The Effect of Future Financial Benefits on PV Adoption - Evidence from Belgium

Justus Böning Kenneth Bruninx Marten Ovaere Guido Pepermans Erik Delarue[1]

EMEE Workshop, 25.01.2024

[1] *J.Böning, G.Pepermans & E.Delarue: KU Leuven; K.Bruninx: TU Delft; M.Ovaere: Ghent University*

Introduction

Introduction

- Policy makers may opt for **incentive schemes** as second-best solution (instead of an emission tax) to **foster energy-related investments of households**.

Introduction

- Policy makers may opt for **incentive schemes** as second-best solution (instead of an emission tax) to **foster energy-related investments of households**.
- Often, these incentives contain **future financial benefits**, i.e. benefits **after the time of investment**.

Introduction

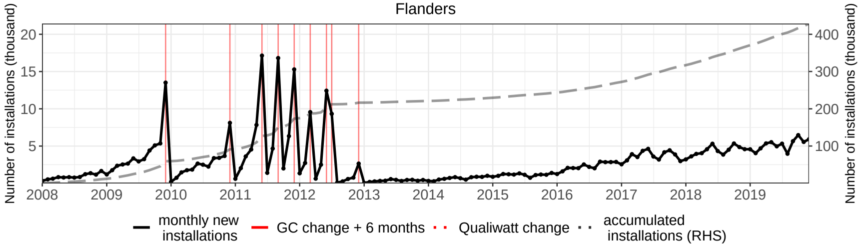
- Policy makers may opt for **incentive schemes** as second-best solution (instead of an emission tax) to **foster energy-related investments of households**.
- Often, these incentives contain **future financial benefits**, i.e. benefits **after the time of investment**.
- Policy makers choose the **design of** these **incentive schemes** $\rightarrow$ schemes **can be quite different** in their setup.

Introduction

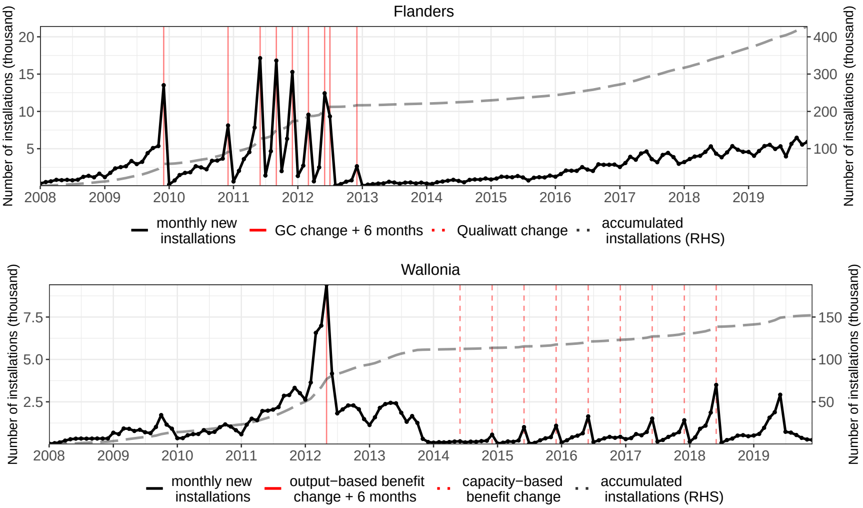
- Policy makers may opt for **incentive schemes** as second-best solution (instead of an emission tax) to **foster energy-related investments of households**.
- Often, these incentives contain **future financial benefits**, i.e. benefits **after the time of investment**.
- Policy makers choose the **design of** these **incentive schemes** $\rightarrow$ schemes **can be quite different** in their setup.
- In this paper, we take a closer look at **different incentive schemes** with future financial benefits in the context of **PV adoption in the residential sector** in Belgium.

Monthly PV installations across the Belgian regions

Monthly PV installations across the Belgian regions



Monthly PV installations across the Belgian regions



Literature and Research Question

[2] Effectiveness (reduced-form): Hughes and Podolefsky (2015), Germeshausen (2018), Gautier and Jacqmin (2019)...
[3] Cost-efficiency (structural models): Burr (2016), De Groote and Verboven (2019), Langer and Lemoine (2022), Feger et al. (2022)

Literature and Research Question

- The literature finds a **positive effects** of **financial benefits** on PV adoption in the residential sector mostly for one **specific incentive scheme** [2] or differences between upfront vs. future benefits [3].

[2] Effectiveness (reduced-form): Hughes and Podolefsky (2015), Germeshausen (2018), Gautier and Jacqmin (2019)...

[3] Cost-efficiency (structural models): Burr (2016), De Groote and Verboven (2019), Langer and Lemoine (2022), Feger et al. (2022)

Literature and Research Question

- The literature finds a **positive effects** of **financial benefits** on PV adoption in the residential sector mostly for one **specific incentive scheme** [2] or differences between upfront vs. future benefits [3].
- How do **higher future financial benefits** affect **PV adoption patterns** (number and average size) (in a month & municipality)?

[2]Effectiveness (reduced-form): Hughes and Podolefsky (2015), Germeshausen (2018), Gautier and Jacqmin (2019)...
[3]Cost-efficiency (structural models): Burr (2016), De Groote and Verboven (2019), Langer and Lemoine (2022), Feger et al. (2022)

Literature and Research Question

- The literature finds a **positive effects** of **financial benefits** on PV adoption in the residential sector mostly for one **specific incentive scheme** [2] or differences between upfront vs. future benefits [3].
- How do **higher future financial benefits** affect **PV adoption patterns** (number and average size) (in a month & municipality)?
- How **effective** are **different incentive schemes** with future financial benefits?

[2] Effectiveness (reduced-form): Hughes and Podolefsky (2015), Germeshausen (2018), Gautier and Jacqmin (2019)...

[3] Cost-efficiency (structural models): Burr (2016), De Groote and Verboven (2019), Langer and Lemoine (2022), Feger et al. (2022)

Incentive schemes can differ in their design

Incentive schemes can differ in their design

In Belgium, three different incentive schemes were implemented in the past:

Incentive schemes can differ in their design

In Belgium, three different incentive schemes were implemented in the past:

(1) **Output-based**: Fixed yearly compensation (MWh) **of produced electricity** for a guaranteed time span (Green certificate scheme) (2006-2014).

Incentive schemes can differ in their design

In Belgium, three different incentive schemes were implemented in the past:

(1) **Output-based**: Fixed yearly compensation (MWh) **of produced electricity** for a guaranteed time span (Green certificate scheme) (2006-2014).

(2.1) **Capacity-based**: Yearly compensation (readjusted, 5 year span) for each kW **of installed capacity** in Wallonia (up to 3kW; 2014-2018).

Incentive schemes can differ in their design

In Belgium, three different incentive schemes were implemented in the past:

(1) **Output-based**: Fixed yearly compensation (MWh) **of produced electricity** for a guaranteed time span (Green certificate scheme) (2006-2014).

(2.1) **Capacity-based**: Yearly compensation (readjusted, 5 year span) for each kW **of installed capacity** in Wallonia (up to 3kW; 2014-2018).

(2.2) **Capacity-based cost:** yearly fee per kW of capacity in Flanders (since 2015).

Incentive schemes can differ in their design

In Belgium, three different incentive schemes were implemented in the past:

(1) **Output-based**: Fixed yearly compensation (MWh) **of produced electricity** for a guaranteed time span (Green certificate scheme) (2006-2014).

(2.1) **Capacity-based**: Yearly compensation (readjusted, 5 year span) for each kW **of installed capacity** in Wallonia (up to 3kW; 2014-2018).

(2.2) **Capacity-based cost:** yearly fee per kW of capacity in Flanders (since 2015).

(3) **Net-metering/cost-saving:** Grid off-take (excess consumption) and injection (excess production) are netted on an annual basis, varies by regional electricity price (active for the whole sample period).

Incentive schemes can differ in their design

In Belgium, three different incentive schemes were implemented in the past:

(1) **Output-based**: Fixed yearly compensation (MWh) **of produced electricity** for a guaranteed time span (Green certificate scheme) (2006-2014).

(2.1) **Capacity-based**: Yearly compensation (readjusted, 5 year span) for each kW **of installed capacity** in Wallonia (up to 3kW; 2014-2018).

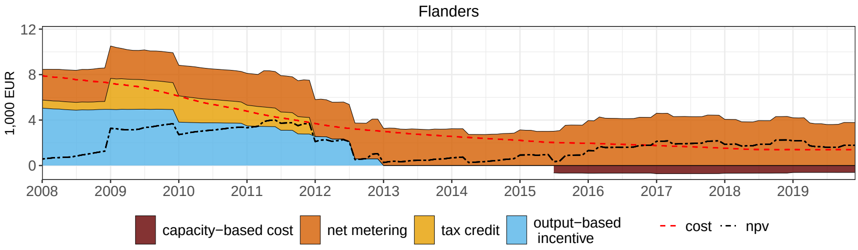
(2.2) **Capacity-based cost:** yearly fee per kW of capacity in Flanders (since 2015).

(3) **Net-metering/cost-saving:** Grid off-take (excess consumption) and injection (excess production) are netted on an annual basis, varies by regional electricity price (active for the whole sample period).

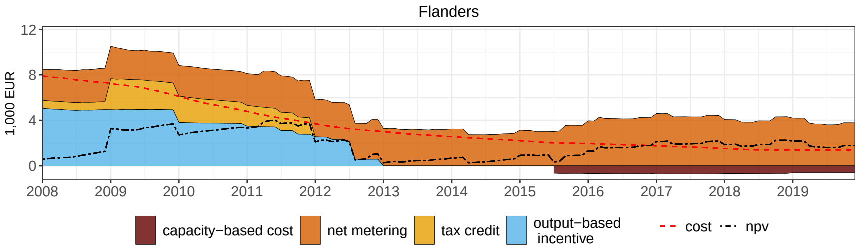
→ We **calculate the present value** for the separate incentive schemes in each month of investment and **assess their effectiveness** in a statistical model.

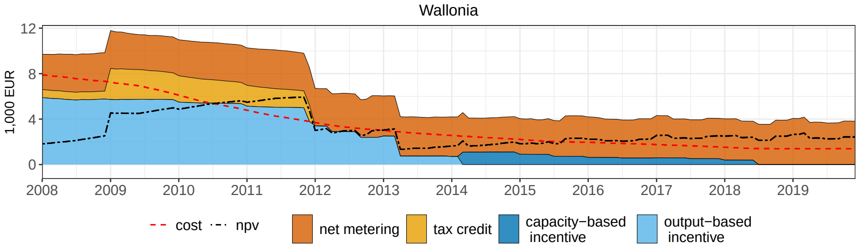
Present value of available incentive schemes per kW

Present value of available incentive schemes per kW



Present value of available incentive schemes per kW





Empirical Methodology

Empirical Methodology

- **Regress PV adoption** (PV count or average capacity size) on **discounted benefits of different incentive schemes**, control variables, municipality and time fixed effects → around 80,000 observations at the municipality-month-level (2009-2018). variables

Empirical Methodology

- **Regress PV adoption** (PV count or average capacity size) on **discounted benefits of different incentive schemes**, control variables, municipality and time fixed effects $\rightarrow$ around 80,000 observations at the municipality-month-level (2009-2018). variables
- **Poisson Pseudo Maximum Likelihood Estimator** (PPMLE):

Empirical Methodology

- **Regress PV adoption** (PV count or average capacity size) on **discounted benefits of different incentive schemes**, control variables, municipality and time fixed effects → around 80,000 observations at the municipality-month-level (2009-2018). variables
- **Poisson Pseudo Maximum Likelihood Estimator** (PPMLE):

$$PV_{it} = \exp[\sum_{j \in J} \beta^j \times b^j_{rt} + \gamma \times \boldsymbol{X_{it}} + \mu_i + \psi_t] \cdot u_{it} \qquad j \in \{yel, nm, cap, capcost\} \quad (1)$$

Empirical Methodology

- **Regress PV adoption** (PV count or average capacity size) on **discounted benefits of different incentive schemes**, control variables, municipality and time fixed effects → around 80,000 observations at the municipality-month-level (2009-2018). variables
- **Poisson Pseudo Maximum Likelihood Estimator** (PPMLE):

$$PV_{it} = \exp[\sum_{j \in J} \beta^j \times b^j_{rt} + \gamma \times \boldsymbol{X_{it}} + \mu_i + \psi_t] \cdot u_{it} \qquad j \in \{yel, nm, cap, capcost\} \quad (1)$$

- **Identification** of benefit coefficients:

Empirical Methodology

- **Regress PV adoption** (PV count or average capacity size) on **discounted benefits of different incentive schemes**, control variables, municipality and time fixed effects → around 80,000 observations at the municipality-month-level (2009-2018). variables
- **Poisson Pseudo Maximum Likelihood Estimator** (PPMLE):

$$PV_{it} = \exp[\sum_{j \in J} \beta^j \times b^j_{rt} + \gamma \times \boldsymbol{X_{it}} + \mu_i + \psi_t] \cdot u_{it} \qquad j \in \{yel, nm, cap, capcost\} \quad (1)$$

- **Identification** of benefit coefficients:
  - **monthly changes** in **prices and payback period**

Empirical Methodology

- **Regress PV adoption** (PV count or average capacity size) on **discounted benefits of different incentive schemes**, control variables, municipality and time fixed effects $\rightarrow$ around 80,000 observations at the municipality-month-level (2009-2018). variables
- **Poisson Pseudo Maximum Likelihood Estimator** (PPMLE):

$$PV_{it} = \exp[\sum_{j \in J} \beta^j \times b^j_{rt} + \gamma \times \boldsymbol{X_{it}} + \mu_i + \psi_t] \cdot u_{it} \qquad j \in \{yel, nm, cap, capcost\} \quad (1)$$

- **Identification** of benefit coefficients:
  - **monthly changes** in **prices and payback period**
  - Net metering possibly endogenous due to network tariff adjustments (component of electricity prices)

Empirical Methodology

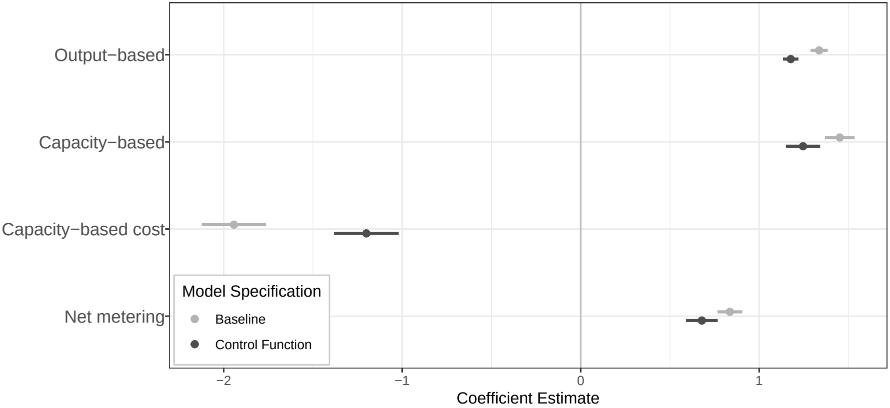
- **Regress PV adoption** (PV count or average capacity size) on **discounted benefits of different incentive schemes**, control variables, municipality and time fixed effects → around 80,000 observations at the municipality-month-level (2009-2018). variables
- **Poisson Pseudo Maximum Likelihood Estimator** (PPMLE):

$$PV_{it} = \exp[\sum_{j \in J} \beta^j \times b^j_{rt} + \gamma \times \boldsymbol{X_{it}} + \mu_i + \psi_t] \cdot u_{it} \qquad j \in \{yel, nm, cap, capcost\} \quad (1)$$

- **Identification** of benefit coefficients:
  - **monthly changes** in **prices and payback period**
  - Net metering possibly endogenous due to network tariff adjustments (component of electricity prices) → for robustness, we use a **control function instrumental variable** approach (Gillingham and Tsvetanov, 2019). Instrument: network tariff-free electricity prices.

Results Number of Installations

Results Number of Installations



Grey dots/lines show results for PPMLE, CF estimates in black. Dots display point estimates, whiskers 95% confidence interval. SEs clustered at the municipality-level for baseline, for CF bootstrapped. CF estimates contains sub-regional variation in capacity-based incentive/cost. Observations at the municipality-month-level. Sample size 78,084.

Summary/Conclusion

Summary/Conclusion

- **Output- and capacity-based** incentive schemes are at least **60% more effective** compared to cost saving-based (indirect) net-metering. regression table

Summary/Conclusion

- **Output- and capacity-based** incentive schemes are at least **60% more effective** compared to cost saving-based (indirect) net-metering. regression table
- Different effectiveness could be due to **differences in the benefit designs**, i.e. more **uncertain**, less **direct** and less **salient** incentive schemes are less effective.

Summary/Conclusion

- **Output- and capacity-based** incentive schemes are at least **60% more effective** compared to cost saving-based (indirect) net-metering. regression table
- Different effectiveness could be due to **differences in the benefit designs**, i.e. more **uncertain**, less **direct** and less **salient** incentive schemes are less effective.

→ The **benefit design** is an **important determinant** concerning the overall uptake of energy-related technology adoption.

Summary/Conclusion

- **Output- and capacity-based** incentive schemes are at least **60% more effective** compared to cost saving-based (indirect) net-metering. regression table
- Different effectiveness could be due to **differences in the benefit designs**, i.e. more **uncertain**, less **direct** and less **salient** incentive schemes are less effective.

→ The **benefit design** is an **important determinant** concerning the overall uptake of energy-related technology adoption.

→ Possible room for **improvement for policy makers**: more certain, more direct and salient incentive schemes increase energy-related technology uptake.

Conclusion

Thank you for listening!

KU Leuven - Energy Systems Integration & Modelling (ESIM) Research Group

justus.boening@kuleuven.be

References

Burr, C. (2016). Subsidies and investmentsin the solar power market. *Working Paper*.

De Groote, O. and Verboven, F. (2019). Subsidies and time discounting in new technology adoption: Evidence from solar photovoltaic systems. *American Economic Review*, 109(6):2137–2172.

Feger, F., Pavanini, N., and Radulescu, D. (2022). Welfare and redistribution in residential electricity markets with solar power. *The Review of Economic Studies*, 89(6):3267–3302.

Gautier, A. and Jacqmin, J. (2019). PV adoption: the role of distribution tariffs under net metering. *Journal of Regulatory Economics*, 57(1):53–73.

Germeshausen, R. (2018). Effects of attribute-based regulation on technology adoption â the case of feed-in tariffs for solar photovoltaic. *SSRN Electronic Journal*.

Gillingham, K. and Tsvetanov, T. (2019). Hurdles and steps: Estimating demand for solar photovoltaics. *Quantitative Economics*, 10(1):275–310.

Hughes, J. E. and Podolefsky, M. (2015). Getting green with solar subsidies: Evidence from the california solar initiative. *Journal of the Association of Environmental and Resource Economists*, 2(2):235–275.

Langer, A. and Lemoine, D. (2022). Designing dynamic subsidies to spur adoption of new technologies. *Journal of the Association of Environmental and Resource Economists*, 9(6):1197–1234.

Data

Data

- **Monthly data**, aggregated at the **municipality** (zip) **level** (262 Wallonia, 300 Flanders), 2008-2019: $\sim$580,000 installations and $\sim$**80,000 observations**.

Data

- **Monthly data**, aggregated at the **municipality** (zip) **level** (262 Wallonia, 300 Flanders), 2008-2019: ∼580,000 installations and ∼**80,000 observations**.
- **Dependent Variable** *variation by month and zip* : number and average capacity size of new PV installations in the residential sector (≤10kWp) (source: VEKA, SPW)

  dep vars summary

Data

- **Monthly data**, aggregated at the **municipality** (zip) **level** (262 Wallonia, 300 Flanders), 2008-2019: ∼580,000 installations and ∼**80,000 observations**.
- **Dependent Variable** *variation by month and zip* : number and average capacity size of new PV installations in the residential sector (≤10kWp) (source: VEKA, SPW)

  dep vars summary
- **Main explanatory variables** *variation by month and region*: discounted benefits per kW (source: market reports VREG & CWaPE). equations

Data

- **Monthly data**, aggregated at the **municipality** (zip) **level** (262 Wallonia, 300 Flanders), 2008-2019: ∼580,000 installations and ∼**80,000 observations**.
- **Dependent Variable** *variation by month and zip* : number and average capacity size of new PV installations in the residential sector (≤10kWp) (source: VEKA, SPW)
  dep vars summary
- **Main explanatory variables** *variation by month and region*: discounted benefits per kW (source: market reports VREG & CWaPE). equations
- **Control variables** *variation by year and zip*: median income deflated (source: statbel), sociodemographics and building characteristics (source: Walstat/provincies.incijfers)
  exp vars summary back

Results Number of Installations

Model:	Aggregate benefits (1)	(2)	Sep. benefits (3)	Sep. ben. (IV) (4)
Net benefits (log)	6.83*** *(0.085)*			
Net benefits (thous)		1.05*** *(0.019)*		
Output-based incentive			1.34*** *(0.025)*	1.18*** *(0.023)*
Net metering			0.84*** *(0.035)*	0.68*** *(0.041)*
Capacity-based cost			-1.94*** *(0.092)*	-1.20*** *(0.094)*
Capacity-based incentive			1.45*** *(0.042)*	1.25*** *(0.045)*
Zip-, Month-, Year-fixed eff.:	Yes	Yes	Yes	Yes
Additional Control Variables:	Yes	Yes	Yes	Yes
Observations	78,048	78,048	78,048	78,048

*Standard-errors in parentheses, Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, obs. at monthly municipality level. Time span 2008-2019. Standard-errors for PPMLE (1)-(3) clustered at the municipality-level, for IV estimates (4) bootstrapped. IV estimates contains sub-regional variation in capacity-based incentive/cost.* back

Results on Average Capacity Size Installations

	Aggregate benefits		Separate benefits	Separate benefits (IV)
Model:	(2)	(3)	(4)	(5)
Net benefits (log)	1.40*** *(0.048)*			
Net benefits		0.344*** *(0.010)*		
Output-based incentive			0.390*** *(0.012)*	0.365*** *(0.012)*
Net metering			-0.113*** *(0.022)*	-0.112*** *(0.030)*
Capacity-based cost			-0.310*** *(0.044)*	-0.253*** *(0.047)*
Capacity-based incentive			-0.144*** *(0.027)*	-0.201*** *(0.036)*
Zip-, Month-, Year-fixed effects:	Yes	Yes	Yes	Yes
Additional Control Variables:		Yes	Yes	Yes
Observations	78,048	78,048	78,048	78,048

*Standard-errors in parentheses, Signif. Codes: ***: 0.01, **: 0.05, *: 0.1, obs. at monthly municipality level. Time span 2008-2019. Standard-errors for PPMLE (1)-(3) clustered at the municipality-level, for IV estimates (4) bootstrapped. IV estimates contains sub-regional variation in capacity-based incentive/cost. Values in thous, EUR unless specified.* back

Present Value Equations

$$b^{tc}_{i,s,r,t}(cap) = \sum_{t=1}^{4} \beta^{12t}\ taxcut_t(cap) \tag{2}$$

$$b^{gc}_{i,r,t}(cap) = \beta \cdot \left(1 - \left(\beta^{gc}\right)^{T^{gc}_{r,t}}\right)\left(1 - \beta^{gc}\right)^{-1} \cdot n^{gc}_{r,t} \cdot p^{gc}_{r,t} \cdot \bar{y}(cap)/12 \tag{3}$$

$$b^{nm}_{i,r,t}(cap) = \beta \cdot \left(1 - \left(\beta^{nm}\right)^{T^{lt}}\right)\left(1 - \beta^{nm}\right)^{-1} \cdot p^{el}_{s,r,m} \cdot \bar{y}(cap)/12 \tag{4}$$

$$b^{qw}_{i,r,t}(cap) = \beta \cdot \left(1 - \left(\beta^{qw}\right)^{T^{qw}}\right)\left(1 - \beta^{qw}\right)^{-1} \cdot p^{qw}_{r,m} \cdot \min(cap, 3\text{kW}) \tag{5}$$

$$b^{pr}_{i,r,t}(cap) = \beta \cdot \left(1 - \left(\beta^{pr}\right)^{T^{lt}}\right)\left(1 - \beta^{pr}\right)^{-1} \cdot p^{pr}_{s,r,m} \cdot AC^{sh} \cdot cap^{p} \tag{6}$$

back

Explanatory Variables - Summary Statistics 2

Variable	Mean	SD	Min	Median	Max	Observations
Benefit Variables						
net benefits (log)	8.48	0.42	7.72	8.32	9.12	70,308
net benefits (thousand)	5.25	2.23	2.25	4.09	9.15	70,308
GC (thousand)	1.95	2.37	0.00	0.00	5.89	70,308
net metering (thousand)	3.38	0.48	2.55	3.31	4.60	70,308
prosumer tariff (thousand)	0.18	0.33	-0.00	0.00	0.86	70,308
Qualiwatt (thousand)	0.11	0.28	0.00	0.00	1.11	70,308
Sociodemographics						
households (log)	8.49	0.86	3.50	8.50	12.37	6,696
net med income per decl. defl. (log)	10.09	0.11	9.72	10.11	10.44	6,516
population density (log)	5.63	1.00	3.18	5.69	8.17	6,696
age:below 18 (sh.)	0.21	0.02	0.10	0.20	0.29	6,696
age:18-49 (sh.)	0.41	0.02	0.24	0.41	0.51	6,694
age:above 64 (sh.)	0.18	0.03	0.10	0.18	0.40	6,694
age:50-64 (sh.)	0.20	0.02	0.13	0.20	0.32	6,696
non-nationals (sh.)	0.06	0.06	0.00	0.04	0.52	6,696
nationals (sh.)	0.94	0.06	0.48	0.96	1.00	6,696
female (sh.)	0.51	0.01	0.40	0.51	0.54	6,696
male (sh.)	0.49	0.01	0.46	0.49	0.60	6,696

Explanatory Variables - Summary Statistics 2

Variable	Mean	SD	Min	Median	Max	Observations
Household Characteristics						
hh single (sh.)	0.24	0.08	0.10	0.22	0.55	6,684
hh single parent (sh.)	0.08	0.03	0.03	0.06	0.18	6,684
hh couple /w children (sh.)	0.36	0.06	0.16	0.37	0.52	6,684
hh couple w/o children (sh.)	0.32	0.08	0.16	0.34	0.51	6,684
Building Characteristics						
house age:until 1981 (sh.)	0.73	0.08	0.46	0.72	0.95	6,696
house age:after 1981 (sh.)	0.27	0.08	0.05	0.28	0.54	6,696
house type:apartments (sh.)	0.12	0.11	0.00	0.09	0.79	6,696
house type:single fam closed (sh.)	0.19	0.13	0.01	0.15	0.71	6,696
house type:single fam semi-detached (sh.)	0.25	0.07	0.03	0.25	0.42	6,696
house type:single fam open (sh.)	0.45	0.19	0.01	0.47	0.85	6,696

back

Dependent Variable: PV installations

Region	zip	Total PV (thous.)	Obs. (thous.)	zerosh. /obs.	PV installations/obs.					mean cap. (KWp)/obs.			
					mean	median	sd	min	max	mean	sd	min	max
Flanders	300	428,175	43,200	0.13	9.91	5.00	16	0	336	4.49	1.25	0.54	10.00
Wallonia	258	152,078	37,152	0.30	4.09	2.00	8	0	278	4.96	1.36	0.75	10.00
Total	558	580,253	80,352	0.21	7.22	3.00	13	0	336	4.68	1.32	0.54	10.00

back

Robustness: Accounting for short-term dynamics

	Number of PV installations			Average new installed capacity		
	Agg. ben.	Sep. ben.	Sep. ben. (IV)	Agg. ben.	Sep. ben.	Sep. ben. (IV)
Model:	(1)	(2)	(3)	(4)	(5)	(6)
Net benefits	1.30***			0.368***		
	(0.018)			(0.012)		
Capacity-based cost		-0.407***	-0.665***		-0.312***	-0.251***
		(0.089)	(0.077)		(0.049)	(0.052)
Output-based incentive		1.30***	1.26***		0.429***	0.406***
		(0.027)	(0.024)		(0.015)	(0.015)
Net metering		0.066	0.796***		-0.164***	-0.157***
		(0.044)	(0.056)		(0.027)	(0.042)
Capacity-based incentive		0.724***	0.910***		-0.151***	-0.186***
		(0.047)	(0.046)		(0.030)	(0.042)
Controls, time-&zip-fixed effects:	Yes	Yes	Yes	Yes	Yes	Yes
Observations	67,775	67,775	67,775	67,775	67,775	67,775

back

Robustness: Different discount rates

	Standard PPMLE				IV Controlfunction			
	0% DR	3% DR (base-line)	7% DR	15% DR	0% DR	3% DR (base-line)	7% DR	15% DR
Model:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Capacity-based cost	-0.943***	-1.64***	-2.85***	-5.93***	-0.551***	-1.01***	-1.77***	-3.58***
	(0.056)	(0.077)	(0.114)	(0.211)	(0.055)	(0.079)	(0.119)	(0.218)
Output-based incentive	1.04***	1.34***	1.78***	2.73***	0.935***	1.18***	1.52***	2.23***
	(0.020)	(0.025)	(0.032)	(0.051)	(0.018)	(0.023)	(0.029)	(0.044)
Net metering	0.583***	0.836***	1.26***	2.37***	0.441***	0.679***	1.07***	2.01***
	(0.027)	(0.035)	(0.049)	(0.082)	(0.030)	(0.041)	(0.059)	(0.103)
Capacity-based incentive	1.17***	1.45***	1.81***	2.47***	0.961***	1.25***	1.59***	2.15***
	(0.038)	(0.042)	(0.048)	(0.060)	(0.040)	(0.045)	(0.052)	(0.066)
Controls, time-&zip-fixed effects:	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations:	78,048	78,048	78,048	78,048	78,048	78,048	78,048	78,048

back