Housing and Income Inequality

A Decomposition Analysis of non-cash Income from Imputed Rents

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Outline

Motivation

Motivation

- Research question
  - How are imputed rents distributed in European countries (participating in the HFCS) and what are the distributional effects of including them to the household income?
- Relevance
  - Generate comparable estimations of imputed rents in European countries
  - Include non-cash income in the analysis of income inequality
  - Analyse distributional issues against the background of institutional cross-country differences of housing markets

Literature

- Imputed rents are distributed more equally than monetary income[1]
- Choice of approach effects imputed rents and their cross-national comparability [2]
  - Capital market approach
  - Rental equivalent approach
  - Self-assessment approach
- Imputed rental income of owner-occupiers is exempted from tax in most European countries[3]
- Homeownership bias could be reduced by adding the net imputed rent to the taxable income[4]

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[1] Smeeding, Saunders, Coder, Jenkins, Fritzell, Hagenaars, Hauser, and Wolfson (1993); Garner and Verbrugge (2009); Yates (1994); Frick, Grabka, Smeeding, and Tsakloglou (2010); Garner and Short (2009); Törmälehto and Sauli (2010)

[2] Frick, Grabka, Smeeding, and Tsakloglou (2010); Saunders, Smeeding, Coder, Jenkins, Fritzell, Hagenaars, Hauser, Wolfson, et al. (1992); Kiel and Zabel (1999)

[3] Figari, Paulus, Sutherland, Tsakloglou, Verbist, and Zantomio (2017); Balcazar, Ceriani, Olivieri, and Ranzani (2014)

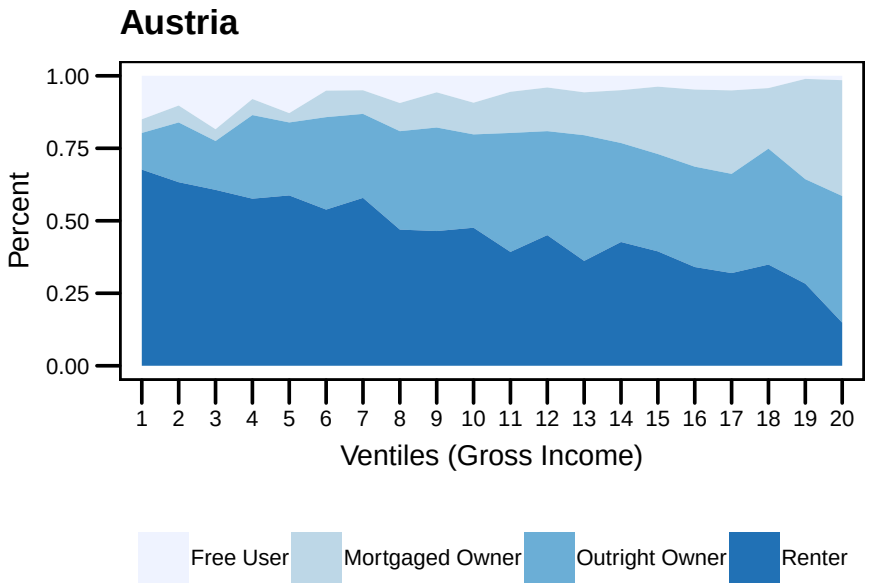
[4] Figari, Paulus, Sutherland, Tsakloglou, Verbist, and Zantomio (2017)

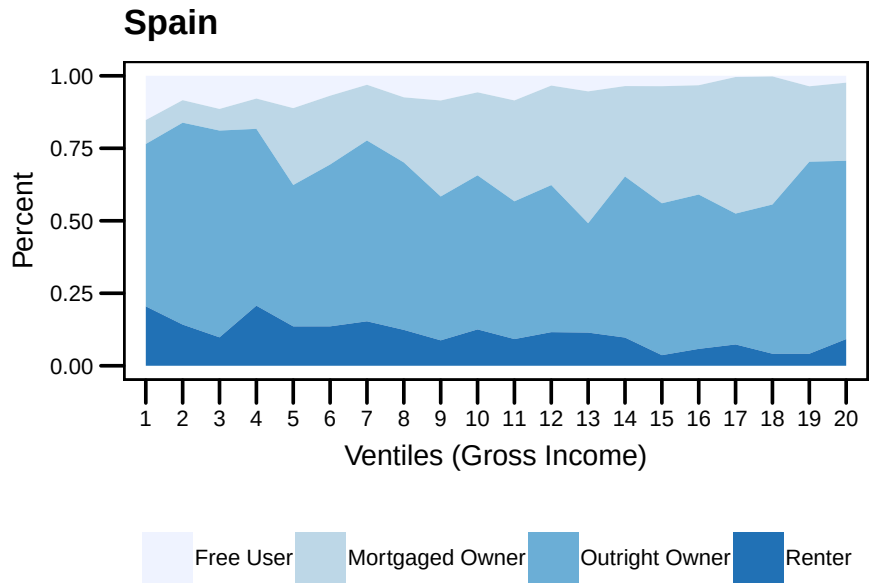
Data

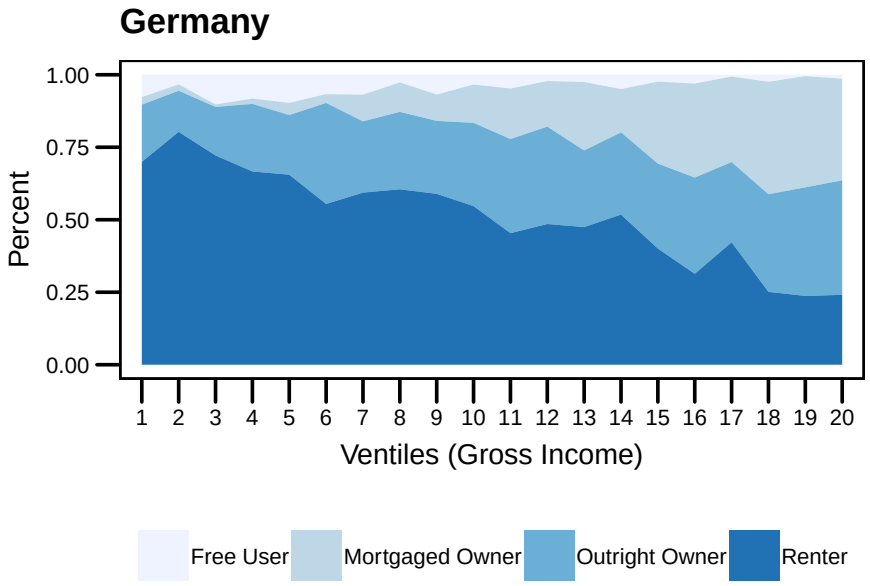
Data Sources

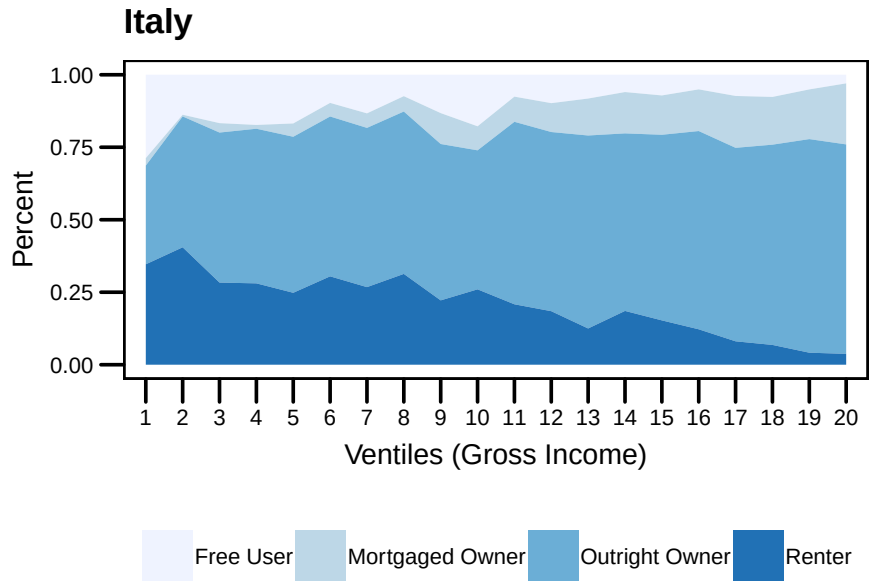
- HFCS 2010 & 2014
- SILC (For tax simulations)
- OECD National Accounts data (Maintenance/upkeep costs)

Tenure Status









Estimation Strategy

Imputed rents

Every houshold i is categorized into four groups by tenure status:

$t_i = 1$ for *Free Users*
$t_i = 2$ for *Mortgaged Owner*
$t_i = 3$ for *Outright Owner*
$t_i = 4$ for *Renter*

Furthermore, we define the following characteristics for every household main residence (HMR) i:

V_i = HMR Market value
M_i = HMR Outstanding mortgage
sqm_i = HMR size in square meter
mtc^c = Maintenance costs per sqm

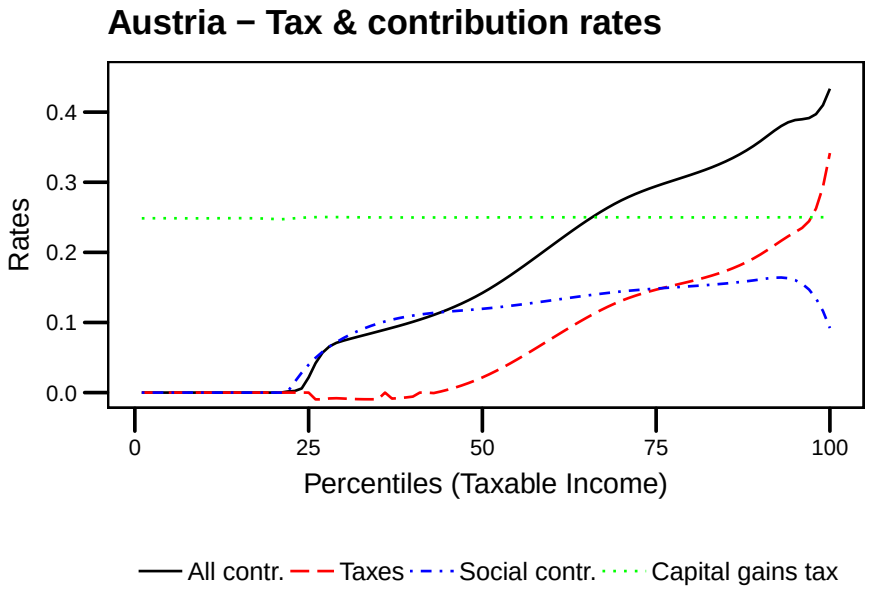
Then the HMR net value V_i^{net} is defined by

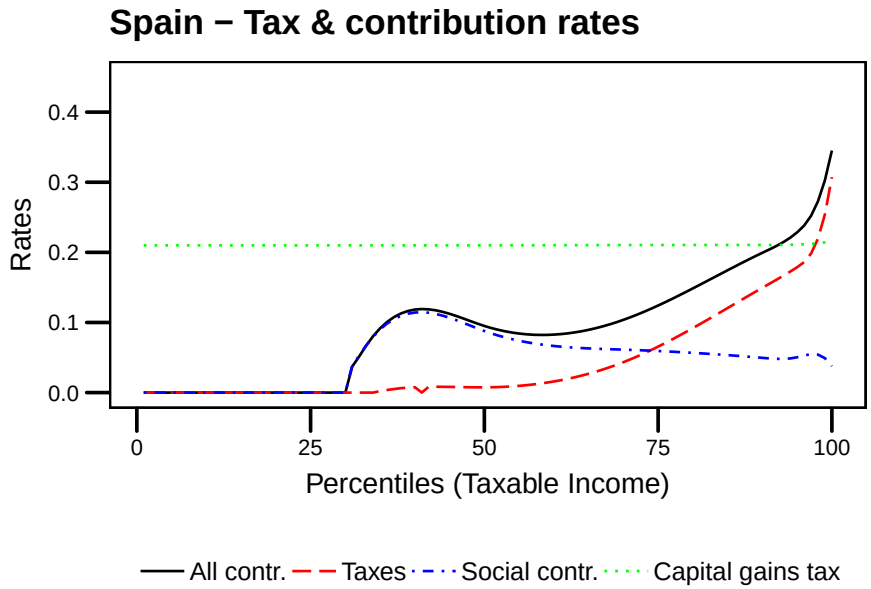
$$V_i^{net} = V_i - M_i \qquad \forall \ t_i = 1, 2, 3$$

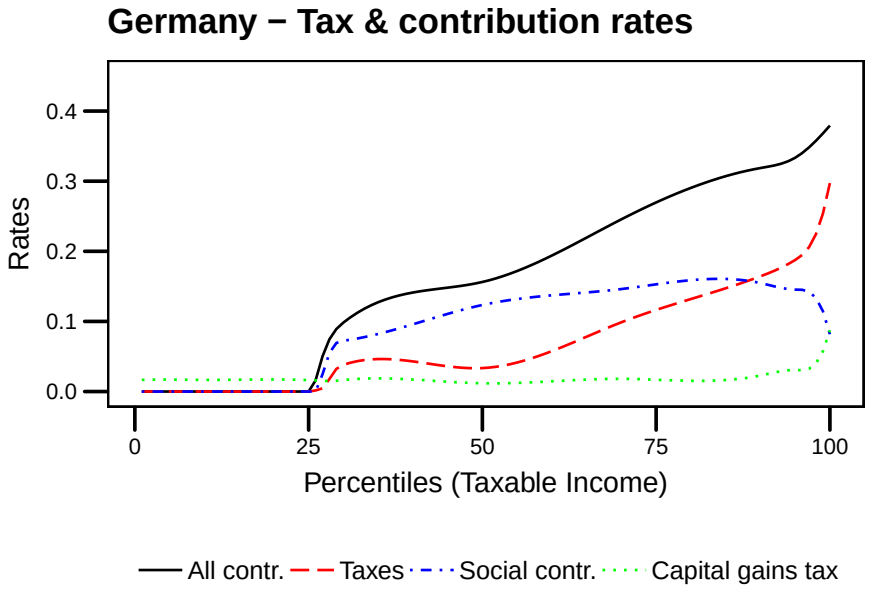
y_i = original gross/net disposable income
y_i^{nc} = net non-cash income from imputed rents
y_i^t = total gross/net income
r = exogenous interest rate

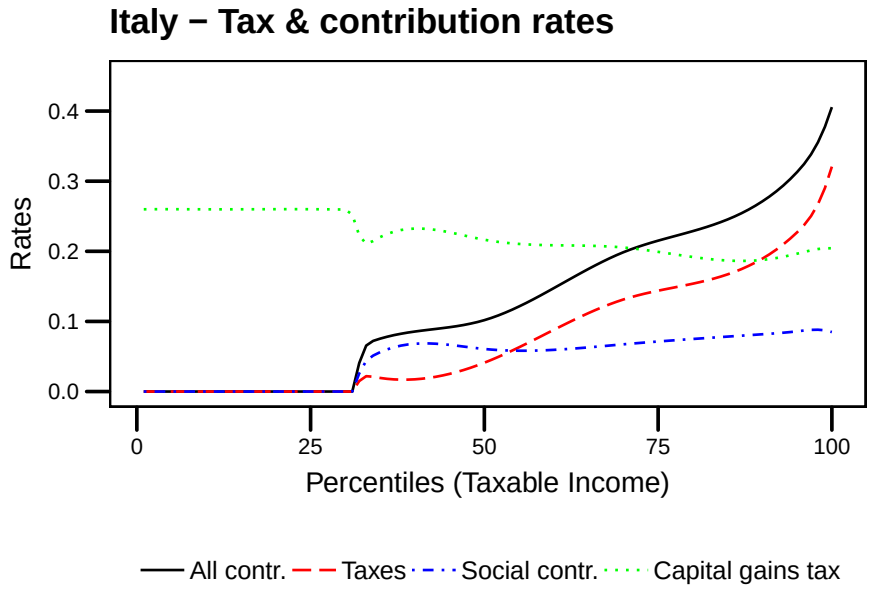
$$y_i^{nc} = V_i^{net} \times r - mtc^c \times sqm_i \qquad \forall \ t_i = 1, 2, 3$$
$$y_i^{nc} = 0 \qquad \forall \ t_i = 4$$
$$y_i^t = y_i + y_i^{nc}$$

Simulation of Net Incomes









Distributional Effects of Imputed Rents

Monetary and non-cash Income

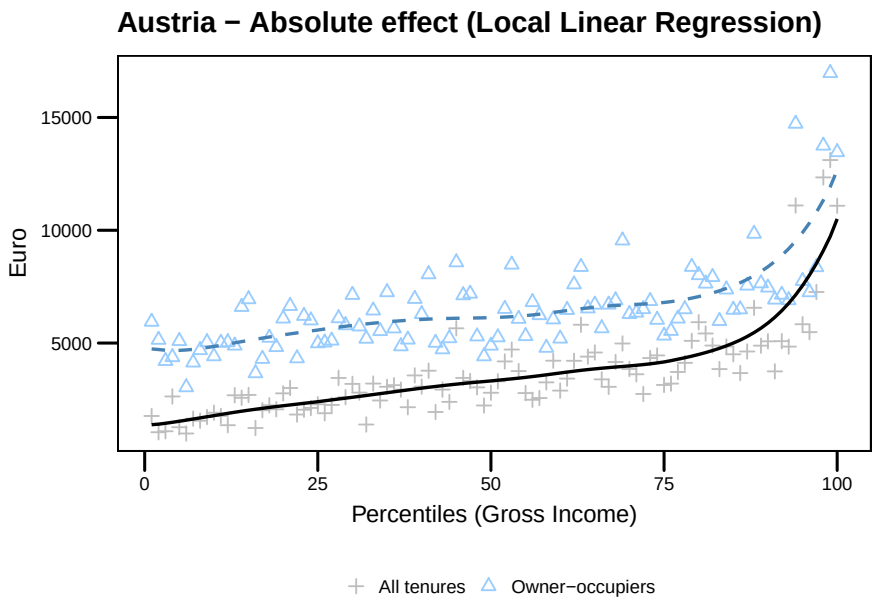
Table: Austria - Gross and net income in 1.000 €

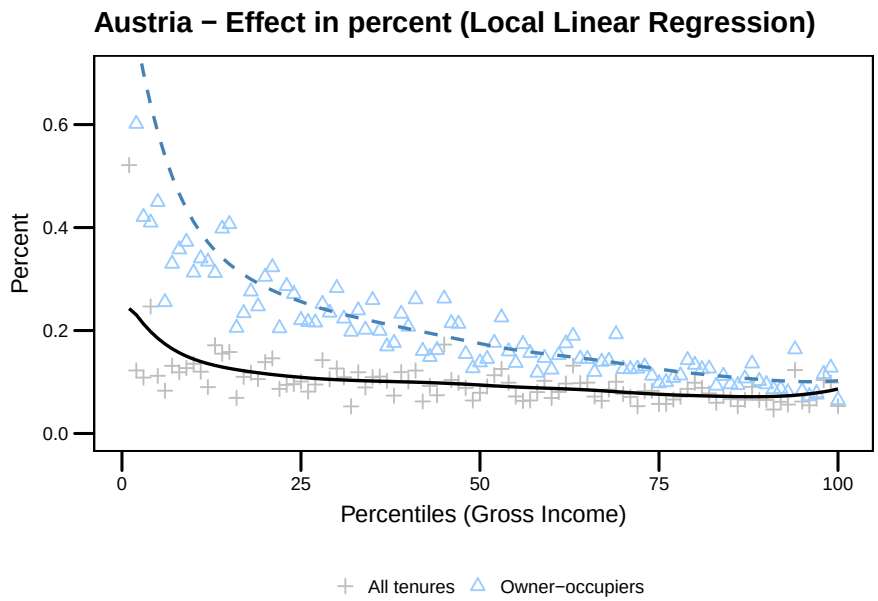
Gross income	Observed income (y_i)		+ Non-cash income (y_i^{nc})		= Total income (y_i^t)		Diff. ∅ values	Household members	
	mean	median	mean	median	mean	median	change in %	above 16y	in employment
Free User	30.6	25.2	6.2	5.5	36.8	31.3	20.3	1.6	0.4
Mortgaged Owner	60.5	54.4	5.3	4.3	65.8	58.2	8.8	2.3	1.6
Outright Owner	49.1	40.2	7.5	5.8	56.6	46.6	15.2	2.1	0.9
Renter	35.3	29.9	0.0	0.0	35.3	29.9	0.0	1.5	0.9
Total	43.3	35.7	3.7	1.7	47.0	39.3	8.4	1.8	1.0

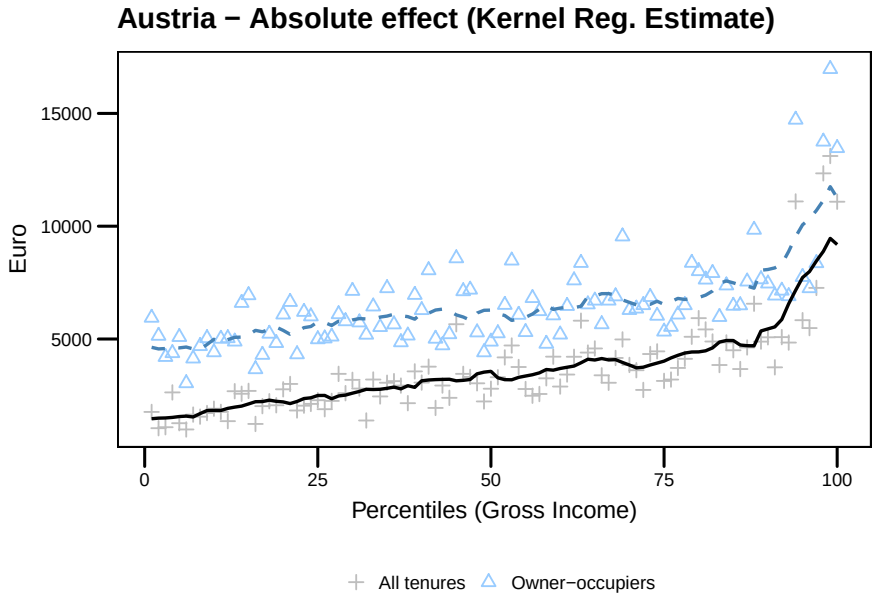
Net income	Observed income (y_i)		+ Non-cash income (y_i^{nc})		= Total income (y_i^t)		Diff. ∅ values	Household members	
	mean	median	mean	median	mean	median	change in %	above 16y	in employment
Free User	23.4	20.0	6.2	5.5	29.6	26.1	26.5	1.6	0.4
Mortgaged Owner	43.3	40.2	5.3	4.3	48.6	45.2	12.3	2.3	1.6
Outright Owner	35.8	30.8	7.5	5.8	43.2	37.3	20.9	2.1	0.9
Renter	26.4	22.8	0	0	26.4	22.8	0	1.5	0.9
Total	31.8	27.3	3.7	1.7	35.5	30.9	11.5	1.8	1.0

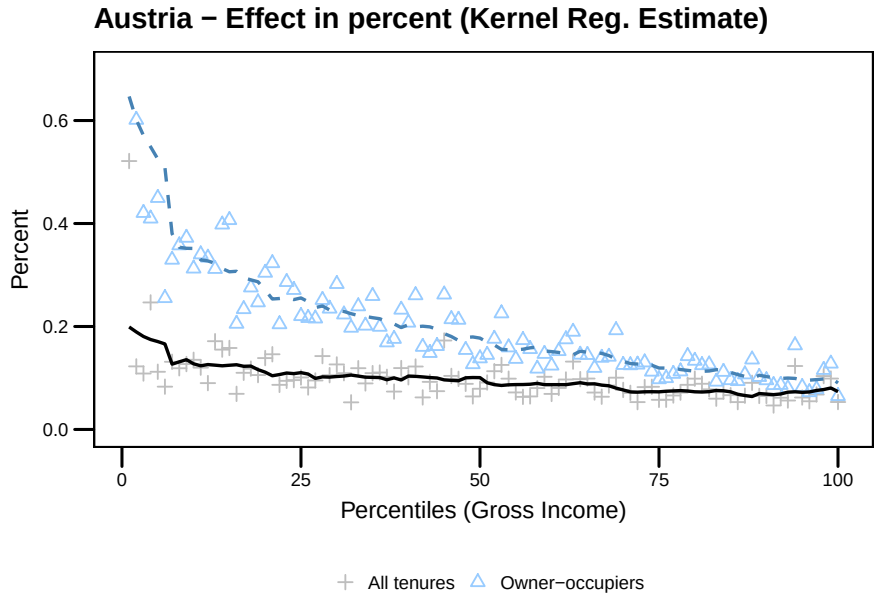
Source: HFCS 2014, net income from EUROMOD simulations. Change in % refers to the percentage change for the average values in terms of the original observed income.

Distribution of Imputed Rents

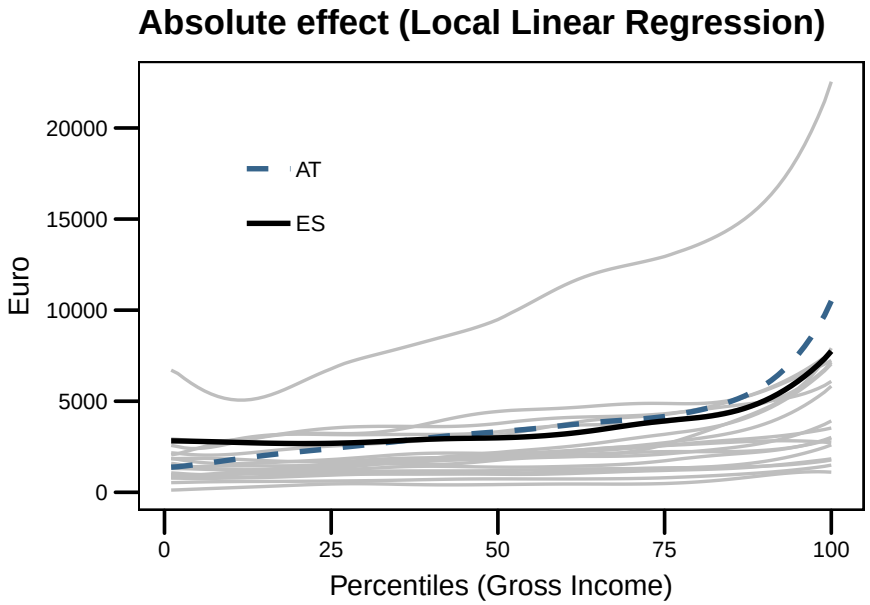


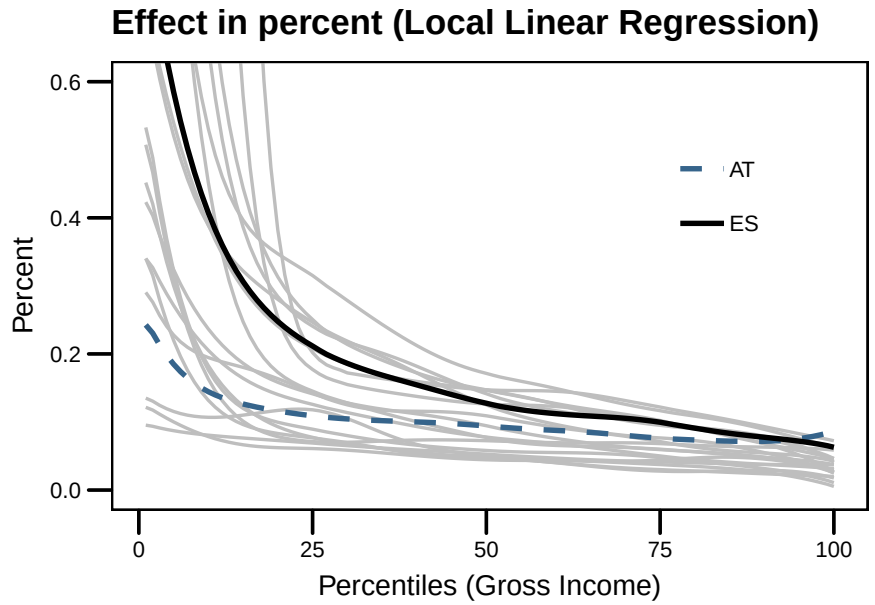


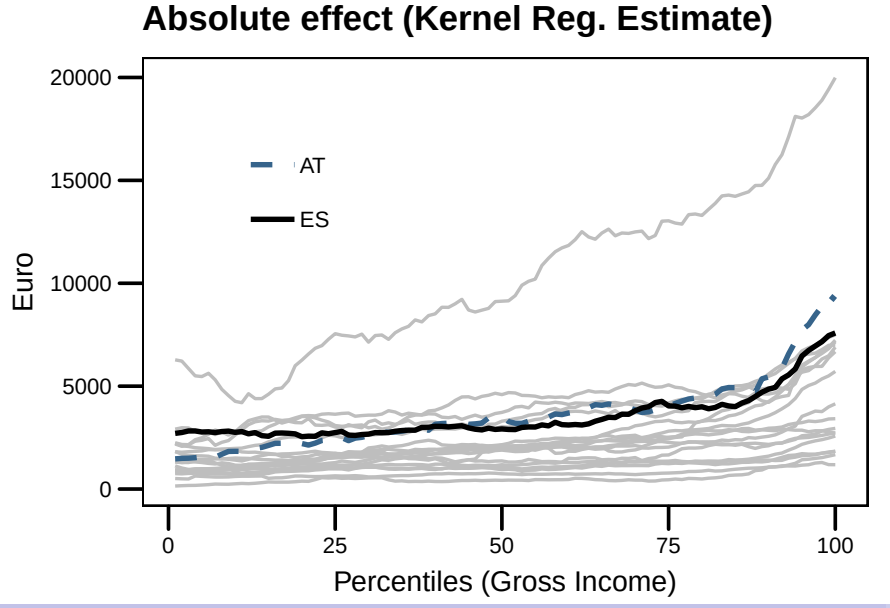


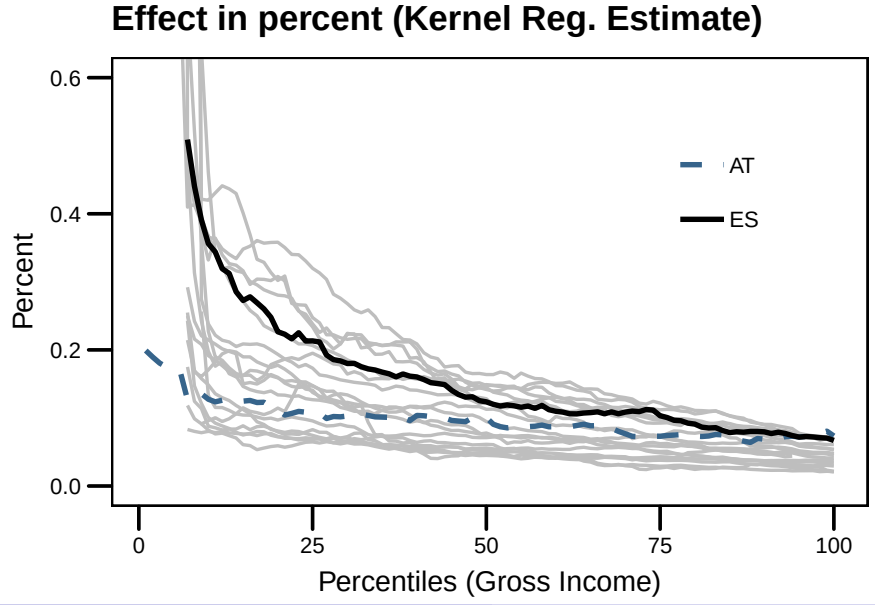


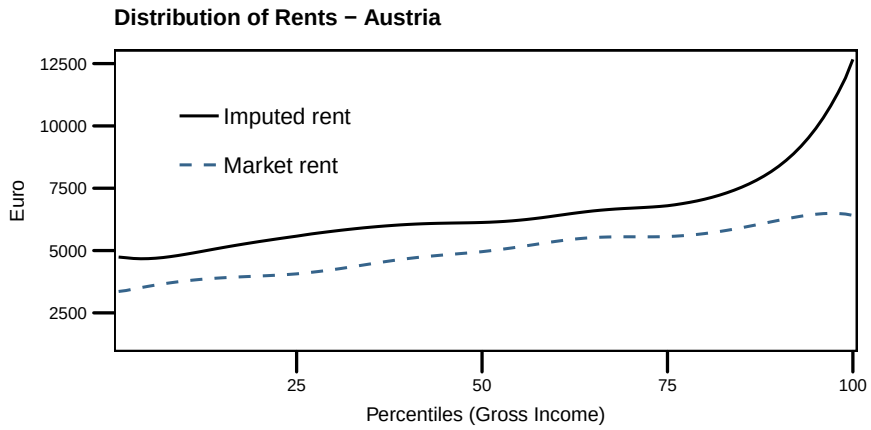
Distribution of Imputed Rents

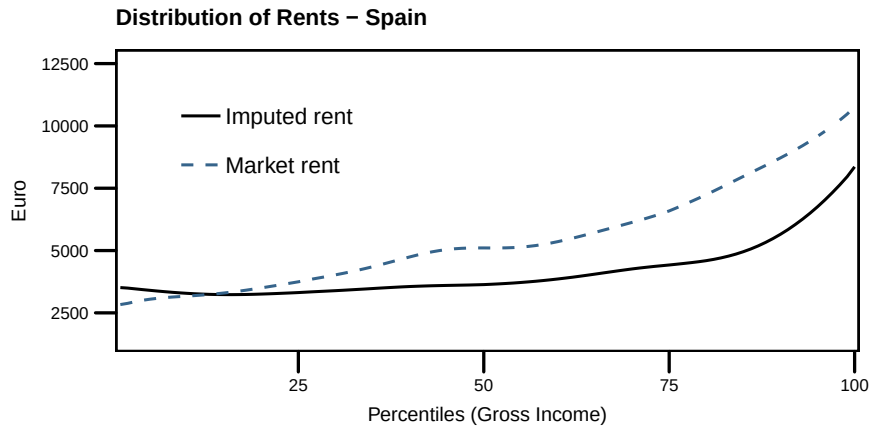


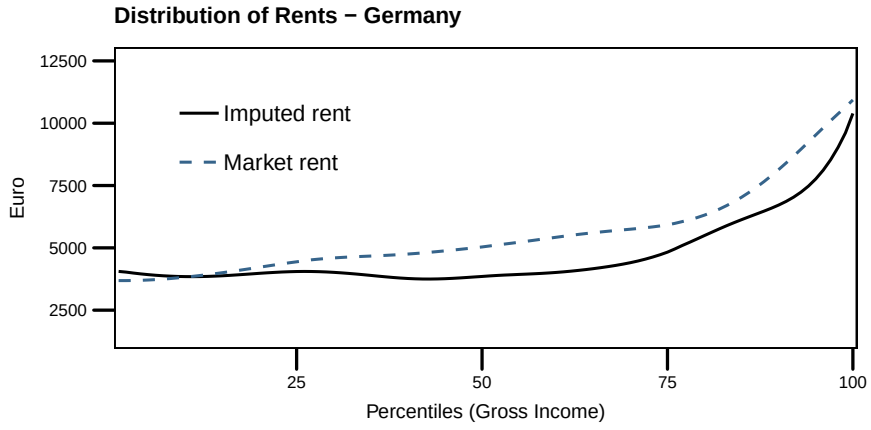


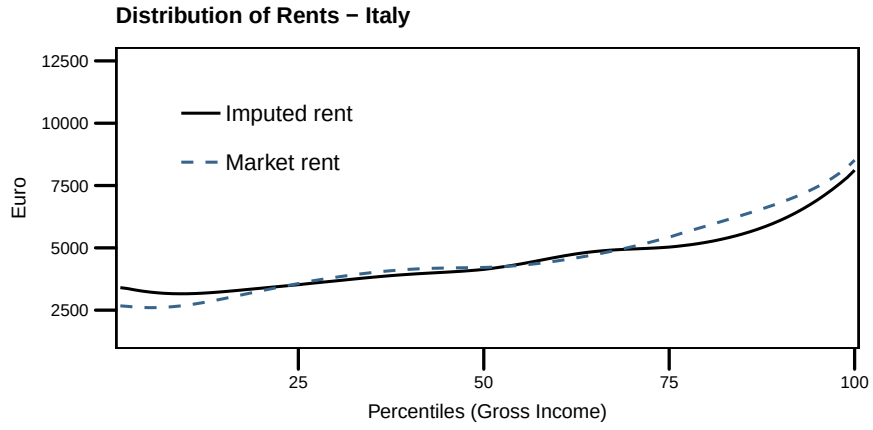


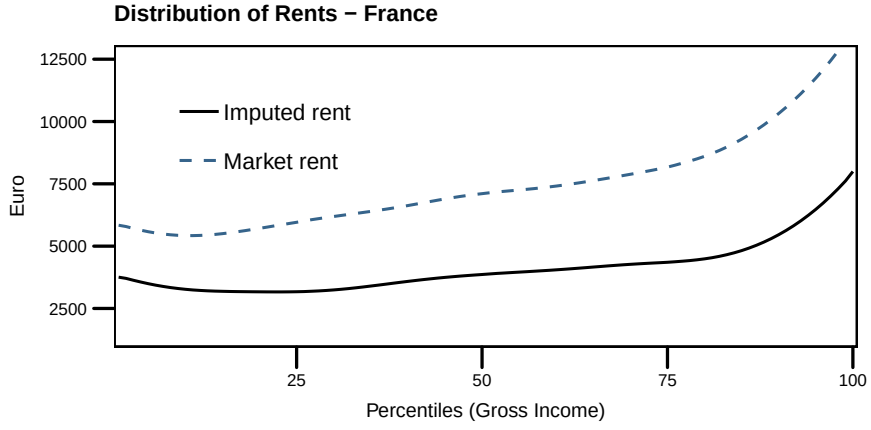


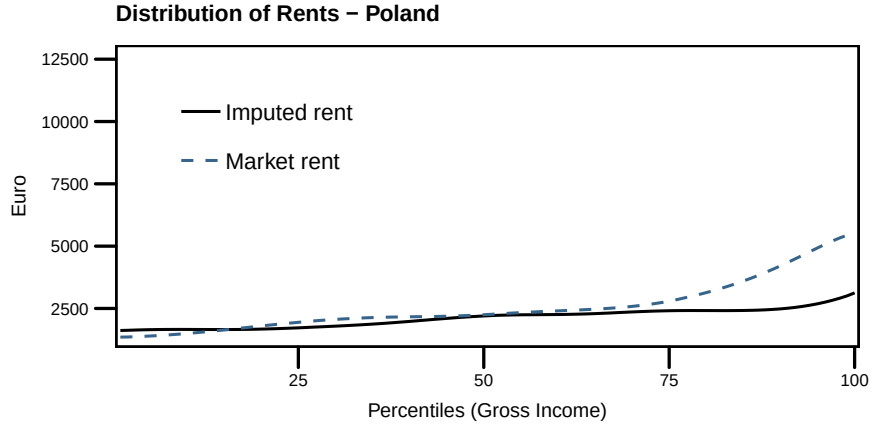

Distribution of Rents − Austria
Imputed rent
Market rent
Euro
12500
10000
7500
5000
2500
25
50
75
100
Percentiles (Gross Income)


Distribution of Rents − Spain
Imputed rent
Market rent
Euro
12500
10000
7500
5000
2500
25
50
75
100
Percentiles (Gross Income)


Distribution of Rents − Germany
Imputed rent
Market rent
Euro
12500
10000
7500
5000
2500
25
50
75
100
Percentiles (Gross Income)


Distribution of Rents − Italy
Imputed rent
Market rent
Euro
12500
10000
7500
5000
2500
25
50
75
100
Percentiles (Gross Income)


Distribution of Rents − France
Imputed rent
Market rent
Euro
12500
10000
7500
5000
2500
25
50
75
100
Percentiles (Gross Income)


Distribution of Rents − Poland
Imputed rent
Market rent
Euro
12500
10000
7500
5000
2500
25
50
75
100
Percentiles (Gross Income)

Effects on the unconditional Distribution

	Observed net income (y_i)			+ Non-cash income (y_i^{nc})			= Total net income (y_i^t)		
	Gini	P90/P50	P90/P10	Gini	P90/P50	P90/P10	Gini	P90/P50	P90/P10
AT	0.31	2.02	4.42	0.52	1.56	Inf	0.31	1.97	4.32
BE	0.35	2.16	5.05	0.31	1.17	Inf	0.33	2.05	4.96
CY	0.41	2.44	8.07	0.21	1.41	2.23	0.38	2.35	6.01
DE	0.43	2.49	7.56	0.59	Inf	Inf	0.42	2.50	7.47
EE	0.49	3.15	10.37	0.26	1.64	Inf	0.46	2.98	8.29
ES	0.42	2.36	6.51	0.23	1.57	Inf	0.38	2.26	5.35
FI	0.36	2.21	5.68	0.39	1.46	Inf	0.35	2.18	5.47
FR	0.36	2.11	4.90	0.47	1.57	Inf	0.35	2.10	4.82
GR	0.35	2.11	5.51	0.29	1.35	Inf	0.34	2.10	4.97
HU	0.43	2.68	7.59	0.21	1.47	1.82	0.41	2.56	6.39
IE	0.38	2.34	6.53	0.35	1.37	Inf	0.37	2.29	5.75
IT	0.38	2.43	6.16	0.32	1.54	Inf	0.36	2.34	5.50
LU	0.39	2.35	6.14	0.36	1.53	Inf	0.37	2.26	5.86
LV	0.52	3.25	10.04	0.36	2.00	Inf	0.50	3.18	9.30
MT	0.39	2.29	6.58	0.22	1.19	Inf	0.35	2.12	5.10
NL	0.32	1.99	4.83	0.43	1.11	Inf	0.31	1.92	4.52
PL	0.40	2.37	6.94	0.18	1.16	1.54	0.36	2.18	5.40
PT	0.39	2.42	6.42	0.28	1.37	Inf	0.37	2.34	5.76
SI	0.42	2.51	8.48	0.21	1.26	Inf	0.38	2.33	6.55
SK	0.39	2.14	7.42	0.20	1.28	Inf	0.37	2.07	6.39

Effects on the unconditional Distribution

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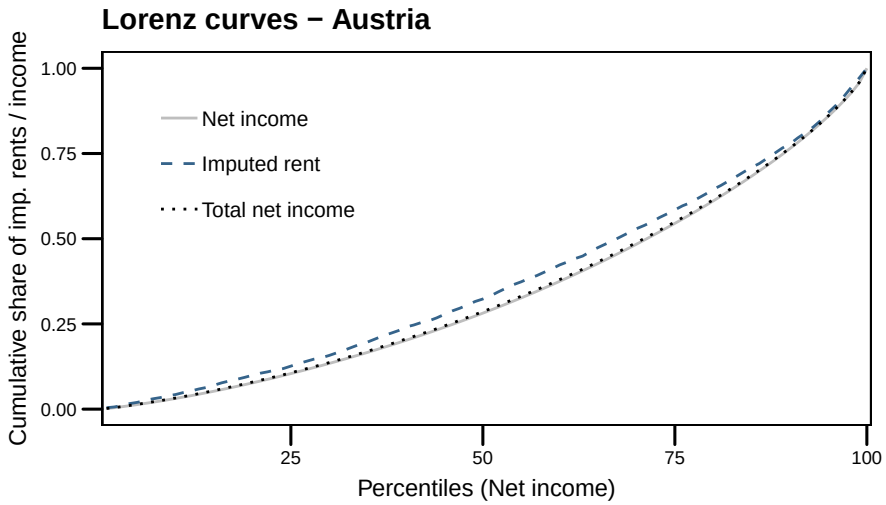
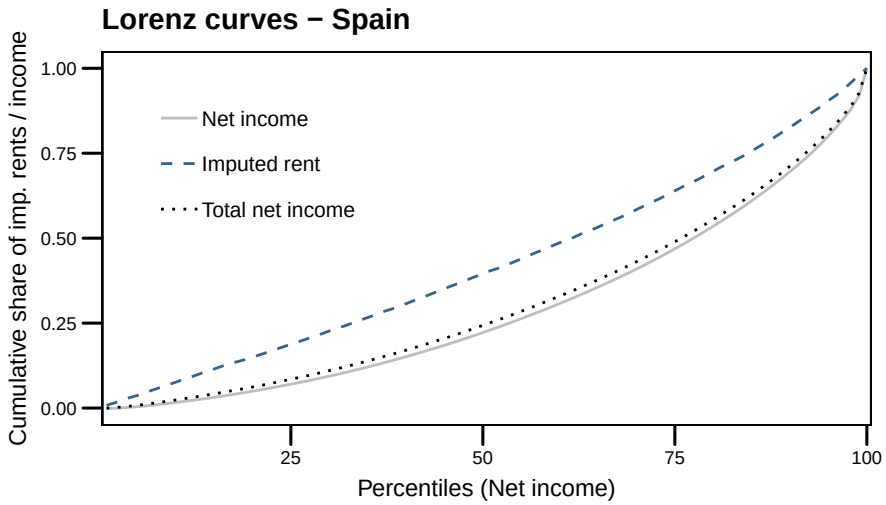
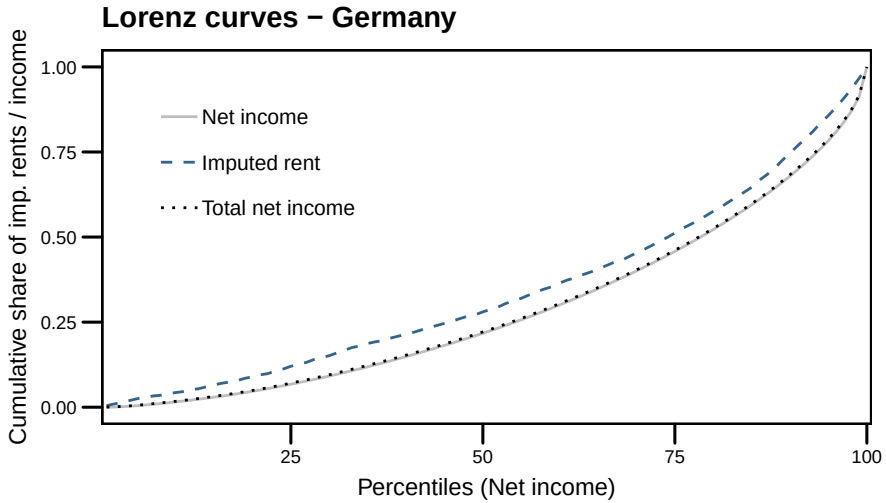
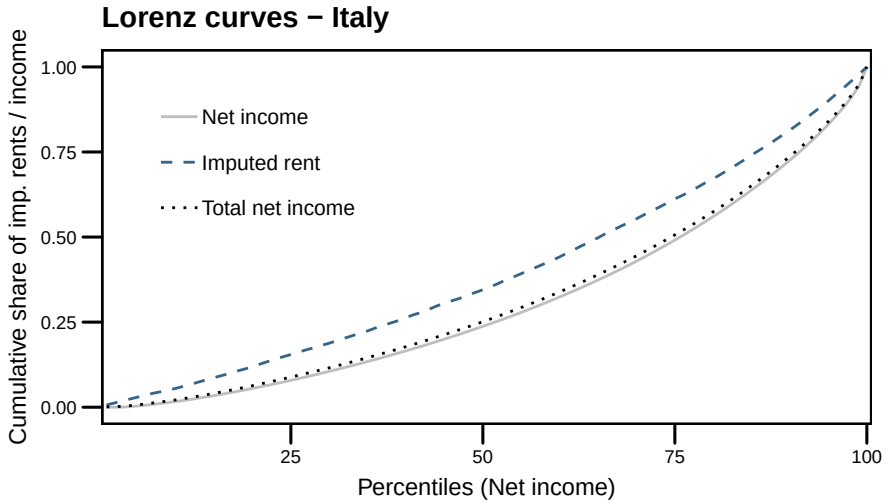
Effects on the unconditional Distribution

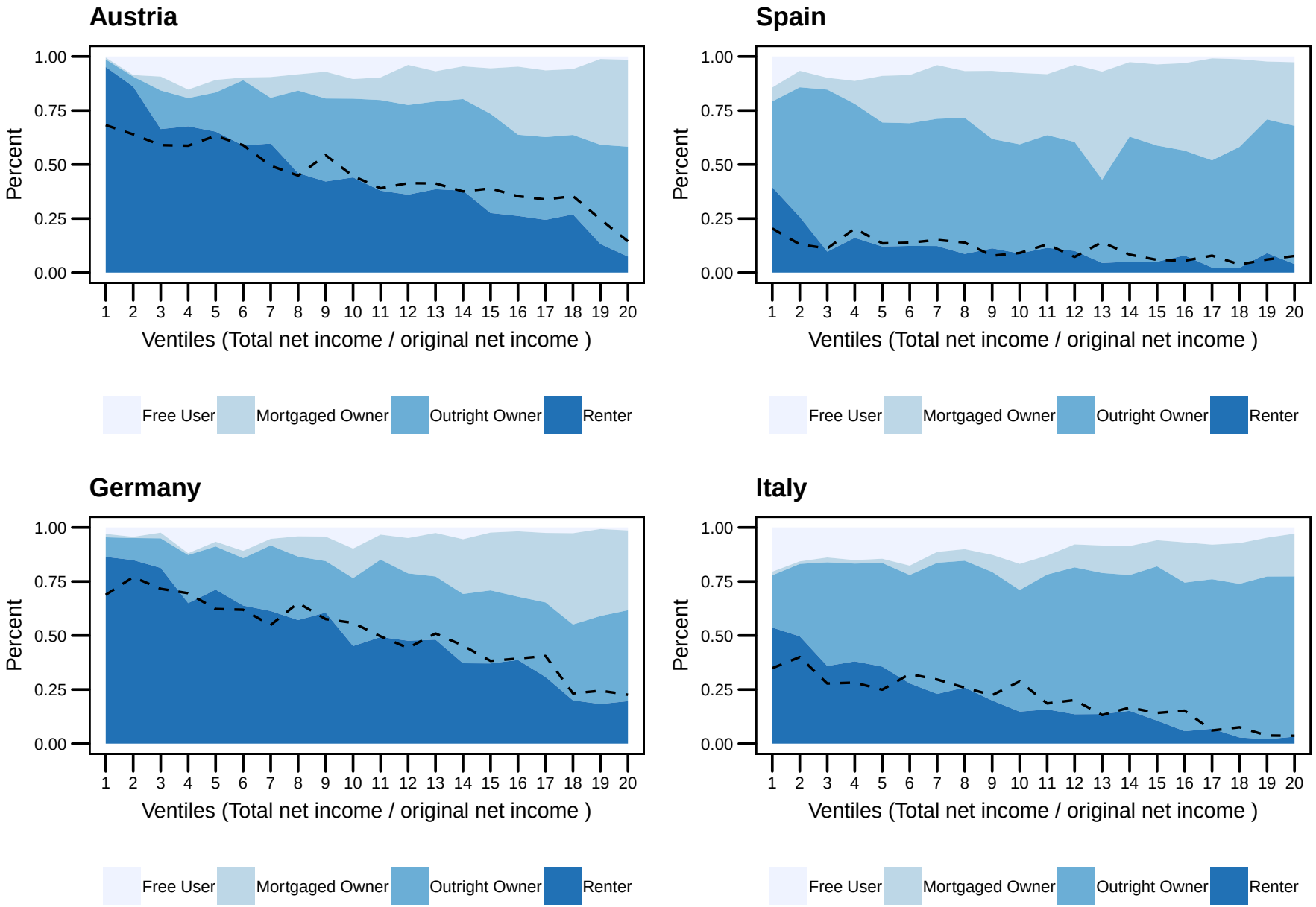








Effects on the conditional Distribution



Decomposition - Theil Index

We define

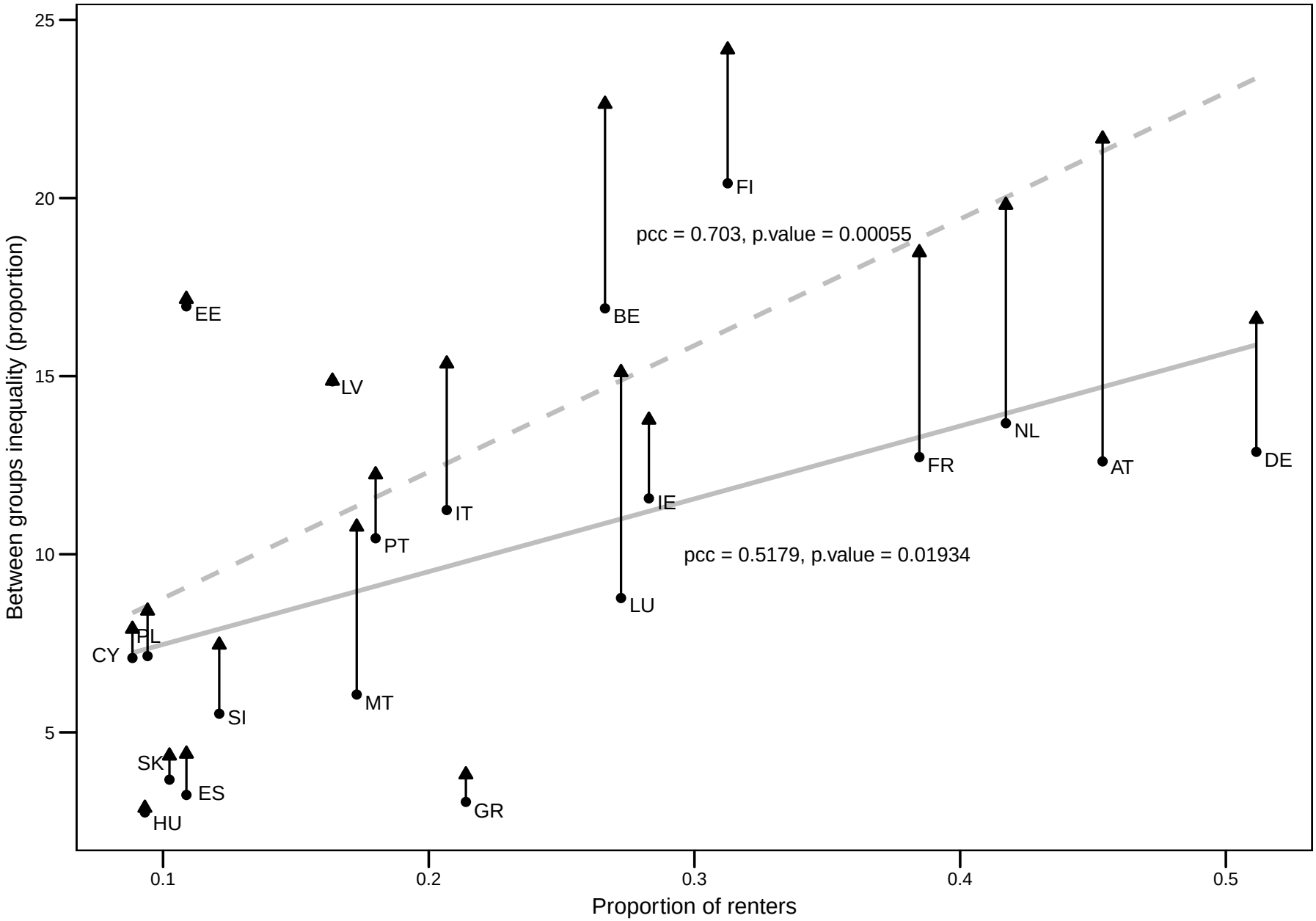
s_k	as the income share of group k,
N	as total population,
N_k	as population of group k,
T_k	as Theil index for group k,
μ	as the average income of the total population,
$\bar{x}_k$	as the average income of group k.

The Theil's T Index can then be written as

$$T_T = \sum_{k=1}^{m} s_k T_k + \sum_{k=1}^{m} s_k \ln \frac{\bar{x}_k}{\mu} \qquad \text{for } s_k = \frac{N_k}{N} \frac{\bar{x}_k}{\mu}$$

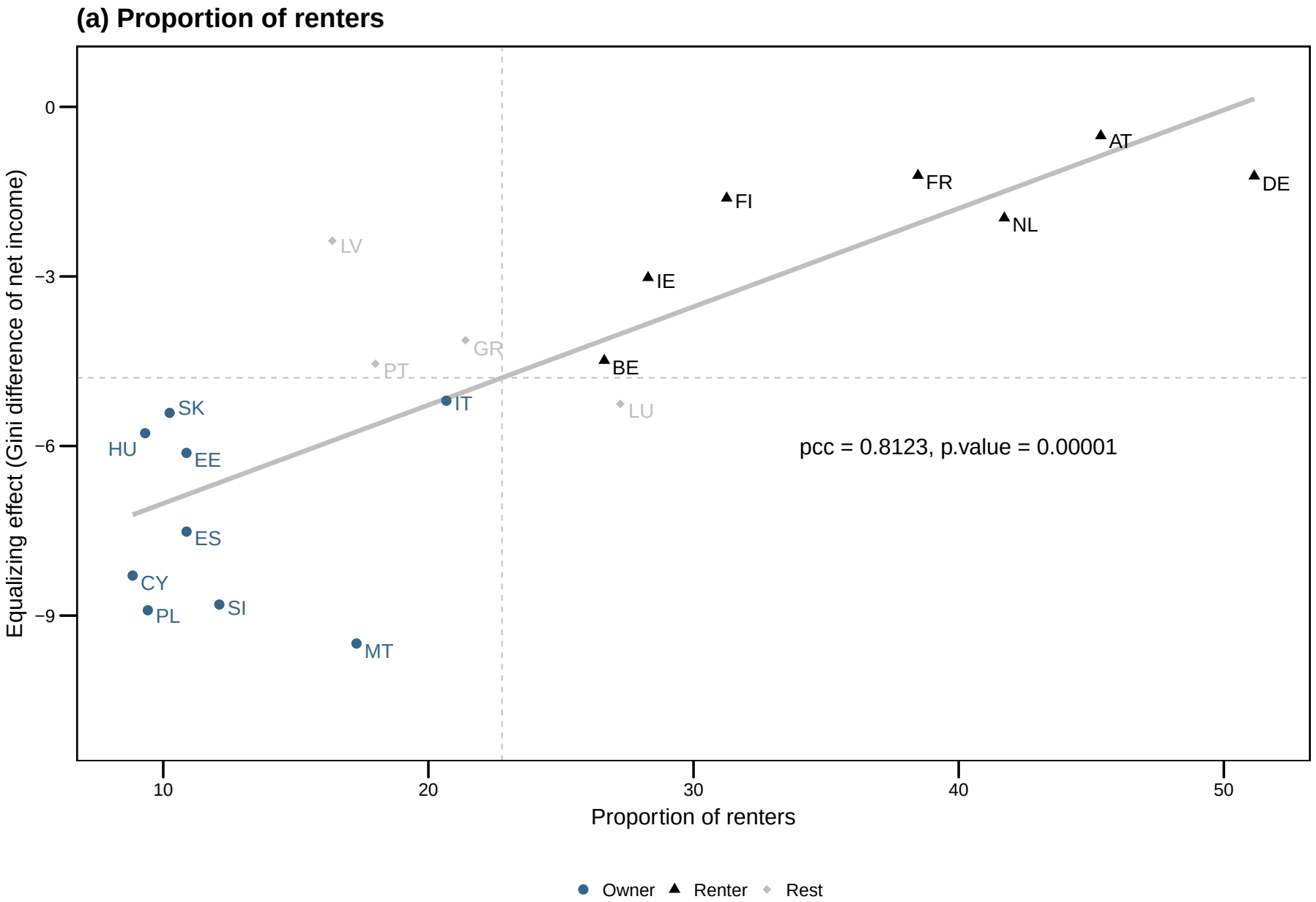
with the first term representing the within-group inequality and the second term representing the between-group inequality.

Effects on the conditional Distribution

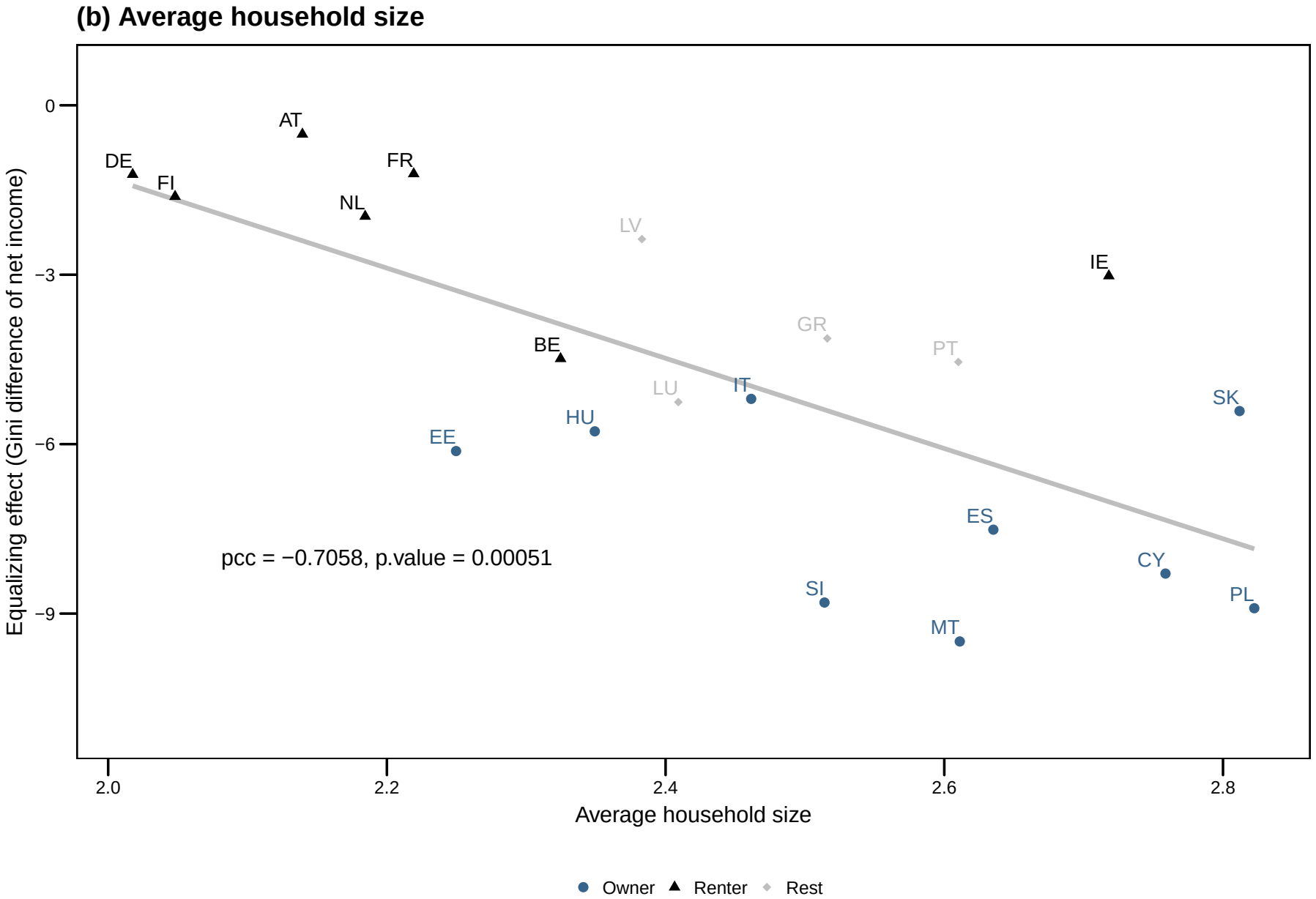


Decomposition of Distributional Effects - What drives the difference?

Controlling for Housing Characteristics



Controlling for Housing Characteristics



Decomposition - Reweighting Approach

- Control for different housing characteristics X among countries
  - Proportion of renters/owner-occupiers
  - Household size
- Set of income variables $Y = \{y_i, y_i^{nc}, y_i^t\}$
- C is a country-dummy set indicating every country $c \in C$
- Interpret HFCS as $i.i.d.$ draw from distribution P of variables (Y, X, C)

Reweighting procedure:

$$P^c_{rew}(Y) = \int_X P^c(Y \mid X) dP(X) \tag{1}$$

$$= \int_X P^c(Y \mid X) dP^c(X) \Psi^c(X)$$

$$= \int_X P^c(Y \mid X) \Psi^c dP^c(X) = P^c_{rew}(Y). \tag{2}$$

Decomposition - Reweighting Approach

The reweighting factor Ψ^C is required for every country c and can be denoted by rewriting

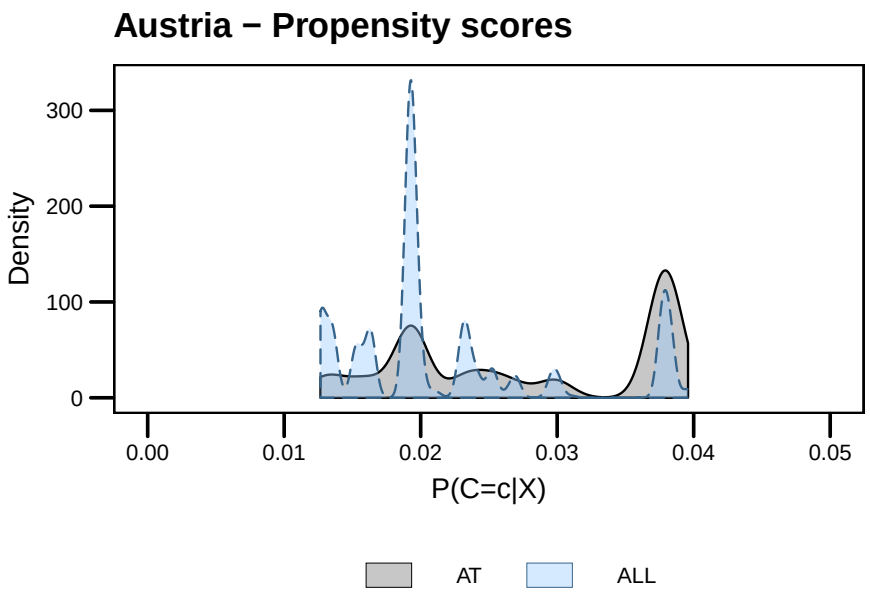
$$dP(X) = P^c(X)\Psi^c(X)$$
$$\Psi^c(X) = \frac{P(X)}{P^c(X)} = \frac{\mathbb{1}(C = c)}{P(C = c \mid X)} \tag{3}$$

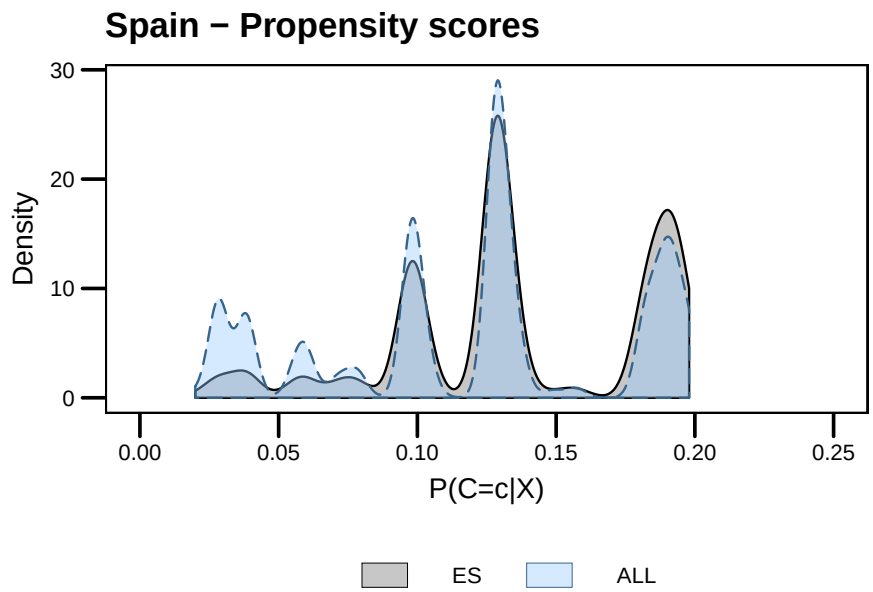
where $\mathbb{1}(...)$ denotes the indicator function from the country-dummies C and $P(C = c \mid X)$ is the probability for a household being from country c given its housing characteristics X.

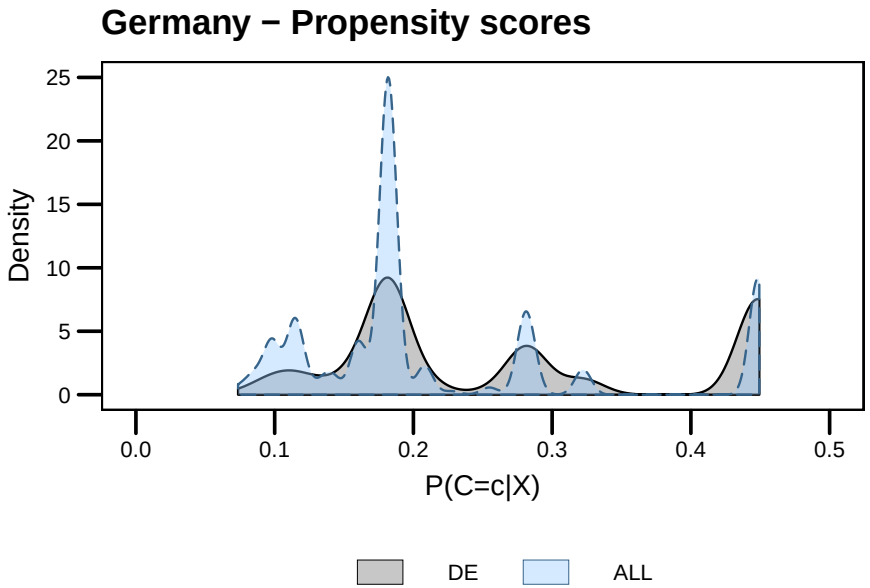
The reweighting factor can be estimated by a logit regression for every country c:

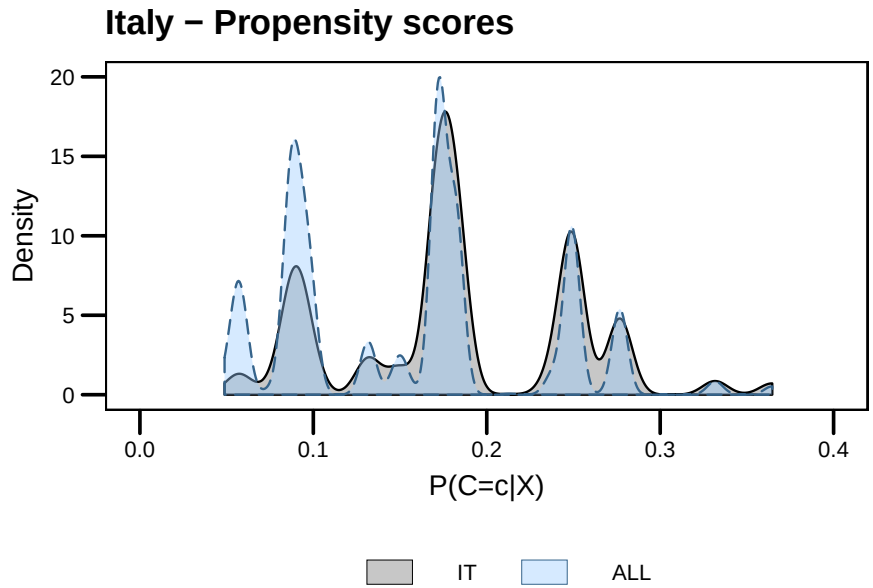
$$\hat{P}(C = c \mid X) = \frac{e^{X \cdot \beta^c}}{1 + e^{X \cdot \beta^c}} \tag{4}$$

Decomposition - Reweighting Approach

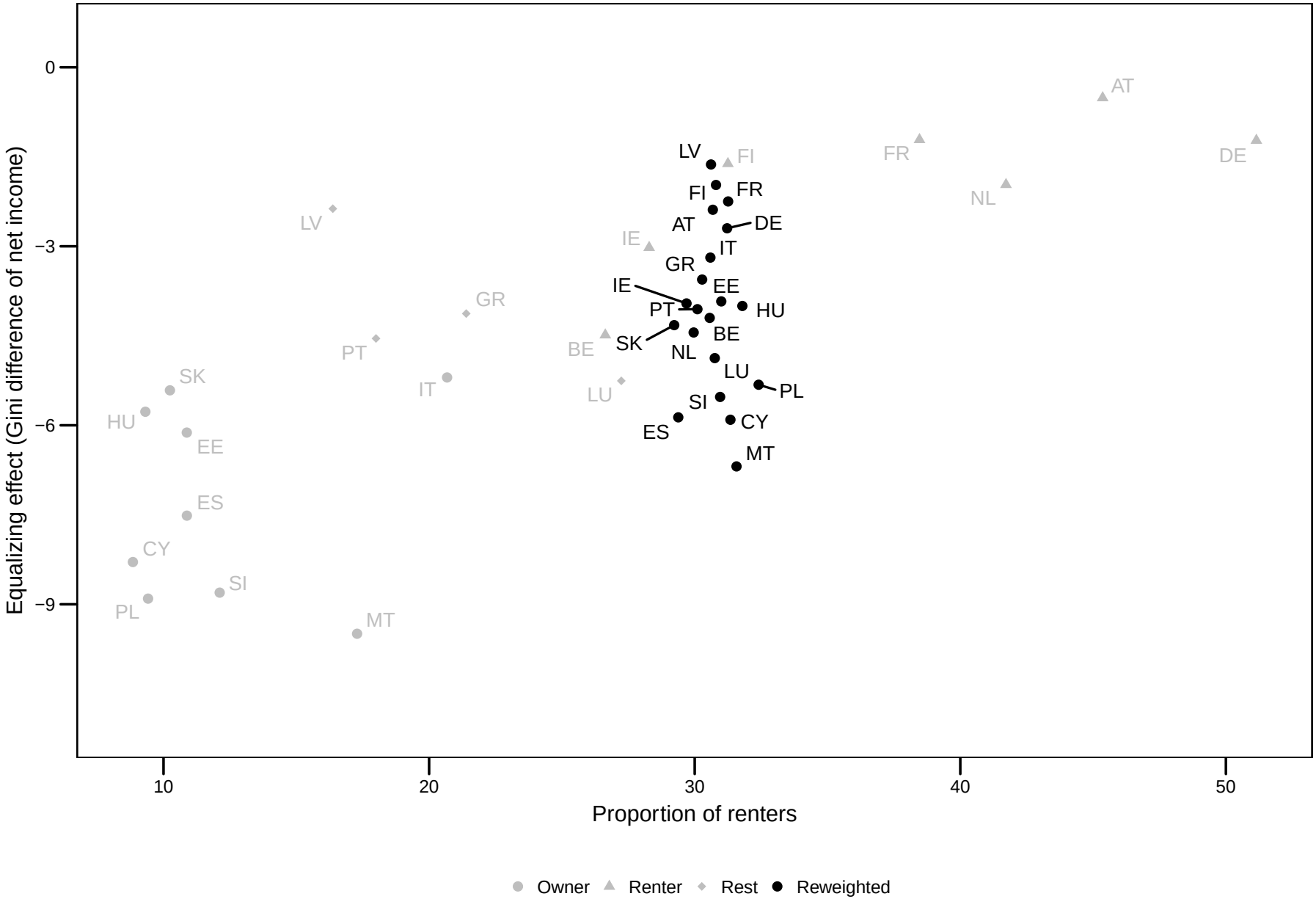








Decomposition - Reweighting Approach



Decomposition - Reweighting Approach

For any Inequality Measure we can now define and estimate

IM	corresponding to the initial net disposable income y_i,
IM^t	corresponding to the total net disposable income y_i^t,
IM_{rew}	corresponding to y_i of the reweighted counterfactual,
IM^t_{rew}	corresponding to y_i^t of the reweighted counterfactual.

By simply expanding the formulae and rearranging the parenthesis we can observe

$$\begin{aligned} IM^t - IM &= IM^t - IM_{rew} + IM_{rew} - IM \\ &= IM^t - IM^t_{rew} + IM^t_{rew} - IM_{rew} + IM_{rew} - IM \\ &= \underbrace{(IM^t - IM^t_{rew})}_{\Delta X^T \text{ decomposition treatment effect}} + \underbrace{(IM^t_{rew} - IM_{rew})}_{\Delta T \text{ treatment effect}} + \underbrace{(IM_{rew} - IM)}_{\Delta X \text{ decomposition effect}} . \end{aligned} \tag{5}$$

$$\begin{aligned} IM^t - IM &= IM^t - IM^t_{rew} + IM^t_{rew} - IM_{rew} + IM_{rew} - IM \\ &= \underbrace{(IM^t - IM^t_{rew} + IM_{rew} - IM)}_{\Delta T^X \text{ treatment decomposition effect}} + \underbrace{(IM^t_{rew} - IM_{rew})}_{\Delta T \text{ treatment effect}} \end{aligned} \tag{6}$$

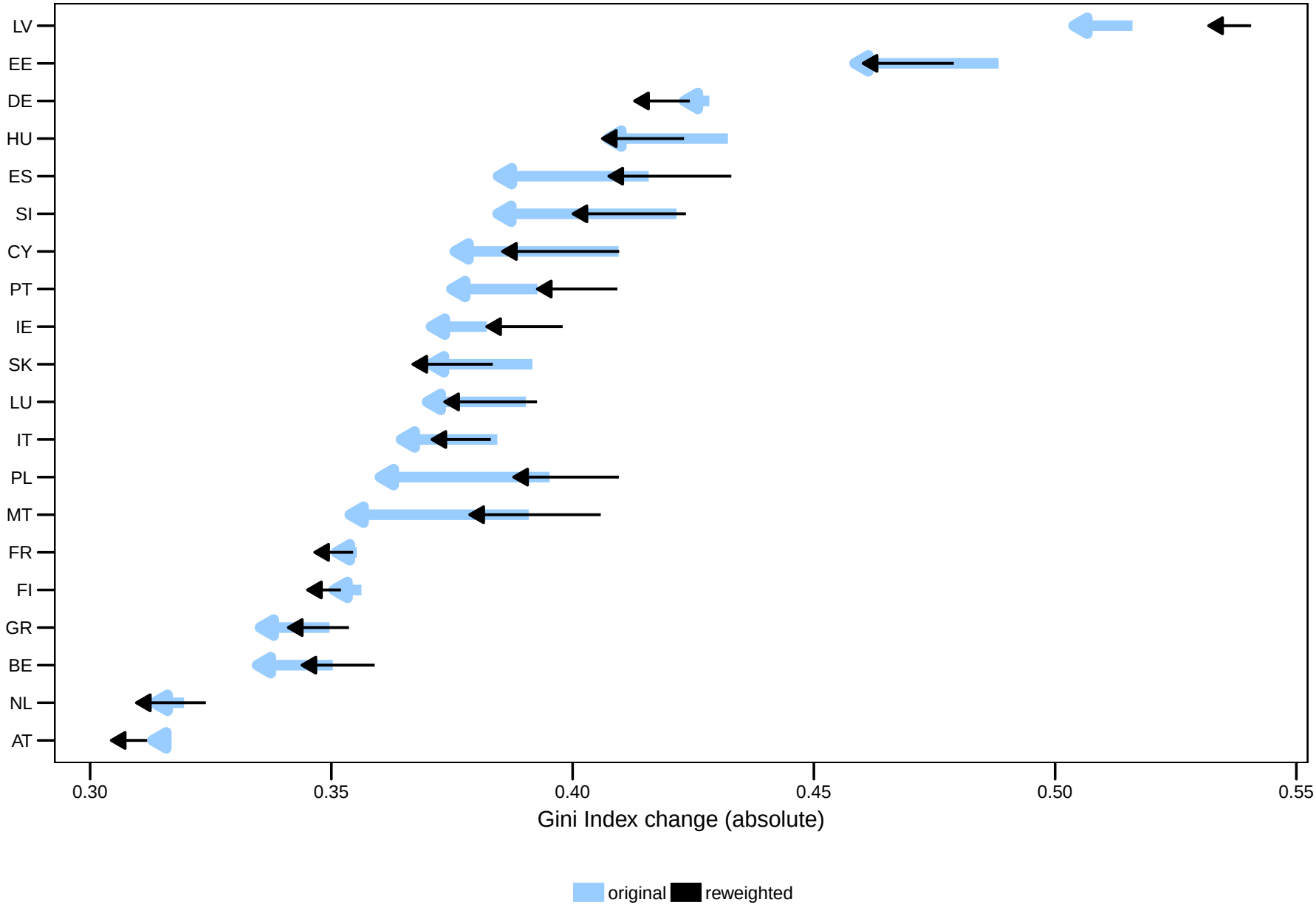
Net income Gini Index Decomposition

	$\Delta Gini$ absolute	In % of Gini Index					Origin of $\Delta Gini$	
		$\Delta Gini$	ΔX^T	ΔX	ΔT	ΔT^X	ΔT	ΔT^X
AT	-0.002	-0.51	2.71	-0.86	-2.37	1.86	56.1	-43.9
BE	-0.016	-4.49	-2.66	2.47	-4.30	-0.18	95.9	4.1
CY	-0.034	-8.29	-2.42	0.03	-5.91	-2.38	71.3	28.7
DE	-0.005	-1.23	2.39	-0.95	-2.67	1.45	64.9	-35.1
EE	-0.030	-6.12	-0.37	-1.91	-3.85	-2.27	62.9	37.1
ES	-0.031	-7.51	-5.52	4.12	-6.11	-1.41	81.3	18.7
FI	-0.006	-1.61	1.52	-1.19	-1.95	0.33	85.4	-14.6
FR	-0.004	-1.21	1.24	-0.21	-2.24	1.03	68.5	-31.5
GR	-0.014	-4.13	-1.68	1.15	-3.60	-0.53	87.2	12.8
HU	-0.025	-5.77	0.25	-2.11	-3.92	-1.86	67.9	32.1
IE	-0.012	-3.02	-3.02	4.12	-4.12	1.10	78.9	-21.1
IT	-0.020	-5.20	-1.67	-0.35	-3.18	-2.02	61.1	38.9
LU	-0.021	-5.25	-0.94	0.59	-4.90	-0.35	93.3	6.7
LV	-0.012	-2.37	-5.43	4.76	-1.71	-0.66	72.0	28.0
MT	-0.037	-9.49	-6.36	3.82	-6.95	-2.55	73.2	26.8
NL	-0.006	-1.97	1.12	1.41	-4.51	2.54	64.0	-36.0
PL	-0.035	-8.91	-7.02	3.62	-5.51	-3.39	61.9	38.1
PT	-0.018	-4.55	-4.53	4.21	-4.22	-0.32	92.9	7.1
SI	-0.037	-8.81	-3.71	0.46	-5.55	-3.25	63.0	37.0
SK	-0.021	-5.42	0.91	-2.10	-4.23	-1.18	78.1	21.9

Net income Gini Index Decomposition

	$\Delta Gini$ absolute	In % of Gini Index					Origin of $\Delta Gini$	
		$\Delta Gini$	ΔX^T	ΔX	ΔT	ΔT^X	ΔT	ΔT^X
AT	-0.002	-0.51	2.71	-0.86	-2.37	1.86	56.1	-43.9
BE	-0.016	-4.49	-2.66	2.47	-4.30	-0.18	95.9	4.1
CY	-0.034	-8.29	-2.42	0.03	-5.91	-2.38	71.3	28.7
DE	-0.005	-1.23	2.39	-0.95	-2.67	1.45	64.9	-35.1
EE	-0.030	-6.12	-0.37	-1.91	-3.85	-2.27	62.9	37.1
ES	-0.031	-7.51	-5.52	4.12	-6.11	-1.41	81.3	18.7
FI	-0.006	-1.61	1.52	-1.19	-1.95	0.33	85.4	-14.6
FR	-0.004	-1.21	1.24	-0.21	-2.24	1.03	68.5	-31.5
GR	-0.014	-4.13	-1.68	1.15	-3.60	-0.53	87.2	12.8
HU	-0.025	-5.77	0.25	-2.11	-3.92	-1.86	67.9	32.1
IE	-0.012	-3.02	-3.02	4.12	-4.12	1.10	78.9	-21.1
IT	-0.020	-5.20	-1.67	-0.35	-3.18	-2.02	61.1	38.9
LU	-0.021	-5.25	-0.94	0.59	-4.90	-0.35	93.3	6.7
LV	-0.012	-2.37	-5.43	4.76	-1.71	-0.66	72.0	28.0
MT	-0.037	-9.49	-6.36	3.82	-6.95	-2.55	73.2	26.8
NL	-0.006	-1.97	1.12	1.41	-4.51	2.54	64.0	-36.0
PL	-0.035	-8.91	-7.02	3.62	-5.51	-3.39	61.9	38.1
PT	-0.018	-4.55	-4.53	4.21	-4.22	-0.32	92.9	7.1
SI	-0.037	-8.81	-3.71	0.46	-5.55	-3.25	63.0	37.0
SK	-0.021	-5.42	0.91	-2.10	-4.23	-1.18	78.1	21.9

Decomposition - Reweighting Approach



Robustness Checks

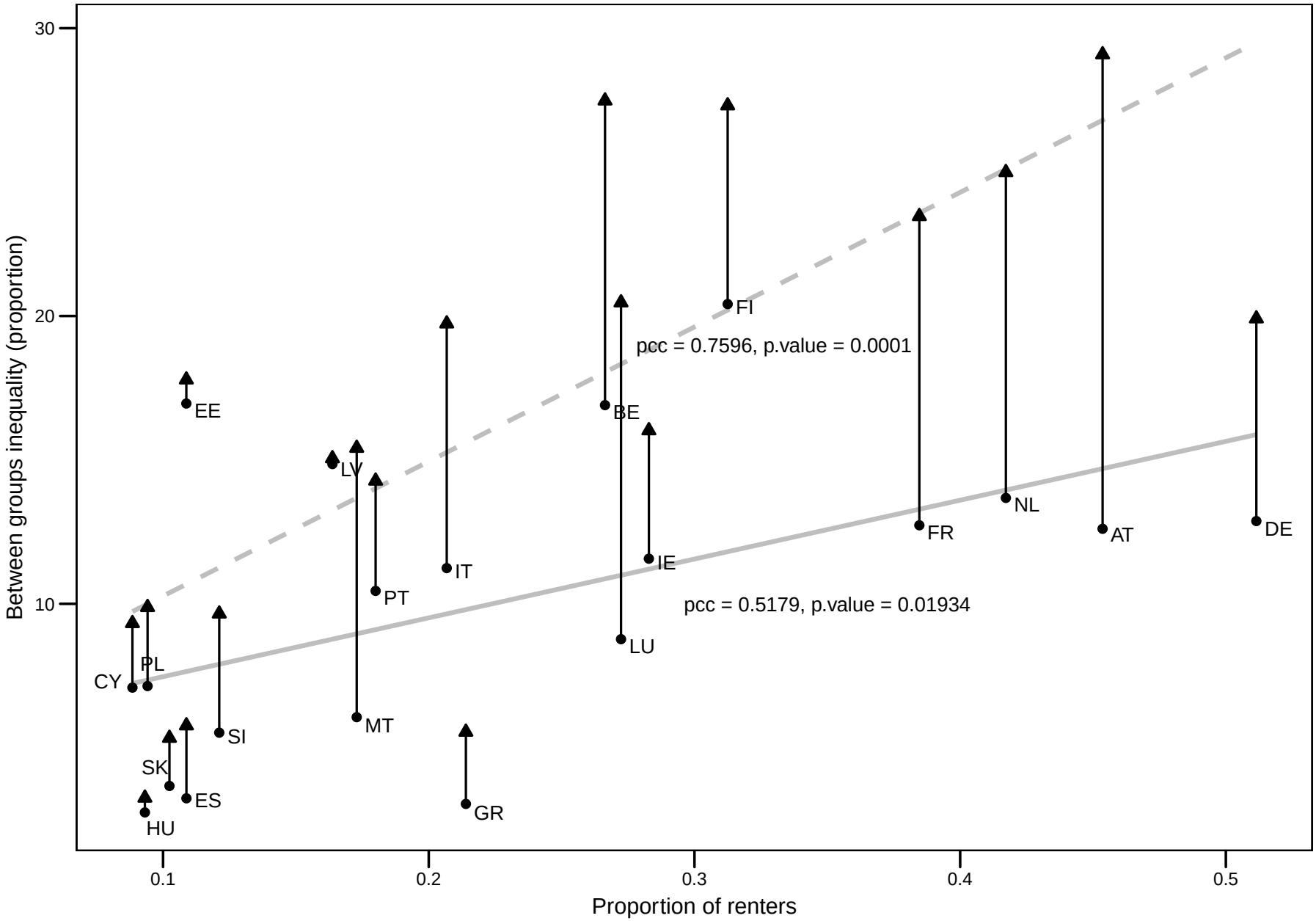
Counterfactual ineq measures - 2 % scenario

	Observed net income (y_i)			+ Non-cash income (y_i^{nc})			= Total net income (y_i^t)		
	Gini	P90/P50	P90/P10	Gini	P90/P50	P90/P10	Gini	P90/P50	P90/P10
AT	0.31	2.02	4.42	0.52	1.55	Inf	0.31	1.98	4.34
BE	0.35	2.16	5.05	0.31	1.16	Inf	0.34	2.09	4.88
CY	0.41	2.44	8.07	0.20	1.39	2.24	0.39	2.37	6.59
DE	0.43	2.49	7.56	0.59	Inf	Inf	0.42	2.51	7.43
EE	0.49	3.15	10.37	0.26	1.64	Inf	0.47	3.05	8.88
ES	0.42	2.36	6.51	0.23	1.56	Inf	0.40	2.30	5.66
FI	0.36	2.21	5.68	0.39	1.47	Inf	0.35	2.19	5.54
FR	0.36	2.11	4.90	0.47	1.58	Inf	0.35	2.10	4.82
GR	0.35	2.11	5.51	0.29	1.33	Inf	0.34	2.10	5.29
HU	0.43	2.68	7.59	0.21	1.46	1.83	0.42	2.61	6.81
IE	0.38	2.34	6.53	0.35	1.38	Inf	0.38	2.31	6.03
IT	0.38	2.43	6.16	0.32	1.56	Inf	0.37	2.37	5.76
LU	0.39	2.35	6.14	0.36	1.51	Inf	0.38	2.28	5.83
LV	0.52	3.25	10.04	0.36	1.97	Inf	0.51	3.21	9.61
MT	0.39	2.29	6.58	0.22	1.22	Inf	0.37	2.19	5.68
NL	0.32	1.99	4.83	0.43	1.12	Inf	0.32	1.94	4.61
PL	0.40	2.37	6.94	0.18	1.15	1.54	0.37	2.25	5.86
PT	0.39	2.42	6.42	0.29	1.44	Inf	0.38	2.38	6.07
SI	0.42	2.51	8.48	0.21	1.26	Inf	0.40	2.38	7.13
SK	0.39	2.14	7.42	0.20	1.24	Inf	0.38	2.09	6.80

Counterfactual ineq measures - 5 % scenario

	Observed net income (y_i)			+ Non-cash income (y_i^{nc})			= Total net income (y_i^t)		
	Gini	P90/P50	P90/P10	Gini	P90/P50	P90/P10	Gini	P90/P50	P90/P10
AT	0.31	2.02	4.42	0.52	1.56	Inf	0.32	1.97	4.50
BE	0.35	2.16	5.05	0.31	1.18	Inf	0.33	1.97	5.16
CY	0.41	2.44	8.07	0.20	1.44	2.22	0.35	2.24	5.11
DE	0.43	2.49	7.56	0.59	Inf	Inf	0.42	2.48	7.51
EE	0.49	3.15	10.37	0.26	1.65	Inf	0.44	2.89	7.35
ES	0.42	2.36	6.51	0.23	1.58	Inf	0.37	2.21	4.73
FI	0.36	2.21	5.68	0.39	1.46	Inf	0.35	2.18	5.40
FR	0.36	2.11	4.90	0.47	1.59	Inf	0.35	2.10	4.92
GR	0.35	2.11	5.51	0.29	1.34	Inf	0.32	2.05	4.63
HU	0.43	2.68	7.59	0.21	1.48	1.83	0.39	2.46	5.71
IE	0.38	2.34	6.53	0.34	1.33	Inf	0.36	2.24	5.37
IT	0.38	2.43	6.16	0.32	1.53	Inf	0.35	2.26	5.10
LU	0.39	2.35	6.14	0.36	1.54	Inf	0.36	2.20	6.07
LV	0.52	3.25	10.04	0.36	2.04	Inf	0.50	3.19	8.83
MT	0.39	2.29	6.58	0.22	1.20	Inf	0.33	2.01	4.63
NL	0.32	1.99	4.83	0.43	1.11	Inf	0.31	1.89	4.56
PL	0.40	2.37	6.94	0.18	1.16	1.53	0.34	2.07	4.80
PT	0.39	2.42	6.42	0.27	1.34	Inf	0.36	2.26	5.27
SI	0.42	2.51	8.48	0.21	1.27	Inf	0.36	2.24	6.00
SK	0.39	2.14	7.42	0.20	1.27	Inf	0.35	2.04	5.64

Theil Decomposition 5 % interest rate



Conclusion

Conclusion

- Aggregate of imputed rents account for a substantial part of total income
  - Owner-countries: 13 % - 15 % of net income
  - Renter-countries: 6 % - 11% of net income
- Imputed rents decrease the unconditional income inequality
  - Magnitude of the effect varies strongly among countries
  - Housing characteristics crucially determine the effect
- Imputed rents increase inequality between renter and owner-occupier
  - Owner-countries: ES: 3.2 % to 4.6% IT: 11.2 % to 15.6 %
  - Renter-countries: AT: 12.6 % to 21.9% DE: 12.9 % to 16.8 %

Conclusion

- Controlling for average household characteristics shows that
  - Average housing characteristics strongly determine distributional effects
  - Remaining effect accounts for distribution of housing-types along the income distribution
  - High segregation: AT, DE, IT, PL
  - Low segregation: IR, FI, BE, ES, PT
- Policy implications
  - Adding non-cash income from imputed rents to the taxable income base would decrease income inequality
  - Progressive taxation could address inequality-increasing effects that stem from segregation

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