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Working Paper 2016-02

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Eva Fleiß[a,], Stefanie Hatzl[a], Sebastian Seebauer[b], Alfred Posch[a]*

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Abstract

We currently face the challenge of reducing greenhouse gas emissions in order to mitigate climate change. A transition towards renewable energy production is one proposed solution. In this regard, photovoltaic (PV) citizen participation initiatives (CPIs) are a cornerstone in fostering the diffusion of renewables and in promoting a transition towards a carbon neutral and adaptive society allowing for active citizen engagement.

Based on survey data, this article investigates the drivers behind people's decision to adopt in two selected Austrian PV-CPIs. In addition to commonly used indicators, we also include variables that allow us to assess both – people's desires, (their 'preferences' with respect to energy autarky, environmental protection, financial aspects, etc.) and their beliefs in term of how likely they think their participation in a PV-CPI will help them achieve their goals. We find that joining a PV-CPI is predominantly driven by people's financial beliefs.

Keywords: pro-environmental drivers, citizen participation initiatives, photovoltaic, energy transition

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ABSTRACT

We currently face the challenge of reducing greenhouse gas emissions in order to mitigate climate change. A transition towards renewable energy production is one proposed solution. In this regard, photovoltaic (PV[2]) citizen participation initiatives (CPIs[3]) are a cornerstone in fostering the diffusion of renewables and in promoting a transition towards a carbon neutral and adaptive society allowing for active citizen engagement.

Based on survey data, this article investigates the drivers behind people's decision to adopt in two selected Austrian PV-CPIs. In addition to commonly used indicators, we also include variables that allow us to assess both – people's desires, (their 'preferences' with respect to energy autarky, environmental protection, financial aspects, etc.) and their beliefs in term of how likely they think their participation in a PV-CPI will help them achieve their goals. We find that joining a PV-CPI is predominantly driven by people's financial beliefs.

Keywords: pro-environmental drivers, citizen participation initiatives, photovoltaic, energy transition

1. Introduction

Austrian and EU policies currently call for an increase in renewable energy production in order to reduce carbon emissions and dependency on fossil fuel imports (e.g. EU 2009, BMWFJ & BMLFUW 2010). Among the various means of renewable energy production available, solar panels have recently shown rapidly decreasing costs (IEA 2013, IRENA 2013). Photovoltaics (PV) are widely perceived as being a cornerstone of future energy production as they are characterized by ease of deployment, cost-efficiency in small-scale installations, and low maintenance costs, notwithstanding an ongoing debate on the integration of daytime, weather, and seasonal variability in electricity grid control (Francés et al. 2013, Grossmann et al. 2013).

In order to speed up market entry, several countries passed legislation to subsidize PV through guaranteed feed-in tariffs (e.g. the Ökostromgesetz ÖSG 2012 in Austria, and the Erneuerbare-Energien-Gesetz EEG 2014 in Germany). Together with the liberalization of energy markets, these feed-in tariffs have served to foster the development of PV-citizen participation initiatives (PV-CPIs). In such initiatives, private citizens join together to finance - and in some cases to operate - PV power plants.

PV-CPIs may promote the transition to more decentralized and inclusive structures in renewable energy production (e.g., Parkhill et al. 2015, Seyfang et al. 2013, Vasileiadou et al. 2015). They provide citizens with the possibility to help along the diffusion of renewable energy production, typically by offering citizens a form of financial investment with a guaranteed rate of return. Although some people may perceive such projects simply as an attractive form of investment, others are clearly attracted to PV-CPIs by the chance to engage in community-level discourse on ecological lifestyle and the possibility of strengthening local energy autarky (Mautz 2007; Yildiz 2014). By enabling citizens to become active agents in bringing about a future of renewable energy production, PV-CPIs may raise public support for the related policies.

In Austria, the first CPIs in renewables emerged in the 1980s in the field of rural biomass district heating systems. The first Austrian PV-CPI was founded in 1999. Thereafter, various forms of PV-CPIs emerged (Haas et al. 2002; Schreuer and Weismeier-Sammer 2010, Schreuer 2011, 2012, Wirth 2014). To date, numerous small initiatives of around 20 participants have been implemented. However, larger projects comprising several hundred participants continue to remain rather scarce (see Hatzl et al. 2015 for an overview of the Austrian PV-CPI market). Typically, a fixed range of investment options is offered, starting at amounts of about 50 euros. Compared to a privately owned PV-power plant, PV-CPIs entail substantially lower upfront investment costs, even for non-house owners who lack proper roof areas (Huijben and Verbong 2013). PV-CPIs thus provide a low entry threshold option for

citizens wishing to actively contribute to the transition towards renewable energy production.

Of course, the mere fact that PV-CPIs provide a welcome opportunity does not necessarily mean that all citizens will immediately jump on the climate mitigation bandwagon. Several studies have been carried out on the drivers and barriers behind private household PV adoption (Balcombe et al. 2014; Faiers et al. 2006; Jager 2006; Keirstead 2007; Vasseur and Kemp 2015; Yamaguchi et al. 2013). While some have looked specifically at individual motives, (i.e. Maruyama et al. 2007), the main focus appears to be on examining the motives of initiators and communities (Oteman et al. 2014, Wirth 2014) or on the adoption criteria of PV entrepreneurs (Brudermann et al. 2013). Some studies have relied on qualitative methods to provide descriptive results (Echegaray 2014; Schreuer 2012). A recent Austrian case study compared the perceived incentives and barriers at work in a farmers' PV cooperative and a municipal PV-CPI project (Reinsberger and Posch 2014).

A review of those studies reveals that different sets of drivers are identified depending on institutional framework in the different countries, renewable energy source, target group and business model of the investigated CPIs. According to those studies, especially a combination of motivational factors appears to play a crucial role in the adoption of PV-CPIs. These are economic aspects, like a secure return on investment on the one hand together with aspects like active participation, social cohesion, relevance of networks, energy autarky and technological issues (i.e. identification with the technology) on the other hand.

However, empirical evidence based on quantitative research on the factors behind PV-CPI adoption is still relatively scarce. The study at hand aims to close this gap, and focuses on individual decision making.

Numerous empirical studies have applied rational choice theory to investigate environmentally relevant behaviour (e.g. Davidov et al. 2002, Hedström and Swedberg 1996, Hedström 2005: 38; Diekmann and Preisendörfer 2003, Liebe and Preisendörfer 2010). An important cornerstone in these theories is the separation of people's desires (their "preferences") and people's beliefs. Disentangling people's desires and beliefs – together with their opportunities has already led to a greater understanding of actors' behavior in several areas, e.g. concerning the adoption of organic farming (Best 2006, 2008), or – more generally – in situations involving some form of social dilemma or trade off (e.g. Murphy and Ackermann 2013) as does, for example, climate change mitigation (Ackermann et al. 2015). While an analysis of desires helps capture people's goals, and specific aspects or things they want to achieve, an analysis of their beliefs provides additional information concerning the extent to which they expect their goals will be met by following a specific course of action (i.e. in this case, participating in a PV-CPI). The term 'opportunities' refers in this context to the set of concrete alternatives available to individuals in a given setting (Hedström 2005: 38-40).

With respect to the present paper, the distinction made between desires (preferences) and beliefs is crucial for two reasons. First, focusing on desires as the sole motivational source behind PV-CPI adoption, is likely to result in an erroneous underestimation of the importance of people's beliefs. Imagine, for example, someone who is worried about climate change, and who is willing to do something about it. While such a person might then consider joining a PV-CPI but conclude that this is not a good way to mitigate climate change and instead choose another action. We would not be able to understand the decision without knowledge about what this person's believes. Second, extending knowledge about the role of individual beliefs is likely to open up a new policy pathway to foster adoption of PV-CPIs. While usually – often perceived as difficult – a change of desires in terms of awareness building is called for (e.g. BMWFJ and BMLFUW 2010). A more attractive or effective path may be to address those willing to contribute to the diffusion of renewables by changing their beliefs, i.e. by providing relevant information or through local social networks.

In this article, we present a quantitative empirical case study which investigates people's decision to participate in two selected PV-CPIs, focusing on separating their beliefs from their desires. Each of the PV-CPIs has around 500 adopters and is located in the Austrian province of Upper Austria. A comparison of respective adopters and non-adopters is especially fruitful when attempting to investigate which desires or beliefs contribute to explaining the decision to adopt.

The selected PV-CPIs are described in the following section. Details of empirical methods are provided in Section 3; and the results of the statistical analysis are presented in Section 4. The paper ends with discussion and conclusions in Section 5.

2. Two citizen participation initiatives

For the purpose of our study, two rather large PV-CPIs in Upper Austria were selected. These are HELIOS Sonnenstrom GmbH (HELIOS) and MEA Solar (MEA). While each of these has about 500 participants, they offer different participation models.

HELIOS is a replacement for the association "Energiebezirk Freistadt" founded in 2005, and is run by individuals who have been actively engaged in raising awareness within their community of renewable energy transition and environmental issues for several years. To implement the sale & lease-back model, PV-power plants have been installed in various municipalities in the Freistadt region using the roofs of private households, municipalities and companies. Individuals may participate by investing a minimum of €500 in the installation of community PV-power plants. They are offered a fixed interest rate of 3% for 13 years (an earlier scheme, now discontinued, offered 2.2% for 6 years). After 13 years, the invested capital is returned to individuals. They also receive information about the specific PV-power plant they are supporting. HELIOS plans to expand further with additional PV-CPIs.

MEA is a subsidiary of the electric power utility Wels AG. Using a contracting model, MEA started to install PV-power plants on private and municipal roofs in 2009. MEA had already gained experience with this business model in other areas and applied it to PV after being approached by a municipality. MEA installs PV-power plants (> 10 kWp) on participants' roofs if certain technical and administrative conditions are met (e.g. relating to roof pitch, southward orientation, approval of network operator, OeMAG subsidy, signing of the lease contract, etc.). Adopters have to make a one-time investment of €1,800 but have no further expenses, e.g. for the installation of the PV-power plant. After 13 years, ownership of the PV-power plant is passed to the roof owner at no additional cost. The electric power utility Wels AG is responsible for the operation of the PV-power plants during the whole contracting period.

Both initiatives can be considered as best-practice examples of PV-CPIs in Austria and are known throughout the country. The sale & lease-back model offered by HELIOS has also been implemented by several other initiatives. HELIOS is part of a long tradition in awareness raising with respect to the transition towards renewable energy production. It was originally founded as a grassroots, ideology-driven CPI. During the last few years, the initiative has expanded and has changed its legal form. It has now become more focused on generating commercial profit. In contrast, with respect to its institutional setting, resources and overall goal, MEA can be considered as a market-oriented initiative from the onset (see Hatzl et al. 2016). These two initiatives thus present an interesting contrast for the purpose of investigating adopters' decision making. Note that the two initiatives offer different types of economic revenue to their adopters: While HELIOS pays annual interest like any other financial bond, MEA provides a return in the form of a non-cash benefit, i.e. in the form of a working PV installation. We return to this difference below when we describe our survey in detail.

3. Methods

3.1. Research Design

The research design to investigate individuals' decisions to join the selected PV-CPIs consists of two phases: Extensive qualitative research was employed in order to explore the desires and beliefs relevant for adoption. These were then included in the questionnaire in an online and postal survey.

3.2. Exploratory qualitative research

In this first phase of our research, 26 semi-structured interviews with key actors (persons who play a major role in the founding process of PV-CPIs), experts in the field of PV (i.e. representatives of energy supply companies, practitioners, funding institutions, local politicians, etc.) and adopters were conducted between July 2013 and March 2014. All interviews were conducted face-to-face and lasted about an

hour. All interviews were transcribed and analyzed with qualitative content analysis using MAXQDA.

The purpose of the interviews was twofold. First, information had to be collected concerning different PV-CPI characteristics, e.g. type of business model, actor constellations, (shared) purpose of key actors, reputation, location in Austria and number of participants. This provided us with a basis for the final selection of our two PV-CPI cases.

Secondly, the interview guidelines included questions concerning the potential drivers behind individual decisions to adopt in different PV-CPIs. In order to measure people's desires and beliefs, the results of the qualitative interviews were then used to refine and extend the set of items which had been compiled on the basis of previous studies.

3.3. The survey instrument: Variables and Operationalization

The questionnaire consists of five parts: (1) items to measure (non-)adopters' desires and (2) beliefs, (3) items regarding the PV-CPI, (4) the environmental awareness scale (Diekmann and Preisendörfer 2001) and (5) sociodemographic characteristics.

Desires and Beliefs. Special attention was given to include items measuring people's desires and beliefs. A set of potential drivers of PV-CPI participation was selected on the basis of a literature review and the results of the qualitative interviews described in section 3.2. These address a number of different aspects, ranging from an intention to contribute to environmental protection, to making an attractive financial investment (see Table 1).

The implementation and wording of these questions is based on a study by Best who used a similar framework when analyzing the adoption of organic farming (Best 2006).

In order to measure 'desires', all respondents were asked to indicate how important they perceive the various aspects (in total 16 items, see Table 1) are *in general* , using a five point scale ranging from 'very important' to 'not important' whereby a higher number indicates higher importance. To facilitate the answering of the questionnaire, the items were divided into three groups: (1) life in the region where respondents live, (2) environment and renewable energy and (3) investment. To prevent responses referring to the CPI influencing responses relating to assessment of desires, this was the first question we posed. To avoid that responses referring to the CPI influence the assessment of desires, this was the first question we posed.

To measure beliefs, all respondents were then asked to indicate how likely it is that those aspects can be achieved when adopting a *specific* PV-CPI, ranging from 'sure' to 'not at all' on a five-point scale. Prior to this question, a brief description of the respective PV-CPI and its business model was provided in order to familiarize non-adopters with the PV-CPI's characteristics. To measure beliefs about financial as-

pects, customized items relating to each of the selected PV-CPI's business models were devised. The wording used here differed to that used for the rest of the belief items. For the PV-CPI HELIOS, the financial items used addressed the interest rate and binding period of the investment. In contrast, for the PV-CPI MEA, where no direct financial return is provided, only one item concerning the necessary one-off investment was employed.

Items regarding the CPI were designed not only to identify adopters and non-adopters, but also to elicit whether people intended to adopt in future or not.

We also included the *environmental awareness scale* (Diekmann and Preisendörfer 2001) recommended for German speaking countries (Best 2006: 48). Here the questionnaire items addressed people's emotions regarding environmental problems (the affective dimension), whether they perceive environmental issues as problematic or anthropogenic (the cognitive dimension), and finally, whether they are willing to take action in order to combat environmental problems (the conative dimension) (i.e. Best 2006: 48; Diekmann and Preisendörfer 2001:103f.). The level of internal consistency using this scale was found to be acceptable (Cronbach's Alpha= 0.811).

The questionnaire concluded with several items relating to respondents' *sociodemographic characteristics* (these are commonly used in similar studies of PV adoption, e.g. in Islam 2013). Those included age, gender, education, and family income. Educational attainment was measured in terms of three levels, primary, high-school, and degree level. All respondents were asked to provide information regarding the net income of their household, whereby eight categories were offered. We calculated an income variable using two categories by splitting approximately at the median income in Austria: up to 2000€ and above 2000€. Furthermore all respondents were asked if they rent or own a flat/house since we assume this to be an important driver for adopters of the selected PV-CPIs. Considering the business model and results from the qualitative interviews, one may assume that people who do not own a house (and thus have no suitable roof) are more likely to join a community PV-power plant, whereas people who do own a house are more likely to prefer to install a PV-power plant on their own roof, thus providing for the possibility to produce and consume electricity. Due to the specific nature of the benefit offered by the MEA contracting model, we included a question for MEA asking respondents to rate the importance of PV-power plant ownership passing to them after 13 years (on a five point scale).

3.4. Sample and distribution of questionnaire

Both groups, adopters and non-adopters, have to be included in our sample in order to ensure variation of our dependent variable (participation in a PV-CPI). Contact addresses of adopters were provided by the selected PV-CPI. To survey non-adopters, we drew a cluster sample of 14 municipalities in those regions where PV-

CPIs promote their services and where adopters currently live. Before distributing the questionnaire, a pretest with a limited number of respondents was carried out.

All households in the selected municipalities received a hard copy of the questionnaire by post, together with a cover letter (endorsed by the University of Graz and the CPI) and a stamped addressed envelope. After two weeks, all households in the selected regions received a reminder by post. In addition, the selected PV-CPI distributed an online-version of the questionnaire and a later reminder to their adopters via email.

The survey took place between April and May 2014. The response rate in the case of HELIOS amounted to 5.93% (of which, 28% were from adopters, 72% from non-adopters), and 5.6% (29% adopters, 71% non-adopters) in the case of MEA. The final sample used for our statistical analysis included 870 respondents.

4. Results

4.1. Explorative Factor Analysis for the Desire Items

An explorative factor analysis was conducted using all items measuring people's desires. Each aspect is measured on a five point scale ranging from *very important* to *not important at all*, whereby a higher number indicates higher importance. The results are displayed in Table 1. Five factors with an Eigenvalue greater than 1 have been extracted. The factor solution is stable for the two initiatives separately. Belief scales have been calculated accordingly[1] (with the exception of Factor 5, owing to the specifics of the MEA business model, see section 3.3.).

Factor 1 (Energy Autarky) covers the items "Independence from energy supply companies", "Self-generation of electricity from photovoltaics" and "Fostering the diffusion of photovoltaic in the region". Whereas the first two items specifically relate to autarky, the diffusion of PV in the region can be perceived of as a means towards more decentralized structures in producing renewable energy. Several aspects of environmental protection are addressed with Factor 2 (Environmental Protection) which includes the items "Supporting regional environmental initiatives", "Contribution to environmental protection" and "Reduction of greenhouse gas emissions". The importance of social cohesion and participation in the region in which people live as well as that of the opinion of others is covered by Factor 3 (Social Capital). This comprises the items "Strengthening inclusive decision-making in the region", "Strengthening social cohesion in the region" and "Approval and appreciation of others". Factor 4 (Preservation) refers to whether PV-power plants have a negative impact on landscapes and buildings and covers the items "Preservation of the townscape (including cultural heritage sites)" and "Preservation of green spaces (meadows, parks, pastures)". Factor 5 refers to financial aspects and covers the items "Attractive interest rates", "No binding period for invested capital" and "Security of investment".[2]

[1] Cronbach's Alpha values for the belief scales in parentheses: Energy Autarky (0.74), Environmental Protection (0.77), Social Capital (0.82), Preservation (0.78); Financial beliefs for HELIOS (0.848)

[2] The financial aspect belief scale for HELIOS includes the above listed items. Since those items are not applicable to MEA's business model (since there is no explicit financial return), the financial dimension of this business model was assessed in terms of the one-off costs for individuals when adopting.

Table 1 Explorative Factor Analysis for Desire Items

Factor	Item[a]	Factor loading	Cronbach's Alpha	N	Mean	Standard deviation
Social Capital	Strengthening inclusive decision-making in the region	0.47	0.64	866	4.26	0.61
	Strengthening social cohesion in the region	0.58				
	Approval and appreciation of others	0.50				
Preservation	Preservation of the townscape (including cultural heritage, sites)	0.70	0.66	865	4.15	0.74
	Preservation of green spaces (meadows, parks, pastures)	0.55				
Environmental Protection	Contribution to environmental protection	0.55	0.77	868	4.60	0.54
	Reduction of greenhouse gas emissions	0.51				
	Supporting regional environmental initiatives	0.37				
Energy Autarky	Independence from energy supply companies	0.49	0.81	862	4.43	0.71
	Self-generation of eletricity from photovoltaics	0.59				
	Fostering the diffusion of photovoltaics in the region	0.59				
Financial Aspects	Attractive interest rates	0.57	0.58	862	4.21	0.61
	No binding period for invested capital	0.55				
	Security of investment	0.55				

Factor sampling: principal component analysis. Rotation: oblique. Reported are factor loadings of all variables; Cronbach's Alpha values and descriptives are provided for each factor.

[*] The overall question for all items was: "Please indicate how important you consider the following aspects". Responses for all items range from 'not important at all' to 'very important' on a five-point scale; higher values indicate higher importance. *Note*: Items 'Strengthening of the economy in the region' and 'Contributing to a good image of the region' have been omitted due to crossloadings.

Table 2 provides descriptive results comprising the mean values of all desire and belief scales for adopters and non-adopters in the respective PV-CPIs separately.

In general we observe similar and high mean values regarding the desire scales amongst all groups of respondents. In both PV-CPIs, adopters and non-adopters share similarly strong desires for social capital, preservation, environmental protection and energy autarky. Desires for attractive financial investment also score highly too. While adopters strive less for financial profit than non-adopters the difference of just 0.2-0.3 points on a five point scale is relatively small in absolute terms.

The scores with respect to beliefs indicate whether people think that joining a PV-CPI is an appropriate means for achieving their goals (represented by their desires). This appears to be true with respect to environmental protection and energy autarky for both PV-CPIs and for all respondents. Note, however, that the respective ranking of these items is slightly higher for adopters.

The mean values with respect to social capital, and in particular, with respect to preservation belief scales are rather low for respondents of both initiatives, although HELIOS still seems to perform slightly better here than MEA. Beliefs with respect to the financial aspects fall in the intermediate range. HELIOS' business model for financial investment is rated more favorably than MEA's contracting service.

In the subsequent section, we examine the main drivers behind the decision to adopt or not adopt for both the HELIOS and the MEA model separately.

Table 2 Mean Values for Desire and Belief Items

		HELIOS		MEA	
		Adopter	Non-adopter	Adopter	Non-adopter
DESIRES	Social Capital	4.3	4.3	4.2	4.2
	Preservation	4.1	4.2	4.1	4.2
	Environmental Protection	4.6	4.6	4.7	4.6
	Energy Autarky	4.6	4.4	4.5	4.4
	Financial Aspects	4	4.2	4.1	4.4
BELIEFS	Social Capital	3.4	3.1	2.6	2.7
	Preservation	2.8	2.9	2.5	2.7
	Environmental Protection	4.6	4.3	4.4	4.1
	Energy Autarky	4.6	4.2	4.3	4.0
	Financial Aspects	3.9	3.3	2.9[a]	2.8[a]
	N	129	265	110	189

All scales range from 1 to 5 with higher values indicating higher importance (desires) respective higher subjectively perceived probability (beliefs). N total=693.

[a] *Note*: Financial beliefs for MEA are not measured using the financial aspects belief scale. Owing to the specific nature of the MEA business model, only one specific item relating to initial cost was included in the questionnaire.

4.2. Factors Influencing Decision to Join a CPI

In this section we present the results of a Logit regression analysis to investigate the drivers behind the decision to participate in the two selected PV-CPIs. Logit regression models have been estimated for each PV-CPI separately (see Table 4). In both models, desire and belief scales (see section 4.1 – Factor Analysis) have been included, together with the environmental awareness scale and the control variables described in section 3.3 and 4.1.

Quite surprisingly, none of the scales related to pro-environmental attitudes yield any statistically significant results. For both PV-CPIs, environmental protection desire and belief scales as well as the environmental awareness scale have no significant effect (except environmental protection belief at the $p<.10$ level for MEA). None of the included scales measuring energy autonomy or social capital yield significant results.

For both models we find a negative effect of the preservation belief scale (significant at the 10% level for MEA). If people hardly perceive that PV-CPIs will protect local landscape and green areas, they are more likely to join the initiative. This result is possibly a simple reflection of a down-to-earth assessment that the advantages of PV-CPIs only go so far: While photovoltaics panels obviously affect the natural scenery far less than e.g. a hydropower plant, it is highly unlikely that extensive structures for energy production will be built in the surveyed municipalities in the near future. Thus, when comparing PV to probable alternatives, adopters seem to hold a realistic view concerning what to expect from PV-CPIs.

Looking at the Logit regression models for the respective PV-CPIs, we can observe an age effect for both HELIOS and MEA indicating that older people appear more likely to adopt. With respect to MEA only, men, and those who hold a university degree, are more likely to participate. As expected, the contracting model offered by MEA, means that house ownership increases the probability of CPI participation.

Even though HELIOS is dedicated to promoting renewable energy production and to contributing to environmental protection, this appears to be a positive side effect of this initiative since adopters are mainly driven by their belief that this PV-CPI offers an attractive investment opportunity. With respect to the differences entailed by the contracting model, the same pattern applies for MEA, where the main driver (besides the already mentioned sociodemographic effects) is the benefit of owning the PV plant after the contracting period of 13 years.

Table 3 Logit Regression on the Decision to Join a PV-CPI

	VARIABLES	HELIOS	MEA
Energy Autonomy	Desire	-0.156 (0.856)	-0.520 (0.595)
	Belief	0.416 (1.516)	0.201 (1.222)
Environmental Protection	Desire	-0.496 (0.670)	0.450 (1.568)
	Belief	0.530 (1.670)	0.683* (1.979)
Social Capital	Desire	-0.150 (0.860)	-0.036 (0.965)
	Belief	0.144 (1.155)	-0.391 (0.676)
Preservation	Desire	0.011 (1.011)	-0.162 (0.850)
	Belief	-0.502*** (0.605)	-0.375* (0.687)
Financial Aspects	Desire	-0.577* (0.561)	-0.055 (0.946)
	Belief	1.291*** (3.638)	-0.232 (0.793)
	Ownership of PV plant after 13 years	n.a.	0.719*** (2.005)
	Environmental Awareness	0.489 (1.632)	0.252 (1.286)
	Age	0.029** (1.030)	0.066*** (1.068)
	Gender (1=male)	0.538 (1.713)	1.665*** (5.287)
	House Ownership (1=yes)	-0.196 (0.822)	0.968** (2.633)
	Education: School leaving examination	-0.187 (0.830)	0.580 (1.787)
	Education: University	0.273 (1.314)	1.314*** (3.712)
	Family Income (>€2000)	0.636 (1.889)	-0.430 (0.650)
	Constant	-7.072***	-9.756**
	Observations	309	224
	Pseudo R-squared	0.261	0.263

The table shows the unstandardized regression coefficients from a Logit regression. Odds are displayed in parentheses. The dependent variable takes a value of 1 if a subject has decided to join a PV-CPI (adopter) and 0 if a subject has not joined (non-adopter). All scales range from 1 to 5 with higher values indicating higher importance (higher subjectively perceived probability) with respect to the desire (belief) scales. For the dummy variables included for education, "no matura" serves as base category (representing the lowest of our education categories). *p<0.1, **… p<.05, ***…p<.01. Note: Desire*Belief predictors as interaction terms were generated using centered variables to avoid collinearity; the interaction terms do not yield any significant results and leave most effects of other variables unchanged (exception for HELIOS: financial desire appears to have no significant effect; the effect of age is significant only at the 10% level; exception for MEA: the environmental protection belief scale is significant at the 5% level).

5. Conclusions

Citizen participation initiatives (CPIs) in the field of photovoltaics (PV) are perceived as a cornerstone in fostering the diffusion of renewables and in reducing CO2 emissions. Thus, the study at hand investigates the drivers behind participation in two PV-CPIs in Austria (HELIOS and MEA) by means of a survey study. We innovate by distinguishing between people's desires (their general goals or 'preferences') and people's beliefs (how likely they think PV-CPIs may fulfill these goals or preferences). This enables us to investigate the impact of specific desires people have (i.e. the protection of the environment) and their belief if the investment in a PV-CPI can act as a means to foster these desires separately using multivariate Logit regression analysis. This expands on recent studies in Austria (Brudermann et al. 2013, Reinsberger and Posch 2014) which relied solely on bivariate analyses and contributes to research in this field by providing quantitative results on individuals' motives behind joining a PV-CPI.

Our results point to the crucial role of economic motives as several measures of (non)adopters' pro-environmental attitudes (energy autonomy, environmental protection, environmental awareness) do not show statistically significant effects. Expectations regarding a potential gain in social capital do not influence adoption either.

For both CPIs we study, economic aspects are identified as the major drivers behind adoption. In the case of HELIOS, the positive effect of the financial belief scale underscores the importance adopters ascribe to the annual interest payment received by participants. Our survey was conducted in 2014, a time when most European countries were attempting to recover from an economic crisis and citizens faced low interest rates in traditional forms of investment. The investment conditions offered by the HELIOS' sale & lease-back business model were more than competitive with respect to those of other investment opportunities available on the market by offering an interest rate of 3.3% for 13 years. MEA's contracting model offers the installation and maintenance of PV-plants on houses for a one-time investment of 1800€ whereby the ownership of the PV-power plant passes to the homeowner after 13 years. For this PV-CPI we find owning the PV-power plant after 13 years as core driver. MEA's business model is welcomed by participants as a means of obtaining a private PV installation with low upfront costs and minimum effort in construction and maintenance.

Our results contradict a widespread narrative which perceives PV-CPIs as a form of 'green' investment catering specifically to environmental-friendly, ideology-driven citizens. HELIOS' mission statement for example puts strong emphasis on the promotion of renewables and the contribution HELIOS can make to environmental protection. Nevertheless, when examining participants' drivers, pro-environmental aspects seem to be merely a welcome co-benefit while maximizing their personal profit is most relevant when deciding whether or not to participate in a PV-CPI.

Still, albeit not explicitly intended by adopters, participating in a PV-CPI supports the diffusion of PV and thus fosters the transition towards a more sustainable society based on renewable energy production. From a policy perspective, sustainability goals are served anyway: Even though adopters aim to satisfy their economic motivations, they still help promote environmental goals through their decision to participate in PV-CPIs.

However, PV-CPIs in Austria heavily depend on attractive and guaranteed return on investment arising as a result of the present government subsidies for green electricity. In line with Reinsberger et al. (2015) we argue that continued or extended legislation enabling PV-CPIs to offer attractive investment conditions is needed by providing attractive feed-in tariffs to foster the diffusion of such initiatives through this economic channel. Without these tariffs, the financial prospects of investing in PV-CPIs would be much less favorable. Adoption rates would then presumably decline as adopters' core motivations would no longer be satisfied. Policy makers should therefore consider strategies to maintain and foster the successful implementation of PV-CPIs in the long run, especially by continuous subsidies that allows them to offer financially attractive investment opportunities.

Our present advocacy for feed-in tariffs is based on empirical data derived from two initiatives. While HELIOS and MEA can be considered well-established reference cases for PV-CPIs in the Austrian context (Hatzl et al. 2016), we are aware that a wide range of business models exists – both in photovoltaics as well as in other forms of 'green' investment. In small-scale grassroots initiatives, which tend to place more emphasis on community cohesion and inclusive decision-making, non-financial motives might be more important with respect to the adoption decision. Thus, we welcome future studies which may attempt to replicate our results in other national contexts or with respect to other 'green' investment schemes.

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