



On the added value of utility-sponsored energy efficiency subsidies: Insights from the French White Certificate program (Phase III)

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<https://enpc.hal.science/hal-05052175>

Utility-sponsored EE subsidies

- A widespread policy tool
 - As of 2020: 49 programs in 24 countries (Source: IEA)
 - US: Demand-side management, since 1980s
 - Europe: (Tradable) White Certificates, since 2000s
- A hybrid mechanism
 - EE obligation imposed on utilities (command-and-control)
 - They comply by granting end-users EE subsidies (incentive 1)
 - Cost recovered through increased energy prices (incentive 2)
- Alleged added value, compared to public subsidies
 - Allocative: by leveraging private information, utilities offer better-targeted subsidies, thus increasing overall cost-effectiveness
 - Political: private spending

Motivation

- The French program in a nutshell (*certificats d'économies d'énergie, CEE*)
 - Running since 2006
 - Obligations are tradable -> market price
 - 50-80% savings achieved in the residential sector
 - Coexisting with residential public subsidies. As of 2024: ~€3 bl each
- **What is the added value of the program?**
 - **Did it trigger additional investment?**
 - **Was induced investment more cost-effective?**

Identification: RDD

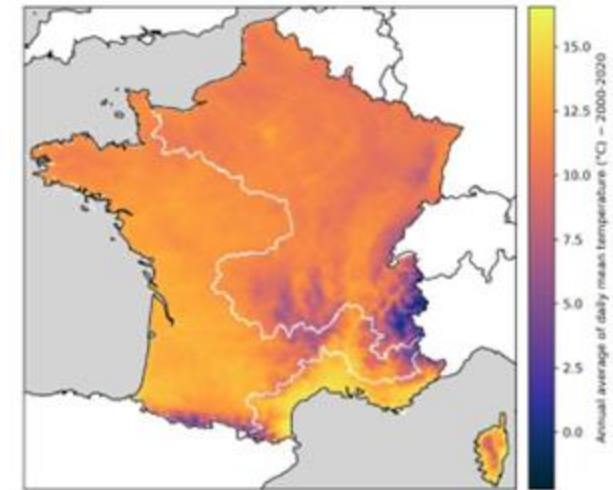
- Geographical zoning of subsidy amounts
- Despite continuous climate (hence benefit) across the border
- Assumption: No sorting

5. Montant de certificats en kWh cumac

Montant en kWh cumac par m ² d'isolant		
Zone climatique	Énergie de chauffage	
	Électricité	Combustible
H1	2 400	3 800
H2	2 000	3 100
H3	1 300	2 100

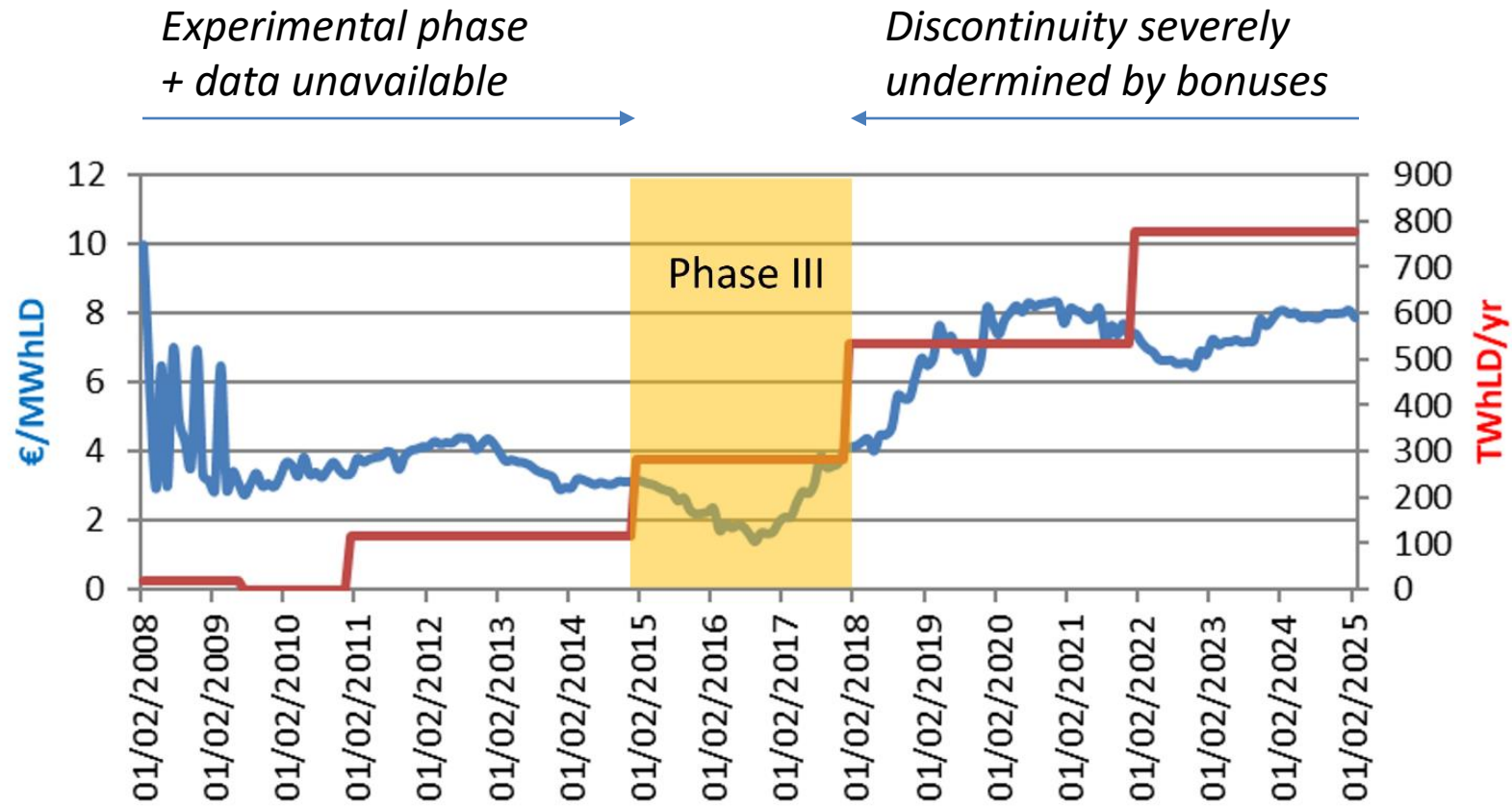


(b) Administrative borders of France



(a) Mean temperature across municipalities in France

Focus on Phase III (2015-2018)



Low-price period, expected to be little additional

Data

- CEE measures
 - Source: Ministry of the Environment
 - Provide measure category, income category, municipality identifier
 - Household and dwelling characteristics
 - Source: FILOCOM
 - Provides income distribution, dwelling characteristics, occupancy status
 - Temperature and geographical data: Météo France, data.gouv.fr
- **132k obs (measures), from 33k municipalities**

Model specifications

Table 2: Parameters of specifications: Number of subsidies

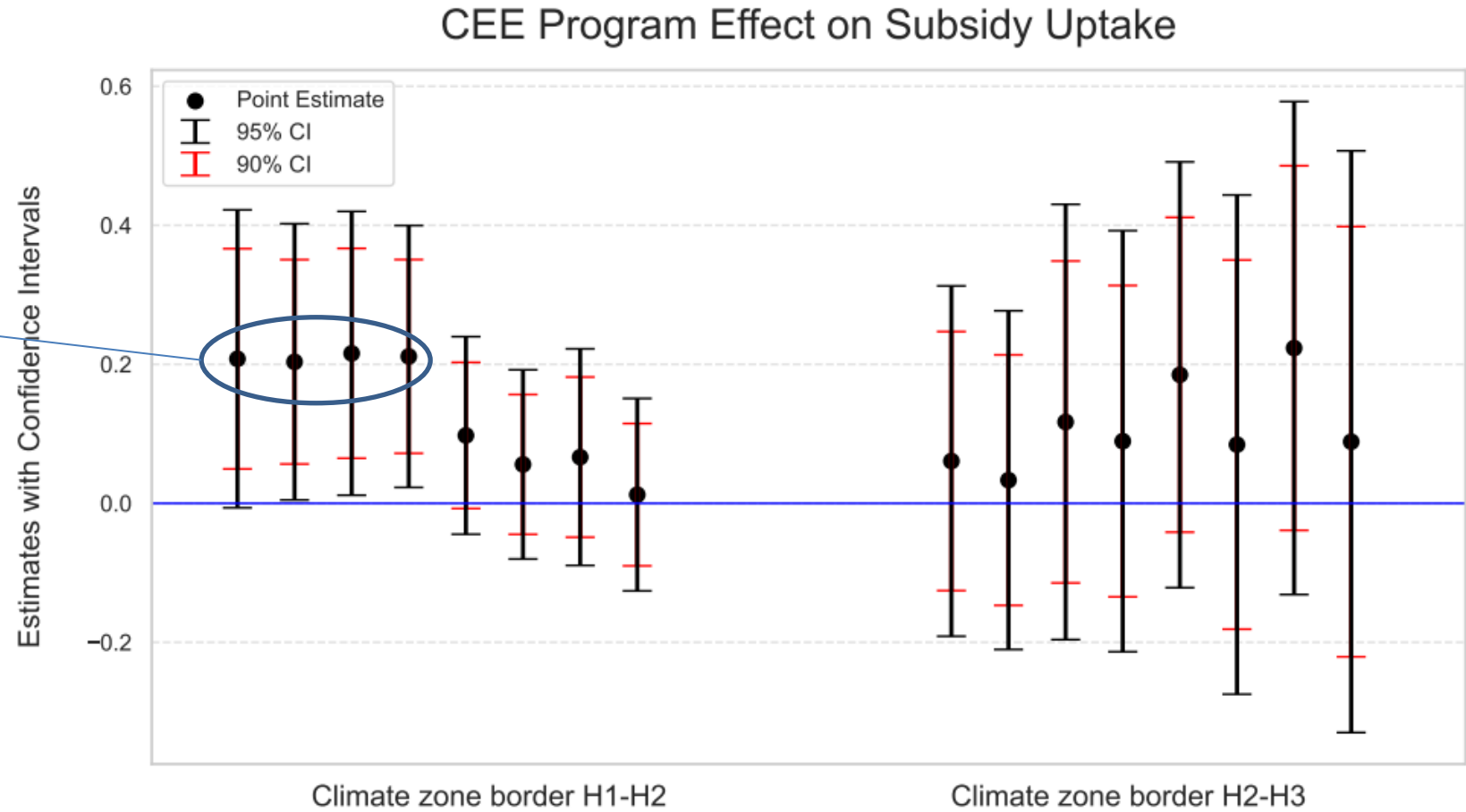
Specification	Outcome variable	Sample	Geo-difference control	Scope
1	Number of subsidies	Imputation 1	HDD	55km bandwidth, 5km binwidth
2		Imputation 2		
3		Imputation 1	Border segments	
4		Imputation 2		
5		Imputation 1	HDD	Cattaneo and Vazquez-Bare (2017)'s bandwidth and binwidth
6		Imputation 2		
7		Imputation 1	Border segments	
8		Imputation 2		

Note: The options in blue are our preferred specification (specification 1)
 Details regarding imputation 1 and imputation 2 are available in the annex
 Optimal bins were determined using the ES setting

Outcome: Number of measures by municipality

Implied elasticity:
1.16

Implied MVPF
([Hahn et al., 2024](#)):
1.11



Note: Specifications 1-8

Heterogeneity by measure

Table 3: Comparison of CEE program's effect size and incentives: number of subsidies

measure			H1-H2			H2-H3		
code	name	share (%)	Δ effect (%)	Δ incentive (%)	elasticity	Δ effect (%)	Δ incentive (%)	elasticity
BAR-EN-101	Attic or roof insulation	30.3	36.4	21.8	1.67	35.7**	47.1	0.76
BAR-EN-104	Window or patio door with glazed surface insulation	18.6	2.2	22.8	0.1	5.6	49.3	0.11
BAR-TH-106	High-efficiency boiler	13.5	-15.1	18.3	-0.83	-36.9	38.4	-0.96
BAR-TH-112	Independent wood heating appliance	8.7	5.8	22.3	0.26	2.8	50.3	0.06
BAR-EN-102	Wall insulation	5.1	40.4**	22.0	1.83	21.2	49.2	0.43
BAR-EN-103	Floor insulation	3.5	89.7	21.0	4.26	127.1**	51.6	2.46
total		100.0	25.0*	21.6	1.16	5.1	47.0	0.11

Note: Effect size and incentive are calculated within a 55 km bandwidth on each side of the border (specification 1).

" Δ effect in %" refers to the RDD effect size relative to the average number of subsidies in the control group (55km bandwidth).

RDD effect size is reported with signif. codes: ***: 0.01, **: 0.05, *: 0.1

" Δ incentive %" refers to the percentage difference in adjusted CEE values (in MWh CUMAC) delivered between the treatment and control groups.

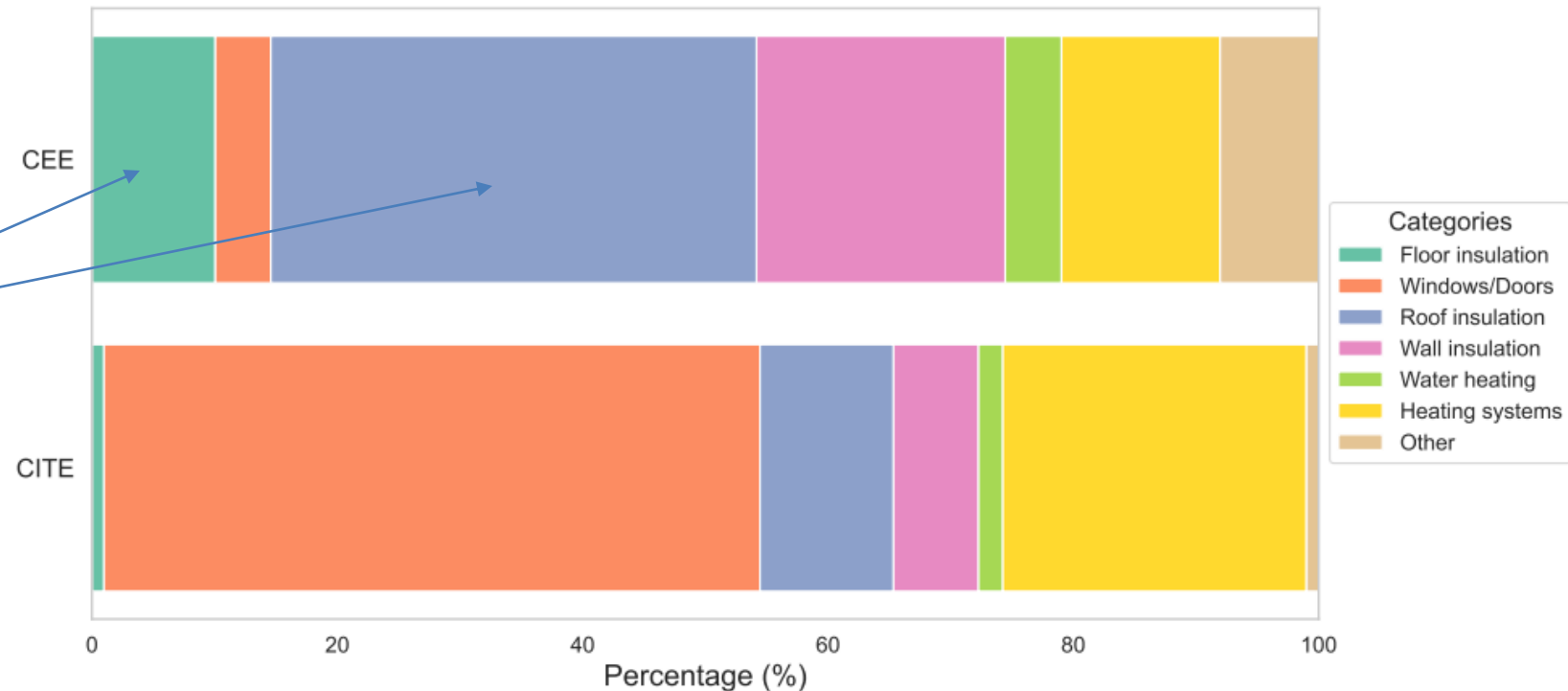
Elasticity is calculated by dividing " Δ effect in %" by " Δ incentive %"

Cost-effectiveness, compared to CITE's

CITE: main publicly-funded program

Comparison of CITE vs CEE

Measures considered most cost-effective (DG Trésor, 2017)

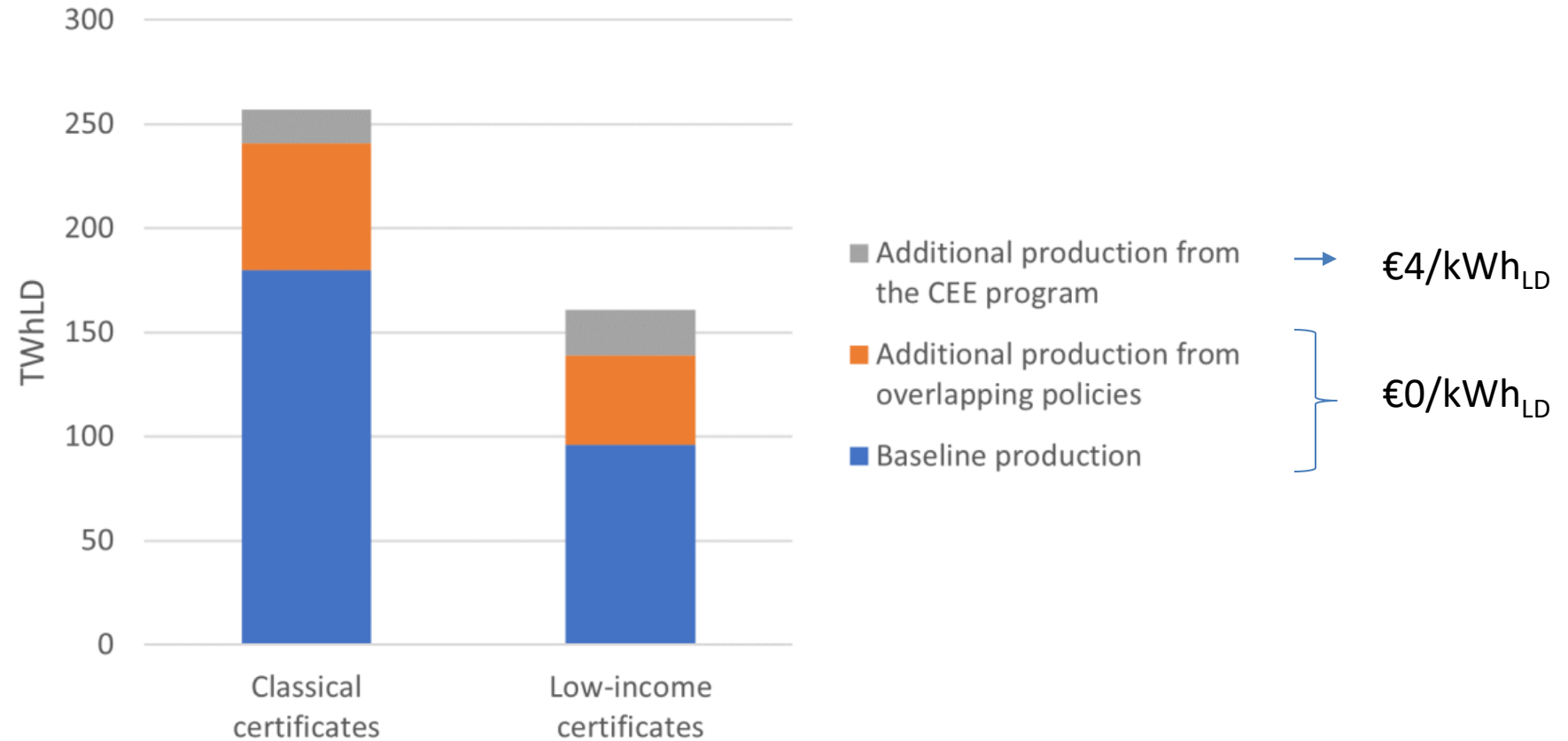


CEE: share of certificates delivered in 2015 to March 2018; CITE: share of funds delivered in 2015 to 2016 (Domergue and Vermont, 2018)

Free-riding on CITE program?

Microsimulations using Res-IRF model ([Giraudet et al., 2021](#))

Figure 7: Microsimulations of white certificate production and its attribution under Phase III



Wrap-up

- Takeaways
 - Program effective qualitatively: better targeting?
 - But hardly quantitatively: overlapping programs allowed obligated parties to fulfill their obligation at ~zero cost
 - Regime changed post-2018, however thanks to a strong public impetus, thus undermining the ‘targeting hypothesis’
 - Advocates for merging publicly and privately-funded programs (but NOT substituting the latter for the former...)
- Next steps
 - Focus on total kWh, a somewhat intensive margin
 - Impact on energy consumption à la [Wald and Glachant \(2024\)](#) – however expected to produce non-significant results

APPENDIX

Covariates balance

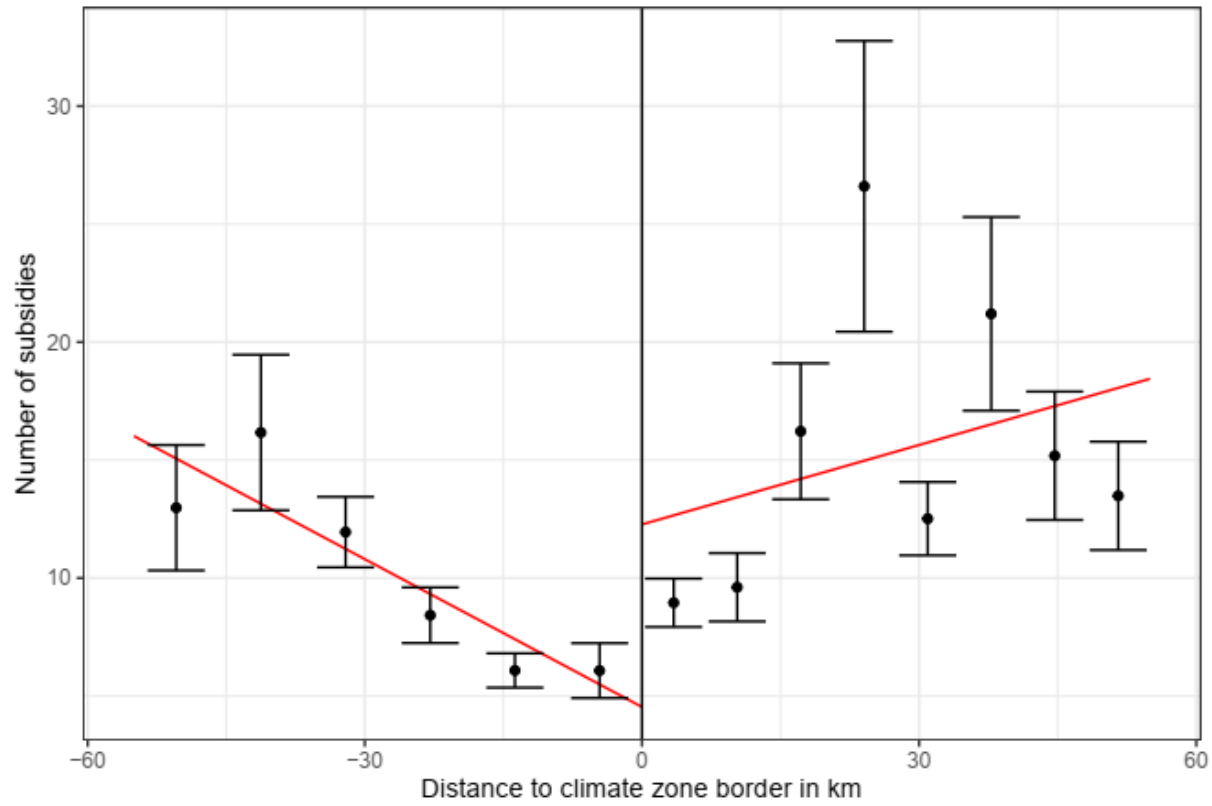
Table 1: Covariates Balance: t-test

Covariate	Bandwidth	H1-H2		H2-H3	
		p-value	t-statistic	p-value	t-statistic
<u>HDD</u>	5/5	0.261	16.80	0.808	10.23
avg annual household revenue in 000s euros		0.420	0.18	0.424	-0.27
nb of households in municipality		0.001	89.08	0.007	436.17
share of houses		0.001	-0.03	0.067	0.01
share of “very modest” households		0.096	-0.01	0.003	-0.02
share of “modest” households		0.442	-0.00	0.048	-0.01
avg nb of minors per dwelling		0.294	-0.01	0.779	0.00
avg cadastral rental value in euros		0.001	88.99	0.024	107.46
share of dwellings with central heating		0.005	0.02	0.014	0.03
avg number of floors		0.001	0.09	0.088	-0.02
comfort ranking: partial comfort		0.082	-0.01	0.010	-0.02
comfort ranking: full comfort		0.006	0.01	0.025	0.02
share of primary residences		0.545	-0.00	0.852	-0.00
share of secondary residences		0.638	0.01	0.849	-0.00
share of owner-occupied dwellings		0.918	-0.01	0.136	0.01
share of tenant-occupied dwellings		0.693	-0.01	0.127	-0.01
share of construction period before 1946		0.135	-0.01	0.071	0.02
share of construction period from 1946 to 1970		0.090	0.00	0.605	0.00
share of construction period from 1971 to 1973		0.120	0.00	0.001	0.00
share of construction period from 1974 to 1982		0.055	0.00	0.336	-0.00
share of construction period from 1983 to 1989		0.010	0.00	0.001	-0.01
share of construction period from 1990 to 2000		0.256	0.00	0.881	-0.00
share of construction period from 2001 to 2005		0.587	0.00	0.529	0.00

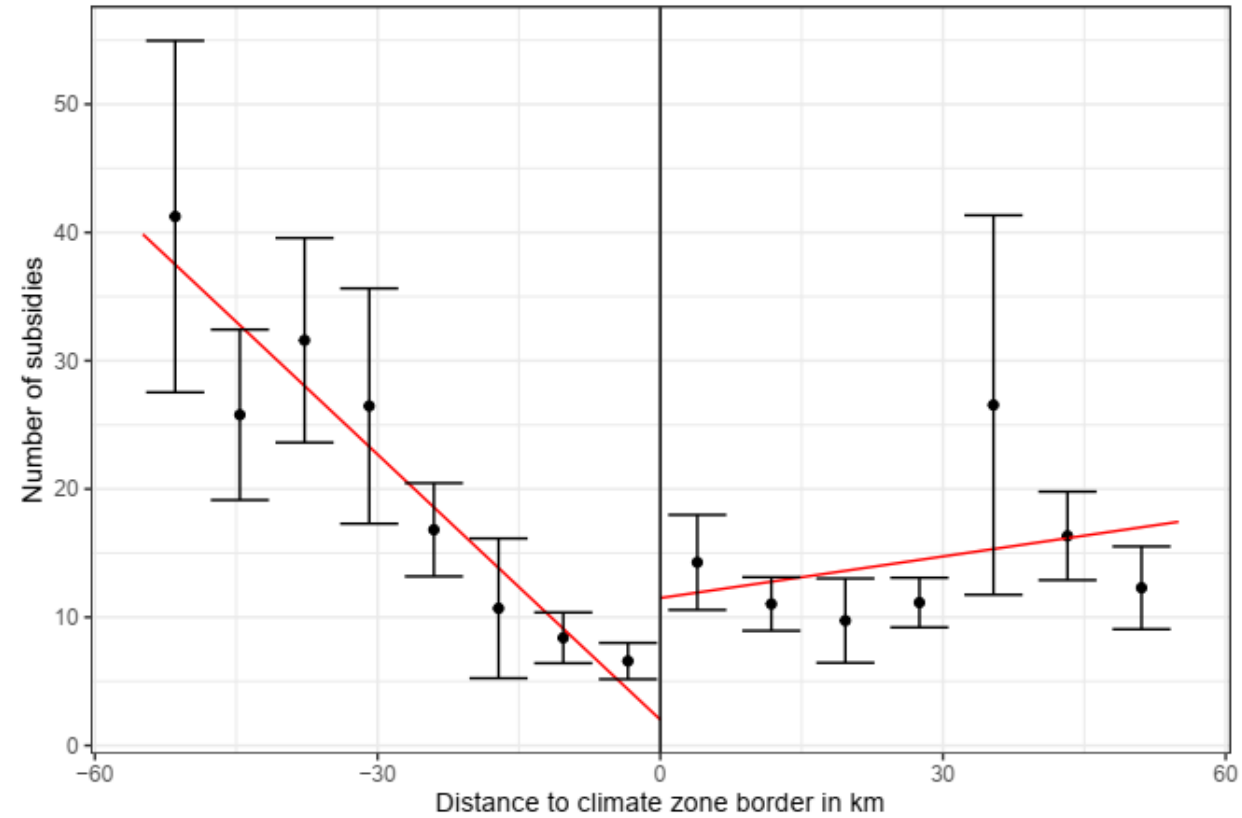
Note: bandwidth of 5km on each side of the climate zone border

Visual analysis without controls

Climate zones 1 and 2: Bandwidth 55. Binwidth es



Climate zones 2 and 3: Bandwidth 55. Binwidth es



Model of subsidies and climate zones

Dependent Variable:	number of CEE subsidies allocated
Model:	(1)
<i>Variables</i>	
heating degree days	$2.09 \times 10^{-5*}$ (8.47×10^{-6})
climate zone H1	0.1586 (0.0855)
climate zone H3	-0.2215*** (0.0345)

Dependent Variable:	number of CEE subsidies allocated
Model:	(1)
<i>Variables</i>	
heating degree days	$2.09 \times 10^{-5*}$ (8.47×10^{-6})
climate zone H1	0.1586 (0.0855)
climate zone H3	-0.2215*** (0.0345)
avg annual household revenue in 000s euros	-0.0039 (0.0061)
share of houses among all dwellings	0.0034*** (0.0589)
share of 'high precarity' subsidies	1.151*** (0.1463)
share of 'precarity' subsidies	1.124* (0.3690)
avg number of minors per dwelling	-0.3760 (0.3611)
avg cadastral rental value in euros	$-4.78 \times 10^{-5*}$ (1.82×10^{-5})
share of dwellings with central heating	0.7041 (0.3304)
avg number of floors	-0.1087*** (0.0105)
share of secondary residences	-0.9777** (0.1907)
share of dwellings with landlord-tenant dilemma	0.0598 (0.1830)
nat. logarithm of nb of households in municip.	Yes
construction periods	Yes
share of households without income category reported	Yes
share of comfort ranking: no comfort or partial comfort	Yes
<i>Fixed-effects</i>	
year	Yes
<i>Fit statistics</i>	
Observations	132,576
Squared Correlation	0.74341

Clustered (year) standard-errors in parentheses

Signif. Codes: ***: 0.01, **: 0.05, *: 0.1

Quasi-Poisson regression.

Variables refer to municipality-level aggregations.

Reference categories: control bin -5km; share of apartments among all dwellings; share of 'classic' subsidies;

share of dwellings not owned by natural person; share of dwelling without central heating;

share of primary residences; share of dwellings whose owners do not have an incentive to renovate;

share of dwellings constructed after 2005

Bandwidth value refers to the distance from each side of the border

Coefficients of the RD model

