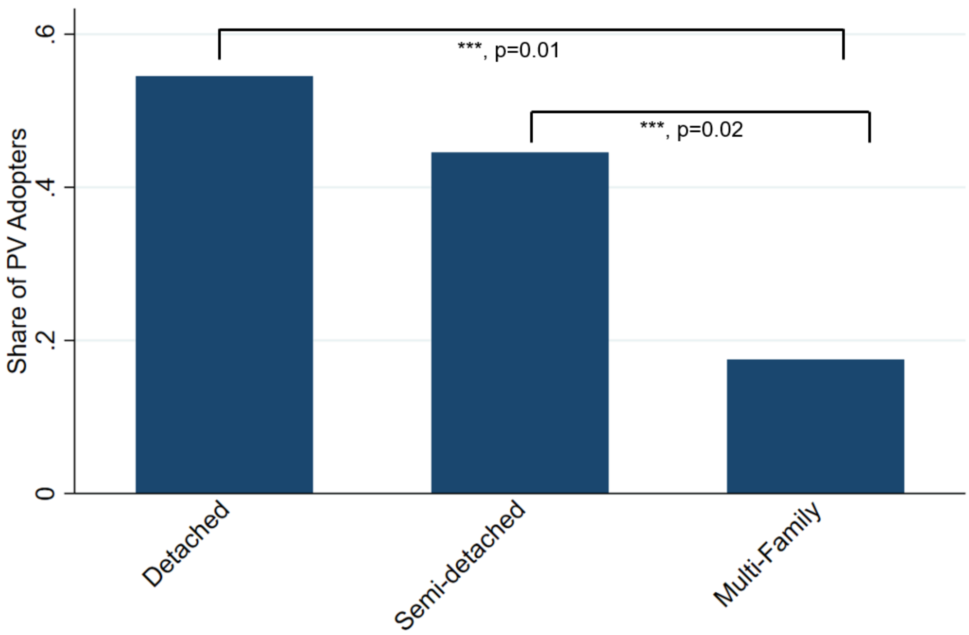

Figure 1: Share of PV Adopters by House Type

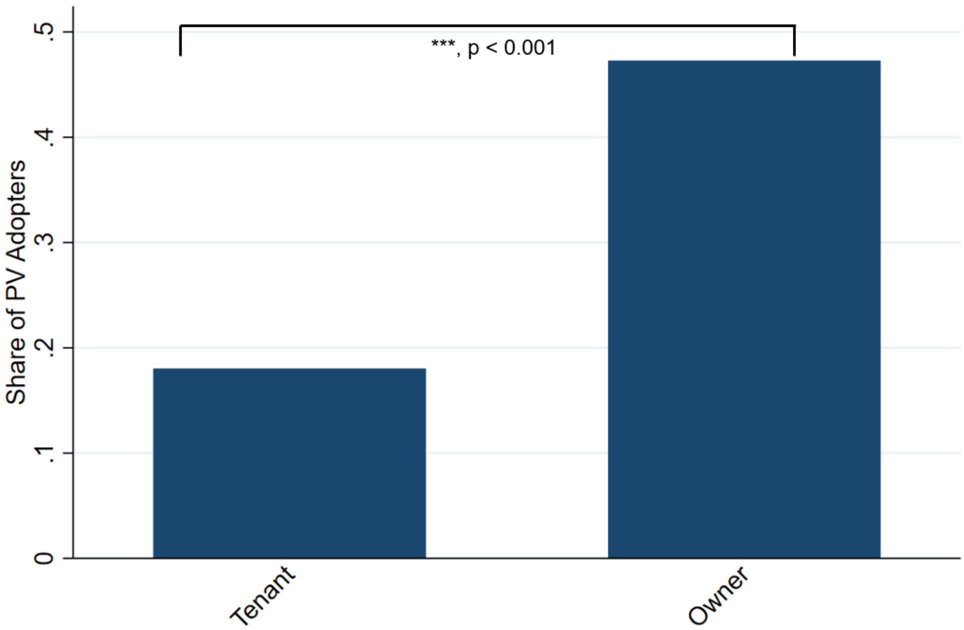

Figure 2: Share of PV Adopters by Occupant Status

A similar pattern emerges with respect to tenure status. Homeowners exhibit substantially higher PV adoption rates than tenants. The difference between the two groups is statistically significant ($p = 0.01$). This finding underscores the importance of investment autonomy and long planning horizons, both of which are more likely to be present among owner-occupiers (see Figure 2).

Residential PV adoption is also closely related to the broader household energy context. Households that operate electricity-based energy-intensive technologies are significantly more likely to own a PV system. In particular, adoption rates are markedly higher among households with heat pumps and among those owning electric vehicles. These patterns suggest that PV installation is often embedded in a broader electrification strategy, in which higher electricity demand increases the value of self-consumption.

Figure 3 shows that PV adoption is strongly associated with electric vehicle ownership. Households owning an electric vehicle exhibit substantially higher adoption rates (approximately 62%) compared to households without an EV (around 30%). The difference between the two groups is statistically significant ($p = 0.001$). This pattern suggests that residential PV adoption is often embedded in a broader household electrification strategy, in which higher electricity demand increases the economic value of self-consumption.

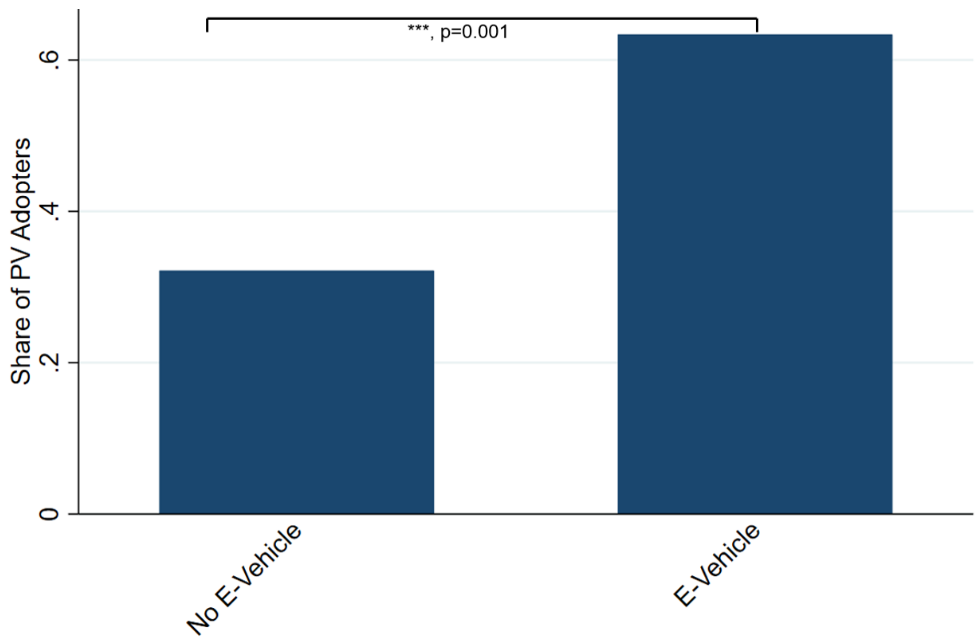

Figure 3: Share of PV Adopters by E-Vehicle Ownership

A similar relationship is observed for heat pump ownership. Households with a heat pump show markedly higher PV adoption rates (approximately 65–70%) than households without a heat pump (around 20%). The difference is highly statistically significant ($p < 0.001$). This finding further supports the view that PV installation is closely linked to complementary electrification investments that increase on-site electricity use and improve the economic attractiveness of residential PV.

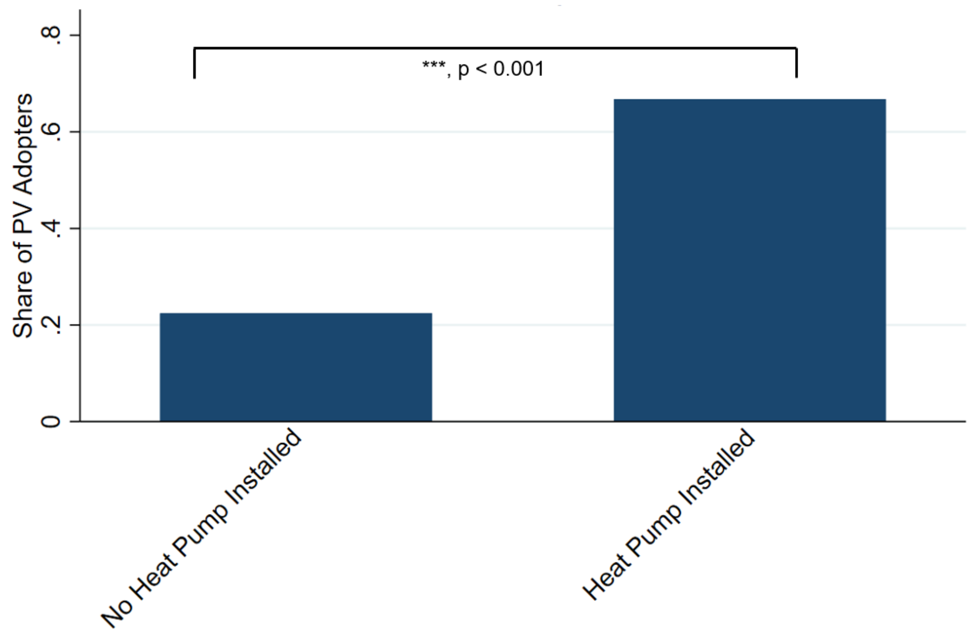

Figure 4: Share of PV Adopters by Heat Pump Use

Overall, the structural evidence suggests that PV adoption is concentrated among households that combine favorable housing conditions, sufficient financial resources, and a broader portfolio of electricity-based technologies.

In addition to analyzing structural differences between adopters and non-adopters, the survey also collects households' self-assessments of the factors that influenced their investment decisions in residential PV systems. PV owners were asked to evaluate the importance of different motivations for installation, while non-adopters assessed a range of perceived barriers to adoption. These responses provide complementary qualitative evidence on how households themselves interpret their adoption decisions and constraints.

Figures 5 and 6 present the distribution of reported motivations and perceived barriers as stacked bars. Among PV owners, economic considerations emerge as the most important drivers of adoption. As shown in Figure 5, expected cost savings and independence from public supply are among the most frequently rated motivations, alongside climate protection. The opportunity to increase self-consumption is also commonly emphasized. Overall, while environmental considerations are salient, financial motives appear more consistently among the highest-ranked factors.

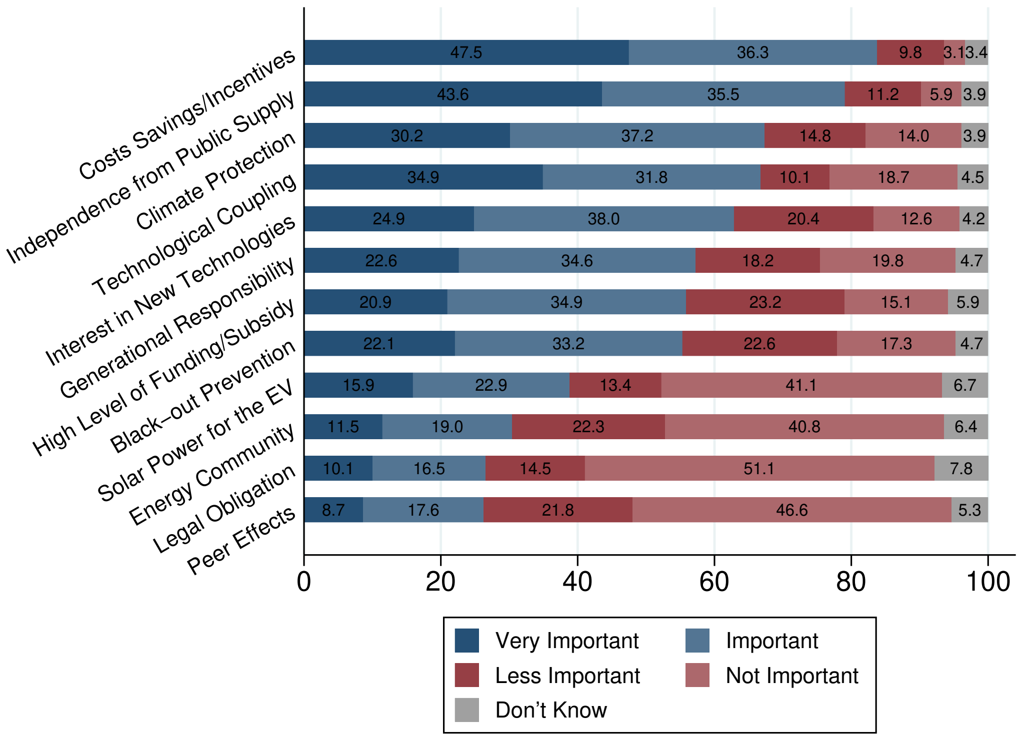

Figure 5: Perceived Importance of Motives Influencing PV Adoption

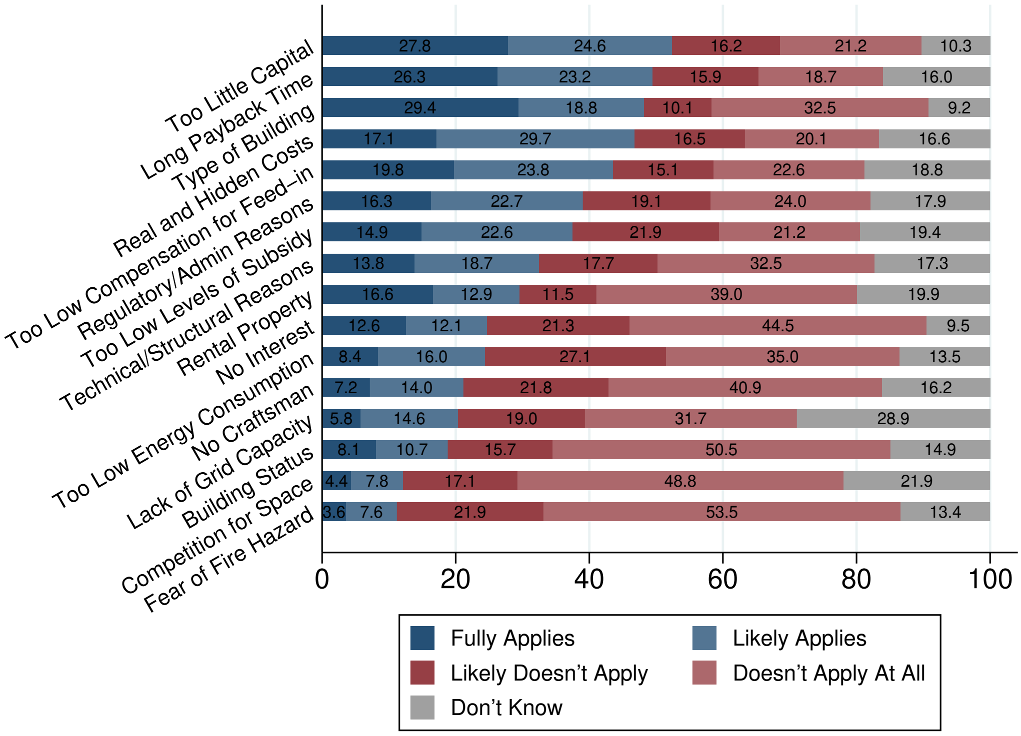

Figure 6: Perceived Importance of Barriers Influencing PV Adoption

Non-adopters, in contrast, most frequently report financial and structural constraints. The most commonly cited barriers include insufficient capital, long payback periods, and concerns about economic viability (see Figure 6). Building-related limitations, such as unsuitable roof conditions or restrictions associated with rental housing or multi-family buildings, are also frequently mentioned. Administrative complexity and regulatory uncertainty further contribute to perceived investment difficulties, whereas a lack of interest in renewable energy is reported much less frequently.

Overall, the reported motivations and barriers are consistent with the structural patterns described above and suggest that non-adoption primarily reflects feasibility constraints rather than insufficient willingness.

4.2 Regression Results

The descriptive evidence indicates that PV adoption is concentrated in specific residential and energy contexts. However, many of the characteristics considered are closely related. Households living in detached homes, for example, are more likely to be homeowners, to have higher incomes, and to invest in complementary technologies such as heat pumps or electric vehicles. To assess the relative importance of these factors, we estimate multivariate logit models to estimate the probability that a household owns a PV system as a function of housing conditions, tenure status, income, the presence of complementary technologies, and environmental awareness. This approach allows us to assess whether the relationships observed in the descriptive analysis persist once observable differences between households are taken into account.

The first specification (Table 2) focuses on key structural conditions and technology characteristics that capture feasibility. The second specification (Table 3) extends the model by adding socioeconomic controls and regional fixed effects. This stepwise approach allows us to assess the robustness of the baseline relationships to differences in household composition and regional context.

Table 2: Average marginal effects on PV adoption

	AME	Std. Err.	z	95% CI
Heat pump (=1)	0.348***	(0.035)	10.00	[0.280, 0.417]
E-Vehicle (=1)	0.154***	(0.050)	3.09	[0.056, 0.251]
Multi-family house (=1)	-0.158***	(0.033)	-4.79	[-0.223, -0.093]
Homeowner (=1)	0.117***	(0.032)	3.61	[0.053, 0.180]
Observations		981		

Notes: Average marginal effects from a logit model. Robust standard errors in parentheses. Reported effects represent the discrete change in the probability of PV adoption when the indicator equals one. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

Table 2 presents the baseline specification, which includes housing characteristics, tenure status, and the presence of complementary technologies. The results closely mirror the patterns observed in the descriptive analysis. Households with a heat pump are substantially more likely to adopt PV, with an estimated increase in adoption probability of around 35 percentage points. Electric vehicle ownership is also positively associated with PV adoption, increasing the probability by roughly 15 percentage points. These findings suggest that PV investment is often part of a broader household electrification strategy.

At the same time, structural constraints play a significant role. Living in a multi-family building reduces the likelihood of adoption, reflecting limitations related to building suitability and decision authority. Homeownership is positively associated with adoption, consistent with the importance of investment control at the household level.

Overall, the baseline results provide a structured confirmation of the descriptive patterns and highlight the central role of structural feasibility and the broader household technology context in residential PV adoption.

While the baseline specification focuses on key feasibility conditions, adoption decisions may also reflect differences in demographic characteristics, and regional context. In a next step, we therefore extend the model by adding income, age, environmental awareness, and regional fixed effects.

Table 3: Average marginal effects on PV adoption

	w/o Region Dummies	w Region Dummies
Heat pump	0.339***	0.337***
	(0.039)	(0.039)
E-Vehicle	0.139***	0.159***
	(0.054)	(0.055)
Multi-Family House (MFH = 1)	-0.163***	-0.140***
	(0.037)	(0.039)
Occupant Status (Homeowner = 1)	0.056	0.048
	(0.037)	(0.036)
Lower Middle Income	0.046	0.045
	(0.051)	(0.049)
Upper Middle Income	0.095**	0.099**
	(0.044)	(0.042)
High Income	0.136**	0.146***
	(0.054)	(0.052)
Age (>50 = 1)	-0.034	-0.033
	(0.030)	(0.029)
Environmental Awareness	0.002	0.002
	(0.003)	(0.003)
Observations	840	840

Notes: Average marginal effects from logit models. Robust standard errors in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$.

The estimated relationships remain largely similar when additional controls are included. The effects of complementary technologies and housing conditions change only slightly in magnitude and remain statistically significant, indicating that the baseline associations are not driven by differences in household composition.

Notably, the effect of homeownership becomes statistically insignificant once income and other socio-economic controls are included, suggesting that its baseline association with PV adoption is partly mediated by financial capacity.

Consistent with this interpretation, financial capacity emerges as an important determinant. Compared to low-income households, those in the upper-middle and high income groups exhibit significantly higher adoption probabilities, indicating that upfront investment requirements continue to constrain adoption for parts of the population.

Environmental awareness does not show a statistically significant association with PV adoption once structural and socioeconomic factors are taken into account. Given the prominent role attributed to environmental motivations in parts of the literature, this result suggests that pro-environmental attitudes alone are not sufficient to translate into realized adoption when feasibility conditions are binding. Age differences are likewise small and not statistically significant.

Environmental awareness does not significantly predict adoption once these factors are taken into account. While environmental awareness serves as a proxy for preference-based drivers, the survey captures a broader set of motivations that are not fully incorporated into the regression analysis. Future work could extend the empirical framework to include a more comprehensive set of preference-based variables.

The magnitude and significance of the main coefficients remain unchanged after controlling for regional fixed effects, indicating that the main relationships operate at the household level and are not driven by regional differences in policy environments or overall adoption levels.

5 Conclusions

This paper examines whether the uneven diffusion of residential PV reflects differences in household motivation or constraints related to structural and economic feasibility. Using a representative survey of Austrian households, the analysis jointly considers housing conditions, socioeconomic characteristics, complementary technologies, environmental awareness, and reported barriers.

The results indicate that PV adoption is strongly associated with structural feasibility and financial capacity. Homeownership, detached housing, higher income, and the presence of complementary technologies such as heat pumps and electric vehicles significantly increase the likelihood of adoption. In contrast, environmental awareness does not significantly predict adoption once these factors are taken into account. Reported reasons for non-adoption are consistent with these findings and point primarily to financial and structural constraints.

Overall, the evidence suggests that limited feasibility rather than insufficient willingness represents the main constraint for further residential PV diffusion. Policy efforts should therefore focus on reducing financial and institutional barriers and improving access, particularly for tenants and residents of multi-family buildings.

The results should be interpreted as indicative rather than causal. The analysis is based on cross-sectional survey data and therefore identifies associations between household characteristics and PV adoption rather than causal effects. In particular, investments in PV, heat pumps, and electric vehicles may be jointly determined within broader household investment strategies. Moreover, some aspects of technical feasibility, such as roof characteristics or building suitability, are not directly observed and are captured only indirectly through housing variables. The evidence presented here should therefore be viewed as preliminary and suggestive. At the same time, the consistent patterns observed across descriptive differences, multivariate estimates, and reported barriers point to a coherent picture of adoption constraints. Future research could build on these findings using longitudinal data, quasi-experimental designs, or more detailed information on building characteristics to more precisely identify the causal role of structural and financial constraints.

Acknowledgments

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