UNIKASSEL
VERSITÄT

Acceptance of Climate-Oriented Housing Policies – A Comparison between Owners and Tenants in Germany

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Motivation (1) – Policy acceptance

- **Why study policy acceptance?**

- The German buildings sector is a large contributor to CO_2 emissions in Germany (Umweltbundesamt 2022)

- Several climate-oriented housing policies are discussed and implemented in Germany

- Public acceptance is important for the implementation and effectiveness of climate-oriented policies (e.g., Attari et al. 2009)

Figure 1: „Yellow Vest“ protest. (Source: Eric Feferberg, AFP)

Motivation (2) – Owners' and tenants' preferences

- **Why compare owners' and tenants' preferences?**

- Owners and tenants are affected differently by individual policies
- The majority (53%) of the German population are tenants (Eurostat 2022)
- The rental housing market is tense: Increasing rents, energy costs, and influx of people
- The average household spends 25% of its income on housing expenses (Statistisches Bundesamt 2023)

→ Possible differences in policy-preferences

Hypotheses: Policy types

Voluntary (pull) or regulatory (push)

- The literature shows that voluntary climate-oriented policies are generally preferred over regulatory policies (e.g., Drews & Van den Bergh 2016)

➢ *H1: Voluntary pull-policies are preferred over regulatory push-policies*

Eco-social policies are preferred by tenants

- Eco-social policies are policies that are designed to reach environmental as well as social goals (e.g., Mandelli (2022), Gugushvilli & Otto 2021)
- Social housing policies are usually “tenant-friendly”

➢ *H2: Tenants are more likely to accept eco-social policies than owners*

Hypotheses: Owners and tenants

Property ownership reduces acceptance for push polices with high perceived costs

- Push policies often come with highly visible costs for property owners

➢ *H3: Tenants are more likely to accept costly push policies than owners*

➢ *H4: Being a landlord makes tenants less likely to accept costly push policies*

The home type affects policy acceptance

- Owner-occupied multi-family homes (MFH) are lacking behind single-family homes (SFH) in energy efficiency-related investments because of coordination issues among the apartment owners
  (März et al. 2020, Feuersänger 2017)

➢ *H5: Owners in MFH are more likely to accept costly push policies compared to owners in SFH*

Contribution of this study

1. Empirical analysis of determinants for pro-environmental behavior (policy acceptance)
2. To our best knowledge, one of the first studies to explore potential differences in preferences for climate-oriented housing policies between homeowners and tenants (e.g., Jansma et al. 2020)

- Basis: Representative sample (in terms of age, gender, and state of residence) of more than 5,000 household decision makers in Germany
- About 2,200 owners and 2,900 tenants
- Survey conducted in 2022 by a market research institute

Dependent variables: 8 policies

	Policies	Completely disagree (= 1)	Rather disagree (= 1)	Undecided (= 2)	Rather agree (= 3)	Completely agree (= 3)
6 push policies	Ban new oil heating systems	□	□	□	□	□
	Ban new gas heating systems	□	□	□	□	□
	Ban non-energy efficient apartments (**Eco-social**)	□	□	□	□	□
	Mandatory solar panels on residential buildings	□	□	□	□	□
	Banning the construction of new single-family homes (**Eco-social**)	□	□	□	□	□
	Banning empty apartments (**Eco-social**)	□	□	□	□	□
2 pull policies	Subsidy on household battery systems	□	□	□	□	□
	Subsidy on household energy efficiency measures	□	□	□	□	□

- 8 three-alternative ordinal variables → Multivariate ordered probit model

Explanatory variables

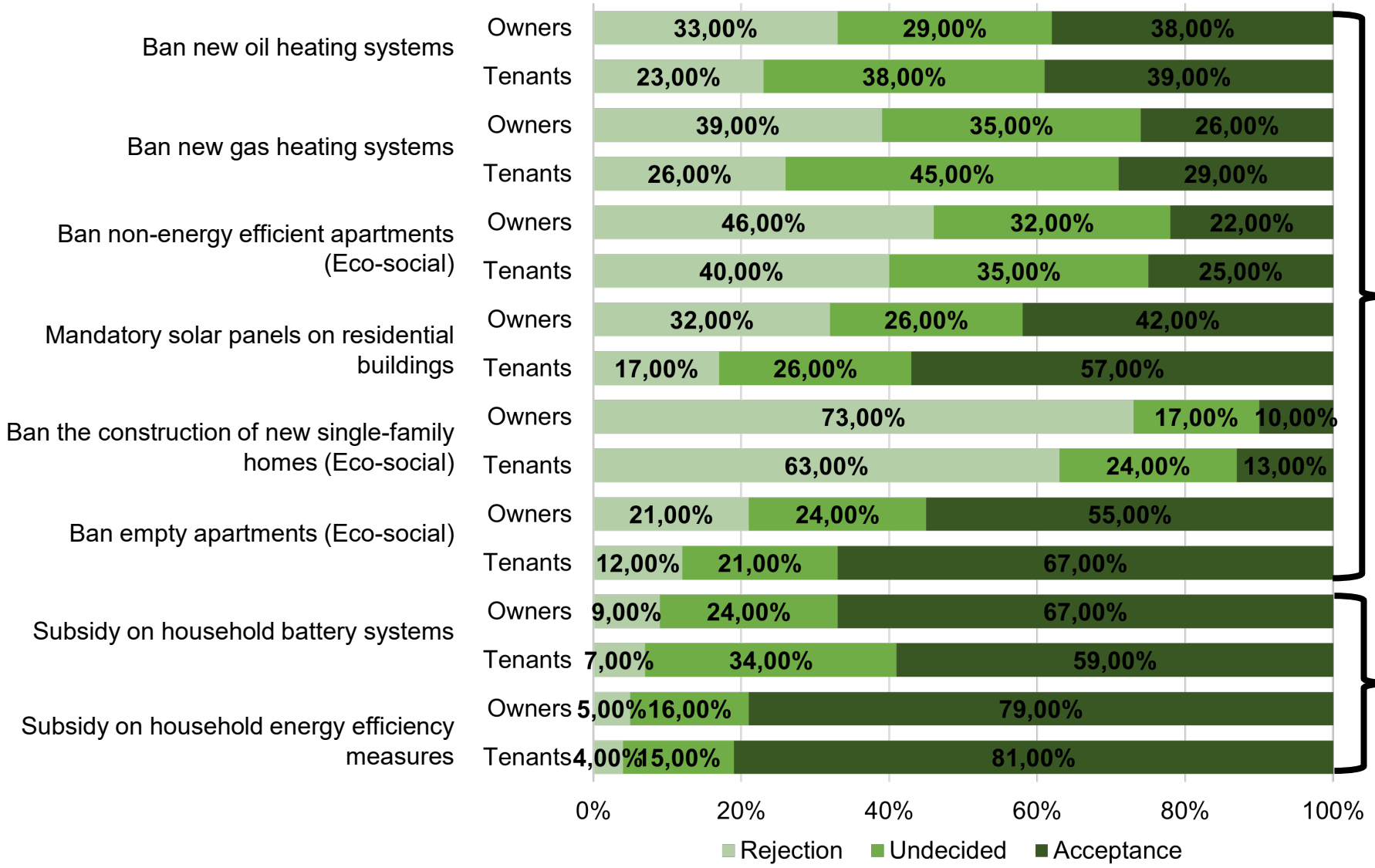
- Derived using the ABC-model (Stern 2000) and a literature review

- **Variables of interest:**
  - **Tenant** (0/1)
  - **Landlord** (0/1)
  - **Home type**
    - MFH
    - Attached SFH
    - Detached SFH

Main variables of interest	**Attitudinal factors**	**Contextual factors**	**Personal capabilities**	**Additional controls**
Tenant	Altruism	Catholic environment	Age	Member of environmental organization
Landlord	NEP score	Left-wing political environment	Gender	Eastern Germany
Home type	Climate change beliefs	Peer pressure	Education	Worrying about consequences of war in Ukraine
	Political identification	General trust	Household income	
		Trust in politics	Employment status	
			Kids	

Table 1: Explanatory variables

Results: Pull vs. push policies

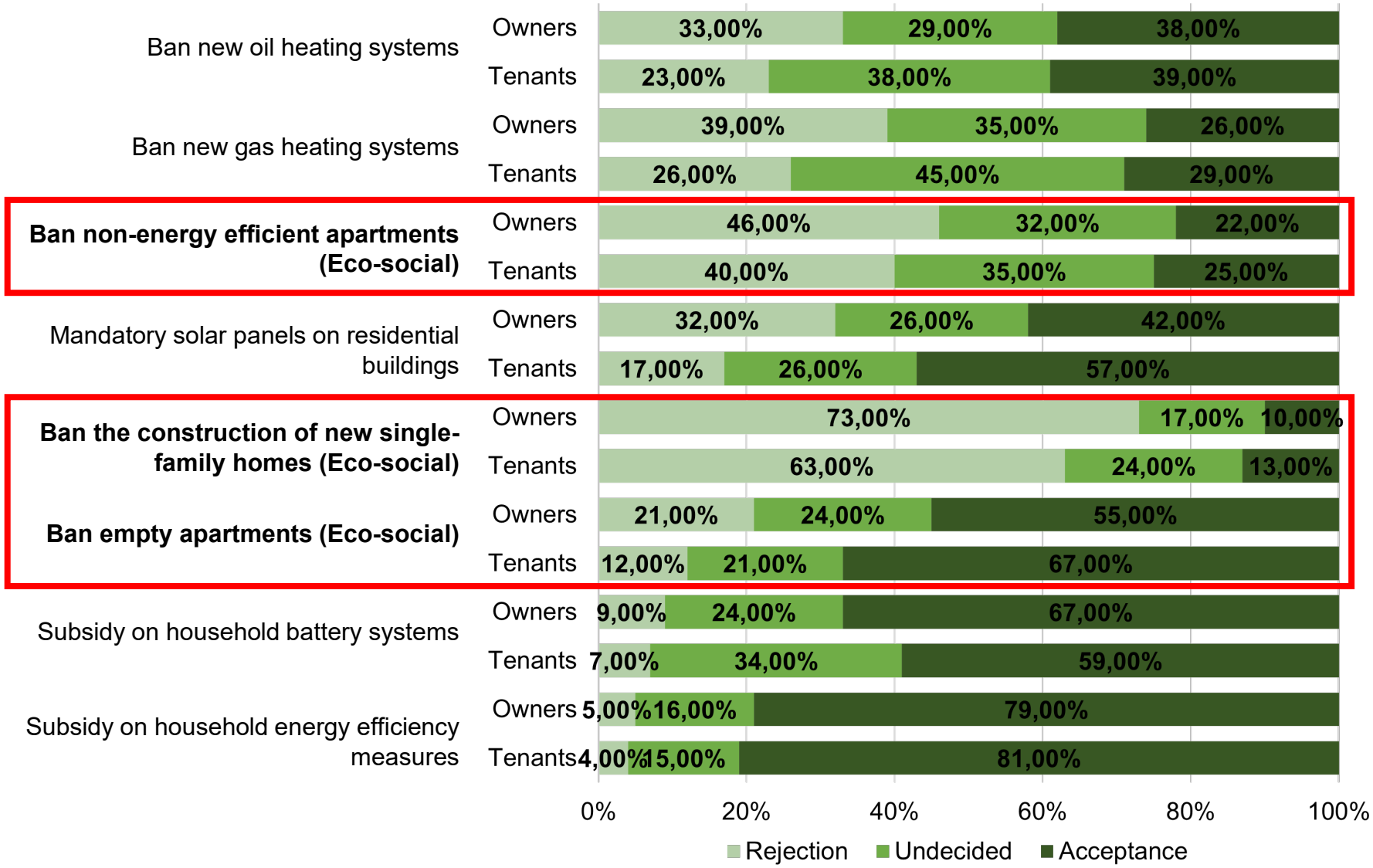


H1: Pull policies are preferred over push policies

Push policies average acceptance: **36%**

Pull policies average acceptance: **71%**

Results: Eco-social policies



H2: Tenants are more likely to accept eco-social policies than owners

Eco-social policies average acceptance:
Owners: 29%
Tenants: 35%

Results: Differences between owners and tenants

H3: Tenants are more likely to accept costly push policies than owners

- Tenants are more likely to accept almost all policies
- Largest effect: Mandatory solar panels for residential buildings (+15%)

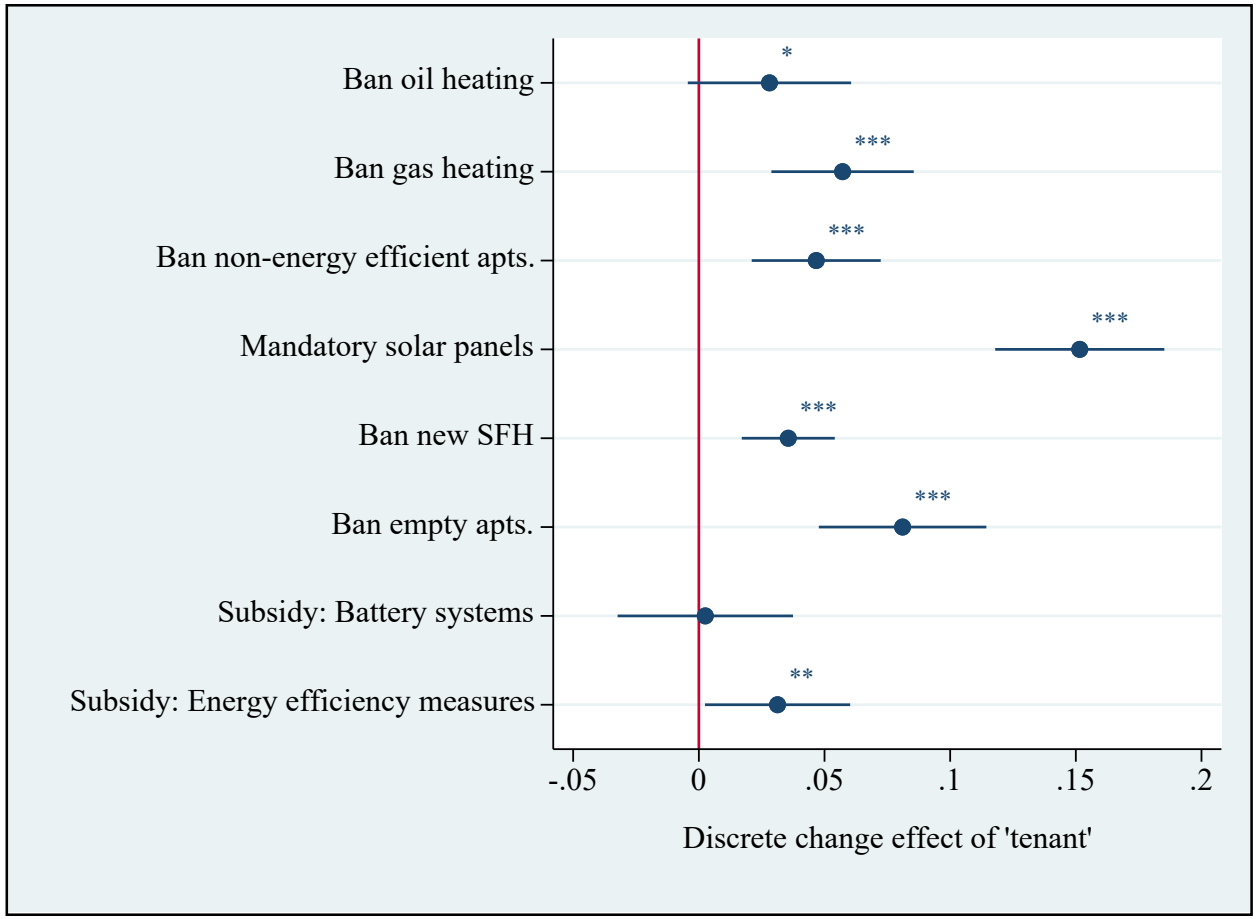


Figure 2: Estimated average discrete probability effects of „tenant“

Results: Tenants with property ownership

H4: Being a landlord makes tenants less likely to accept costly push policies

- Tenants who are landlords are less likely to accept several push policies
- The policies clearly have highly visible costs for landlords
- No comparable effects of being a landlord on owners' policy acceptance

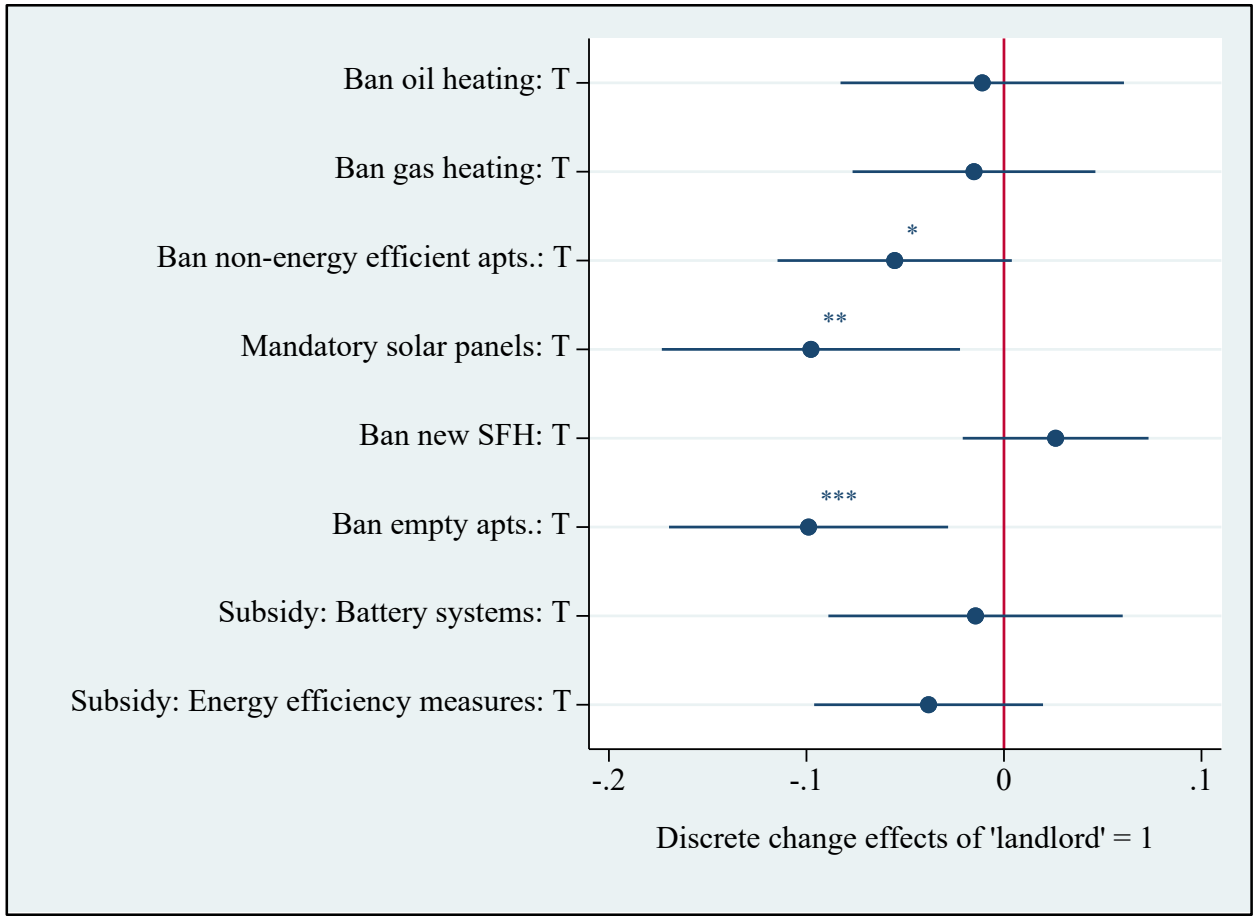


Figure 3: Estimated average discrete probability effects of „landlord" for tenants

Results: Owners in MFH and SFH

H5: Owners in MFH are more likely to accept costly push policies compared to owners in SFH

- Owners in SFH are less likely to accept push policies
- … and more likely to accept pull policies
- No comparable effects of home type on tenants' policy acceptance

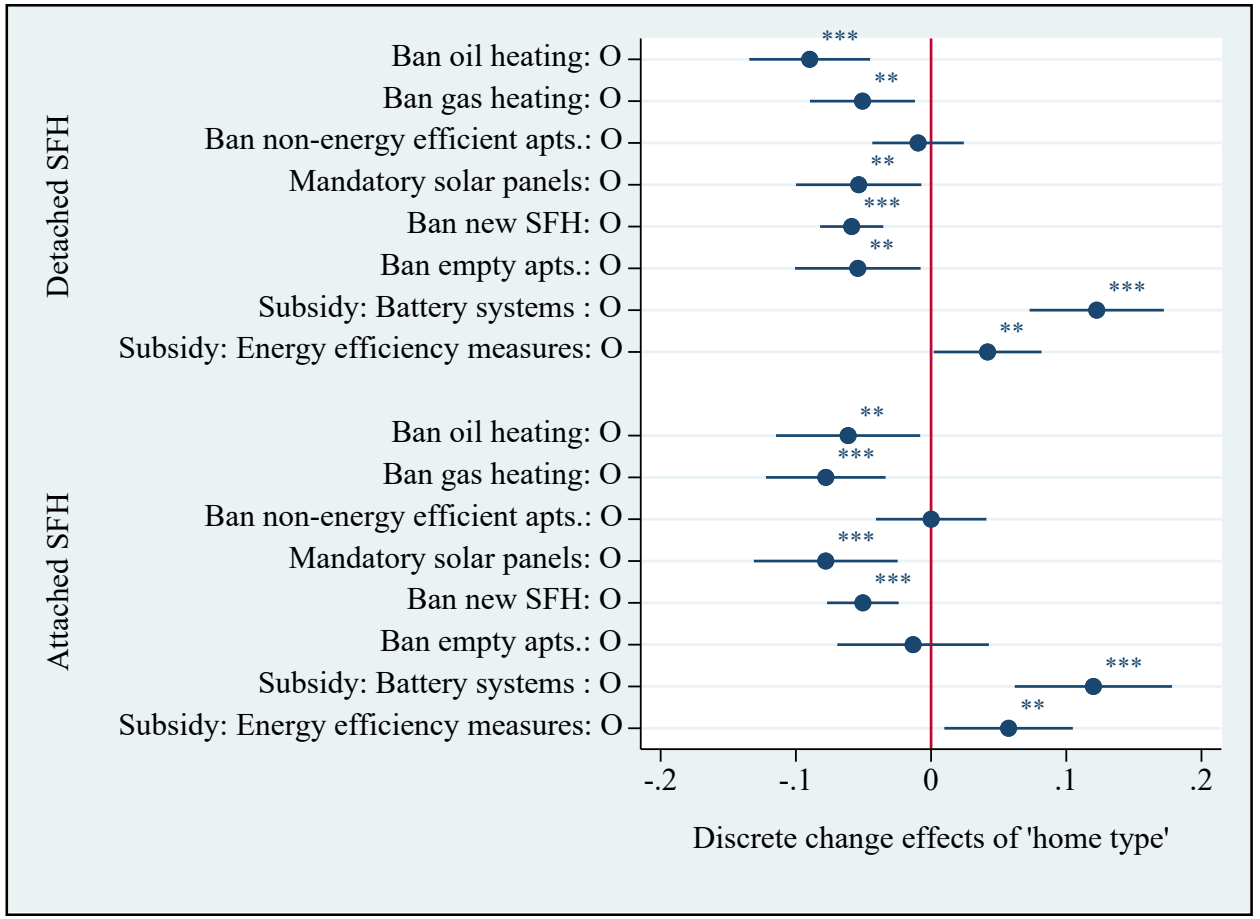


Figure 4: Estimated average discrete probability effect of „home type“ for owners

Conclusions

Findings

- We find differences in acceptance between owners and tenants
- Excluding tenants might lead to biased results regarding policy acceptance
- Self-interest seems to be a deciding factor regarding policy acceptance

Policy implications

- Existing estimates of the acceptance of solar mandates might have been severely underestimated if tenants were not included
- Push policies might be more accepted than previously believed when targeting owner-occupied multi-family homes

Thank you for your attention!

Comments and questions

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Appendix (I)

- Framework for empirical analysis
- ABC-model (Attitude-Behavior-Context theory) (Stern (2000))
- The framework is frequently used in the literature on climate-oriented policy acceptance
  (e.g., Rhodes et al. (2017), Ziegler (2019), Engler et al. (2021))

- Four types of variables that explain pro-environmental behavior
  - Attitudinal factors (Values, Beliefs, Norms)
  - Contextual factors (Context of behavior)
  - Personal capabilities (Sociodemographics)
  - Habits and routines

Appendix (II)

Table 6: Results of the multivariate multiple ordered probit regression

Variables	New oil heating ban	New gas heating ban	Ban on renting out non-energy-efficient apts.	Mandatory solar	Single-family home ban	Empty apartment ban	Battery subsidy	Energy efficiency subsidy
	Push/Eco	Push/Eco	Push/Eco-social	Push/Eco	Push/Eco-social	Push/Eco-social	Pull/Eco	Pull/Eco
Tenant	0.0248	**0.143****	**0.192*****	**0.429*****	**0.150****	**0.271*****	**0.145****	**0.259*****
	(0.38)	**(2.19)**	**(3.08)**	**(6.39)**	**(2.20)**	**(4.04)**	**(2.11)**	**(3.23)**
Attitudinal factors								
Altruism	0.0205	0.0403	**0.0740****	**0.0613***	-0.0216	**0.0933****	**0.0692***	**0.111****
	(0.58)	(1.14)	**(2.09)**	**(1.70)**	(-0.56)	**(2.47)**	**(1.84)**	**(2.53)**
NEP score	**0.0273*****	**0.0103****	**-0.00757***	**0.0209*****	**-0.0241*****	**0.0314*****	**0.0245*****	**0.0423*****
	(6.11)	**(2.31)**	**(-1.67)**	**(4.56)**	**(-4.84)**	**(6.60)**	**(5.11)**	**(7.78)**
Climate change human causation	**0.392*****	**0.223*****	**0.228*****	**0.345*****	**0.150***	**0.176****	**0.129***	**0.191****
	(5.37)	**(3.05)**	**(3.04)**	**(4.86)**	**(1.92)**	**(2.45)**	**(1.78)**	**(2.44)**
Climate change consequences	**0.119****	**0.173*****	0.00952	**0.163*****	**-0.0935***	**0.149*****	**0.117****	**0.245*****
	(2.33)	**(3.43)**	(0.18)	**(3.23)**	**(-1.72)**	**(2.84)**	**(2.24)**	**(4.20)**
Conservative	**-0.114*****	**-0.144*****	**-0.138*****	**-0.124*****	-0.0392	**-0.152*****	-0.0254	-0.0269
	(-2.67)	**(-3.38)**	**(-3.37)**	**(-2.90)**	(-0.85)	**(-3.47)**	(-0.57)	(-0.52)
Liberal	-0.0163	-0.0339	**-0.0985*****	**-0.0893****	-0.0273	**-0.0837****	0.0504	-0.0374
	(-0.43)	(-0.91)	**(-2.62)**	**(-2.32)**	(-0.67)	**(-2.08)**	(1.24)	(-0.78)
Social	**0.0790****	0.0360	0.00116	**0.0827****	-0.0367	**0.209*****	**0.118*****	**0.326*****
	(2.15)	(1.00)	(0.03)	**(2.20)**	(-0.90)	**(5.33)**	**(3.01)**	**(7.02)**
Ecological	**0.477*****	**0.418*****	**0.269*****	**0.476*****	**0.271*****	**0.215*****	**0.228*****	**0.168*****
	(11.95)	**(10.76)**	**(6.86)**	**(11.58)**	**(6.37)**	**(5.05)**	**(5.28)**	**(3.17)**

Appendix (III)

Table 6 continued [2/3]

Contextual factors								
Catholic environment	0.0171	-0.00176	0.0387	**-0.115****	0.0348	-0.0486	-0.0374	0.0122
	(0.36)	(-0.04)	(0.82)	**(-2.32)**	(0.68)	(-0.94)	(-0.74)	(0.20)
Frequency left-wing parties	**0.00950*****	**0.00538***	0.00442	-0.00422	0.00562	**0.00747****	-0.00531	-0.00185
	(2.95)	**(1.70)**	(1.38)	(-1.27)	(1.64)	**(2.21)**	(-1.54)	(-0.45)
Peer pressure	**0.133*****	**0.235*****	**0.333*****	**0.173*****	**0.188*****	**0.165*****	**0.229*****	**0.169*****
	(3.31)	**(5.99)**	**(8.48)**	**(4.18)**	**(4.41)**	**(3.72)**	**(5.25)**	**(3.11)**
General trust	0.00438	-0.0298	**-0.0981*****	0.00655	**-0.0929*****	0.0218	**0.0549*****	**0.0503****
	(0.23)	(-1.59)	**(-5.22)**	(0.33)	**(-4.42)**	(1.04)	**(2.67)**	**(2.03)**
Trust in politics	**0.279*****	**0.350*****	**0.232*****	**0.220*****	**0.165*****	**0.174*****	0.0608	0.112
	(4.93)	**(6.21)**	**(4.32)**	**(3.74)**	**(2.89)**	**(2.88)**	(1.03)	(1.57)
Dwelling type (Reference: Multi-family home)								
Detached single-family home	**-0.262*****	**-0.171*****	-0.0351	**-0.151****	**-0.381*****	**-0.150****	**0.342*****	**0.162****
	(-4.00)	**(-2.63)**	(-0.56)	**(-2.28)**	**(-5.51)**	**(-2.27)**	**(4.89)**	**(2.10)**
Attached single-family home	**-0.177****	**-0.271*****	0.000201	**-0.221*****	**-0.314*****	-0.0370	**0.334*****	**0.227****
	(-2.25)	**(-3.45)**	(0.00)	**(-2.87)**	**(-3.77)**	(-0.47)	**(4.01)**	**(2.35)**
Tenant X dwelling type (Reference: Multi-family home)								
Detached single-family home	0.108	0.0517	-0.0325	0.112	0.0935	-0.0873	**-0.316*****	-0.178
	(1.19)	(0.58)	(-0.36)	(1.20)	(0.95)	(-0.92)	**(-3.32)**	(-1.57)
Attached single-family home	0.106	**0.221****	0.0977	0.148	0.145	0.143	**-0.285****	**-0.272****
	(1.01)	**(2.11)**	(0.94)	(1.39)	(1.28)	(1.26)	**(-2.50)**	**(-2.03)**

Appendix (IV)

Table 6 continued [3/3]

Personal capabilities								
Age	**-0.00268****	**-0.00434*****	**-0.00286****	-0.000272	**-0.00400*****	**0.00827*****	-0.000789	**0.00512*****
	(-2.26)	**(-3.67)**	**(-2.44)**	(-0.22)	**(-3.10)**	**(6.48)**	(-0.63)	**(3.46)**
Female	**-0.152*****	-0.0270	-0.0122	**-0.157*****	-0.0128	**-0.0817****	**-0.210*****	0.00328
	(-4.49)	(-0.81)	(-0.37)	**(-4.51)**	(-0.35)	**(-2.24)**	**(-5.84)**	(0.08)
High education	0.0104	0.0135	**-0.114*****	-0.0483	0.0130	-0.0349	**-0.107*****	-0.0424
	(0.29)	(0.37)	**(-3.15)**	(-1.28)	(0.33)	(-0.90)	**(-2.76)**	(-0.91)
Equivalized household income (1,000€)	0.0246	-0.0000712	0.0165	**0.0414****	0.00187	0.00923	0.0296	0.00597
	(1.44)	(-0.00)	(0.95)	**(2.31)**	(0.10)	(0.51)	(1.49)	(0.29)
Unemployed	**0.163***	**0.180****	0.0584	0.0436	0.152	0.0434	0.130	0.0146
	(1.78)	**(2.16)**	(0.67)	(0.51)	(1.63)	(0.44)	(1.39)	(0.14)
Kids	**0.173*****	**0.0990****	**0.120****	**0.302*****	**0.267*****	**0.167*****	**0.158*****	**0.101***
	(3.58)	**(2.04)**	**(2.45)**	**(6.19)**	**(5.28)**	**(3.29)**	**(3.06)**	**(1.72)**
Further control variables								
Environmental org.	**0.176*****	0.0992	**0.165*****	**0.189*****	**0.249*****	**0.175****	-0.00379	-0.0593
	(2.74)	(1.57)	**(2.62)**	**(2.86)**	**(3.79)**	**(2.57)**	(-0.06)	(-0.73)
Eastern Germany	**-0.125****	**-0.102***	0.0682	**-0.186*****	0.0489	-0.0380	0.0221	0.0464
	(-2.09)	**(-1.73)**	(1.15)	**(-3.05)**	(0.75)	(-0.60)	(0.34)	(0.59)
Ukraine - Economic downturn	0.0103	-0.0306	-0.0363	0.0708	**-0.148*****	0.0266	**0.165*****	**0.300*****
	(0.21)	(-0.63)	(-0.74)	(1.42)	**(-2.86)**	(0.52)	**(3.18)**	**(5.04)**
Ukraine - Energy prices	-0.0341	**-0.110***	**-0.0942***	0.0315	**-0.288*****	**0.217*****	**0.266*****	**0.420*****
	(-0.60)	**(-1.93)**	**(-1.71)**	(0.56)	**(-4.82)**	**(3.75)**	**(4.48)**	**(6.25)**
Landlord	-0.0718	-0.0216	-0.00864	0.0276	**0.111***	**-0.142*****	-0.0233	0.0169
	(-1.36)	(-0.41)	(-0.17)	(0.53)	**(1.93)**	**(-2.71)**	(-0.41)	(0.26)
Tenant X Landlord	0.0405	-0.0251	-0.177	**-0.298****	0.0143	-0.143	-0.0164	-0.174
	(0.35)	(-0.23)	(-1.49)	**(-2.53)**	(0.12)	(-1.26)	(-0.14)	(-1.32)
Observations	5150	5150	5150	5150	5150	5150	5150	5150

Robust z statistics in parentheses. Statistically significant effects in bold.
** p<0.10, ** p<0.05, *** p<0.01*

Appendix (V)

- Robustness checks that were conducted

- Different coding of the dependent variables
  - Ordered probit with original 5-point variables
  - Binary probit with middle category added to „Rejection“
  - Linear regression

- Analysis of the marginal effects on y = „Rejection“ and y = „Neither agree nor disagree“

- Other explanatory variables (Haverkamp et al. (2022); Ziegler (2021); Albanese et al. (2017))
  - Economic preferences (risk, patience)
  - Negative and positive reciprocity
  - Subjective well-being

Appendix (VII) Differences between owners and tenants (I)

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H3: Owners are less likely to accept push policies that require structural changes to their buildings compared to tenants.

- Tenants are more likely to accept almost all policies
- Largest effect: Mandatory solar panels for residential buildings (+15 pp.)

Policy	Discrete Change Effect of „tenant“
Banning new oil heating systems	0.0281* (1.70)
Banning new gas heating systems	0.0572*** (3.96)
Banning renting out apartments with low energy efficiency rating	0.0467*** (3.57)
Mandatory solar panels on residential buildings	0.152*** (8.83)
Banning the construction of new single-family homes	0.0356*** (3.77)
Banning empty apartments	0.0811*** (4.77)
Subsidy on household battery systems	0.00257 (0.14)
Subsidy on household energy efficiency measures	0.0313** (2.13)

Table 5: Discrete effects of „tenant“ = 1 on the probability of choosing „Acceptance“ (y = 3)

Appendix (VIII) Differences between owners and tenants (II)

H4: Tenants who are landlords are less likely to accept push policies that require structural changes to their buildings compared to tenants who are not landlords.

- Tenant-landlords are less likely to accept policies that target building decision makers
- No comparable effects for owners

Policy	Discrete Change Effect of „landlord“ for tenants
Banning new oil heating systems	-0.0110 (-0.30)
Banning new gas heating systems	-0.0152 (-0.48)
Banning renting out apartments with low energy efficiency rating	-0.0553* (-1.83)
Mandatory solar panels on residential buildings	-0.0977** (-2.54)
Banning the construction of new single-family homes	0.0262 (1.09)
Banning empty apartments	-0.0989*** (-2.74)
Subsidy on household battery systems	-0.0144 (-0.38)
Subsidy on household energy efficiency measures	-0.0382 (-1.29)

Table 6: Discrete effects of „landlord“ = 1 on the probability of choosing „Acceptance“ (y = 3) for tenants

Appendix (IX) Differences between owners and tenants (III)

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H5: Owners who live in single-family homes are less likely to accept push policies that require structural changes to their buildings compared to owners living in single-family homes.

- Owners in single-family homes are less likely to accept most push-policies
- Owners in multi-family homes are less likely to accept subsidies
- No comparable effects for tenants

Policy	Discrete Change Effect of „home type“ = Detached SFH	Discrete Change Effect of „home type“ = Attached SFH
Banning new oil heating systems	-0.0898*** (-3.94)	-0.0614** (-2.26)
Banning new gas heating systems	-0.0508** (-2.56)	-0.0779*** (-3.45)
Banning renting out apartments with low energy efficiency rating	-0.00962 (-0.56)	0.0000560 (0.00)
Mandatory solar panels on residential buildings	-0.0536** (-2.26)	-0.0779*** (-2.87)
Banning the construction of new single-family homes	-0.0587*** (-4.93)	-0.0505*** (-3.73)
Banning empty apartments	-0.0542** (-2.29)	-0.0133 (-0.47)
Subsidy on household battery systems	0.122*** (4.84)	0.120*** (4.04)
Subsidy on household energy efficiency measures	0.0418** (2.05)	0.0573** (2.36)

Table 7: Discrete effects of „home type“ = 2 and „home type“ = 3 on the probability of choosing „Acceptance“ (y = 3) for owners

Appendix (X) Limitations

- The study design allows to identify correlations but not causal effects
- Survey studies face challenges such as ensuring that concepts expressed in the survey are properly understood by the respondents

Appendix (XI) Sample structure

Variable	Mean	Min	Max
Tenant	.58	0	1
Altruism	.645	0	1
NEP score	24.272	6	30
Risk taking	.264	0	1
Patience	.539	0	1
Climate change human causation	.921	0	1
Climate change consequences	.819	0	1
Conservative	.231	0	1
Liberal	.316	0	1
Social	.586	0	1
Ecological	.38	0	1
Catholic environment	.519	0	1
Frequency left-wing parties	45.819	34.9	61.3

Variable	Mean	Min	Max
Peer pressure	.254	0	1
General trust	.818	0	3
Trust in politics	.116	0	1
Home type	2.24	1	3
Age	52.712	18	91
Female	.5	0	1
High education	.369	0	1
Equivalized household income	1.895	.033	12.752
Unemployed	.033	0	1
Kids	.157	0	1
Environmental org.	.077	0	1
Eastern Germany	.178	0	1
Ukraine - Economic downturn	.837	0	1
Ukraine - Energy prices	.892	0	1
Landlord	.216	0	1
Number of observations	**5150**	**-**	**-**