Findings

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ENERGY FINDINGS

Community Choice Electricity Aggregation and Solar Adoption: Evidence From Illinois

Hugh Bartling[1], Madeleine Monkman[2]

[1] School of Public Service, DePaul University, [2] McCormick School of Engineering, Northwestern University

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Findings

We explore whether municipalities voting on the community choice aggregation (CCA) model of electricity procurement relates to the adoption of small-scale distributed solar in the US state of Illinois. Municipalities that held a referendum for CCA were more likely to have small-scale solar installations compared to those that did not. Among municipalities with solar installations, those that held CCA referendums have lower per capita solar power generation than those without CCA referendums. The impacts of CCA referendums on small-scale solar adoption are mixed and should be combined with other strategies to promote broader solar adoption in the U.S. energy market.

1. Questions

In jurisdictions with market oriented electricity systems policymakers have various tools at their disposal to incentivize shifts towards low carbon energy sources. In the United States electricity sales to consumers are generally regulated at the state level and ten states have passed community choice aggregation (CCA) policies. CCA allows municipalities to negotiate with electricity suppliers on behalf of their residential consumers, potentially securing lower rates due to the aggregated consumer base. This approach can also be used to reduce renewable energy costs if municipalities prioritize renewable generation during negotiations with suppliers. In a study looking at CCA performance with regard to renewable energy procurement, (O'Shaughnessy et al. 2019) found that nationally CCA customers purchased more voluntary renewable energy than through other renewable energy purchasing channels.

Of the ten states that have passed CCA legislation, Illinois and Ohio require that municipalities gain CCA authority through a referendum. This study focuses on Illinois. Since 2009 740 CCA referendums have been conducted in 677 Illinois municipalities with 619 passing (Bartling 2018). When municipalities put the question to the voters, local leaders often emphasized that CCA could lower electricity prices and increase renewable energy supply due to the municipalities' enhanced bargaining power (Negron 2013).

Although Illinois' deregulated electricity market, which CCA leverages, does not specifically incentivize distributed solar installations, the widespread use of CCA referendums likely raised awareness about the electricity system and

the benefits of renewable energy. Previous studies indicate that environmental knowledge can lead to behavioral change (Liu, Teng, and Han 2020) and that exposure to the CCA can increase support for renewable energy expansion (Wu and Howarth 2023).

This study examines if there are differences in distributed solar adoption between municipalities that held CCA referendums and those that did not. Additionally, it investigates the differences between referendum communities and non-referendum communities in terms of the volume of distributed solar electricity generated.

2. Methods

We compiled a dataset that includes State of Illinois' records on solar installations, US Census data, and voting data on Community Choice Aggregation.

The solar data were compiled by the Illinois Clean Jobs Coalition and Chicago Hack Night from the Illinois Power Agency, which manages the state's electricity procurement plans and implements its Renewable Portfolio Standard. CCA referendum data were gathered by the authors from county clerk and board of elections websites for the 677 municipalities that held referendums between 2008-2018. Some municipalities held multiple referendums. US Census data for Illinois municipalities were included as control variables.

Our focus is on small distributed generation systems, specifically those producing 25kW or less, installed on single properties in the municipalities of interest.

Of the 1405 municipalities included in the study, only 425 have any small distributed solar present, making our response variables of interest zero-inflated. Because of the high proportion of zero values and a right-skewed distribution of per capita kilowatts generated by small distributed solar, we use a two-part, hurdle model to analyze the semicontinuous dependent variable.

The first part estimates the probability of a city having *any* small distributed solar installations using a logit model on the whole sample of municipalities in Illinois. Then we estimate a generalized linear model for the kilowatt hours per-capita generated in municipalities where small scale distributed solar installations have occurred. Because of the skewed distribution, this second stage model uses the gamma distribution with a log-link. We tested for multicollinearity by computing the variance inflation factors for each of the independent variables and found no VIF values above 2.3 which suggests that multicollinearlity is not a problem in these models. The summary statistics for our data are presented in Table 1.

Table 1. Summary statistics

Variables	All Municipalities (n=1405)		Distributed Generation Municipalities (n=425)	
	Mean	*Std.Dev*	*Mean*	*Std.Dev*
Distributed solar generation (KWh per capita)	0.012	0.032	0.038	0.049
Owner occupied homes (%)	78	13	73	14
Population below poverty level (%	12	8.3	11	7.2
Bachelor's degree attained (%)	14	9.3	21	9.7
	Num	*Per*	*Num*	*Per*
Held CCA referendum	677	48	314	74

Distributed solar generation data compiled by Illinois Solar Map. The other variables are from the American Community Survey 5-Year estimates (2018-2022).

Table 2. Hurdle model results

	Model One	Model Two	Model Three
(Intercept)	−1.715***	1.808**	−5.065***
	(0.103)	(0.604)	(0.485)
Held CCA referendum	1.570***	1.105***	−0.309**
	(0.129)	(0.150)	(0.117)
Owner occupied homes (%)		−0.074***	0.026***
		(0.007)	(0.005)
Population below poverty level (%)		0.008	0.000
		(0.011)	(0.011)
Bachelor's degree attained (%)		0.140***	0.003
		(0.010)	(0.007)
Num.Obs.	1405	1405	425
AIC	1560.6	1214.2	−2001.3
BIC	1571.1	1240.5	−1977.0
Log.Lik.	−778.323	−602.113	1006.644
RMSE	0.43	0.37	0.05

+ p < 0.1, * p < 0.05, ** p < 0.01, *** p < 0.001
For Models One and Two the dependent variable measures whether the municipality has any small distributed solar installations (yes=1). For Model Three the dependent variable is the amount of solar power per capita generated by distributed installations.

3. Findings

The results of our models can be found in Table 2. In Model One we look simply at whether cities that held CCA referendums were more likely to have any distributed solar than those cities that did not have referendums. We see that having a referendum does make the odds of a community adopting distributed solar increase by a factor of 4.8 when compared to cities that did not have hold a community choice aggregation referendum.

In Model Two we include additional variables related to education, home ownership, and education to look at the odds of a city having any distributed solar power generation. We continue to see positive log odds with regard to having a community choice aggregation referendum and positive odds associated with the percentage of the population over 25 having a bachelors

degree or higher. Interestingly, the odds of a community having any distributed solar decrease by 5.8% for every percentage increase in the number of home owners per capita.

Model Three explores the second stage in our two stage model by looking at the amount of solar power per capita generated in those municipalities that have reported the presence of distributed solar power. This model is a generalized linear model with a gamma distribution and a log-link function. Thus, the response variable is log transformed and the coefficients represent expected multiplicative changes in the logged value of kw/hr per capita generated solar electricity.

In this model the referendum coefficient is negative, which suggests that in municipalities that had conducted a CCA referendum there is a 27% lower amount of per capita solar electricity generated when compared to municipalities that have not held a CCA referendum. The positive significance of homeownership per capita in this model suggests that higher levels of homeownership are more important in determining per capita small scale distributed solar generation.

Our findings suggest that holding CCA referendums may positively influence the adoption of small distributed solar installations in a community, but for further integration of distributed solar in municipalities CCA referendums should be considered as only a part of a larger set of policy tools and public education campaigns.

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