

Discovering the energy poverty profile: 9 most distinctive groups in 11 countries of Central and Eastern Europe

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Introduction

Research questions

- What is the incidence and depth of energy poverty in 11 CEE countries in 2020?
- How can we describe the portrait of the energy poor?
- How energy poverty profiles are distributed across CEE countries?

Countries: Bulgaria, Croatia, Czechia, Estonia, Hungary, Latvia, Lithuania, Poland, Romania, Slovakia, and Slovenia

Motivation

- The energy poor should not be treated as a homogenous group.
- The policy action is the most effective when targeted on the support of a particular social group with well-known characteristics.
- We believe the energy poor in the CEE countries must have some common traits.

Methods

- **Partitioning around medoids procedure**
- **Gower distance**

$$s_{ij} = \left(\sum_{l=1}^k w_{ijl} s_{ijl} \right) / w_{ijl}$$

- where w_{ijl} is a weight for each variable and s_{ijl} is the distance between i and j cases on the k th variable. The similarity for each variable is between 0 and 1, and the sum gives the overall measure.

Methods

Energy poverty incidence and intensity measures

Energy poverty threshold = > national median (equivalised disposable income – housing costs)* 60%

Foster-Greer-Thorbecke index

$$\text{EPI} = \frac{1}{N} \sum_{j=1}^N \left(\frac{z - y_i}{z} \right)^\alpha$$

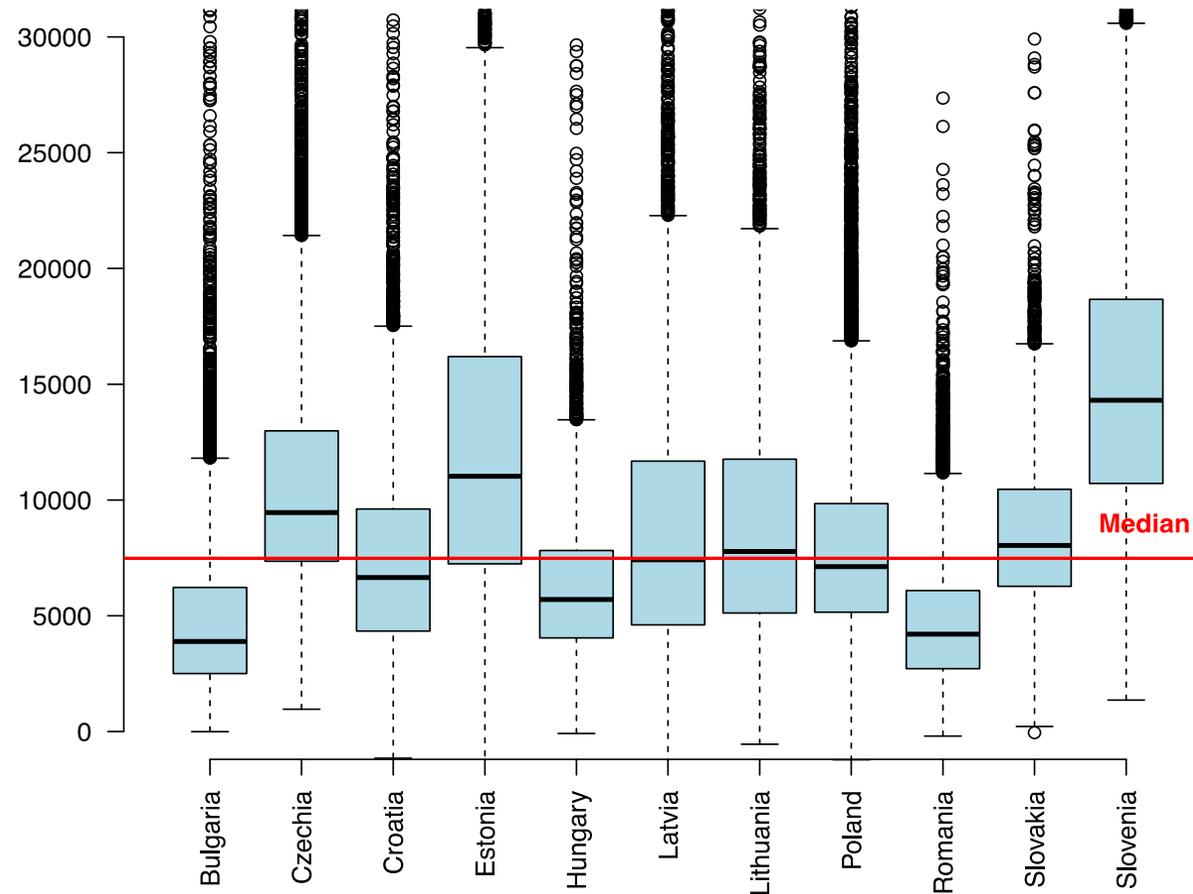
Data

EU Survey on Income and living conditions 2020

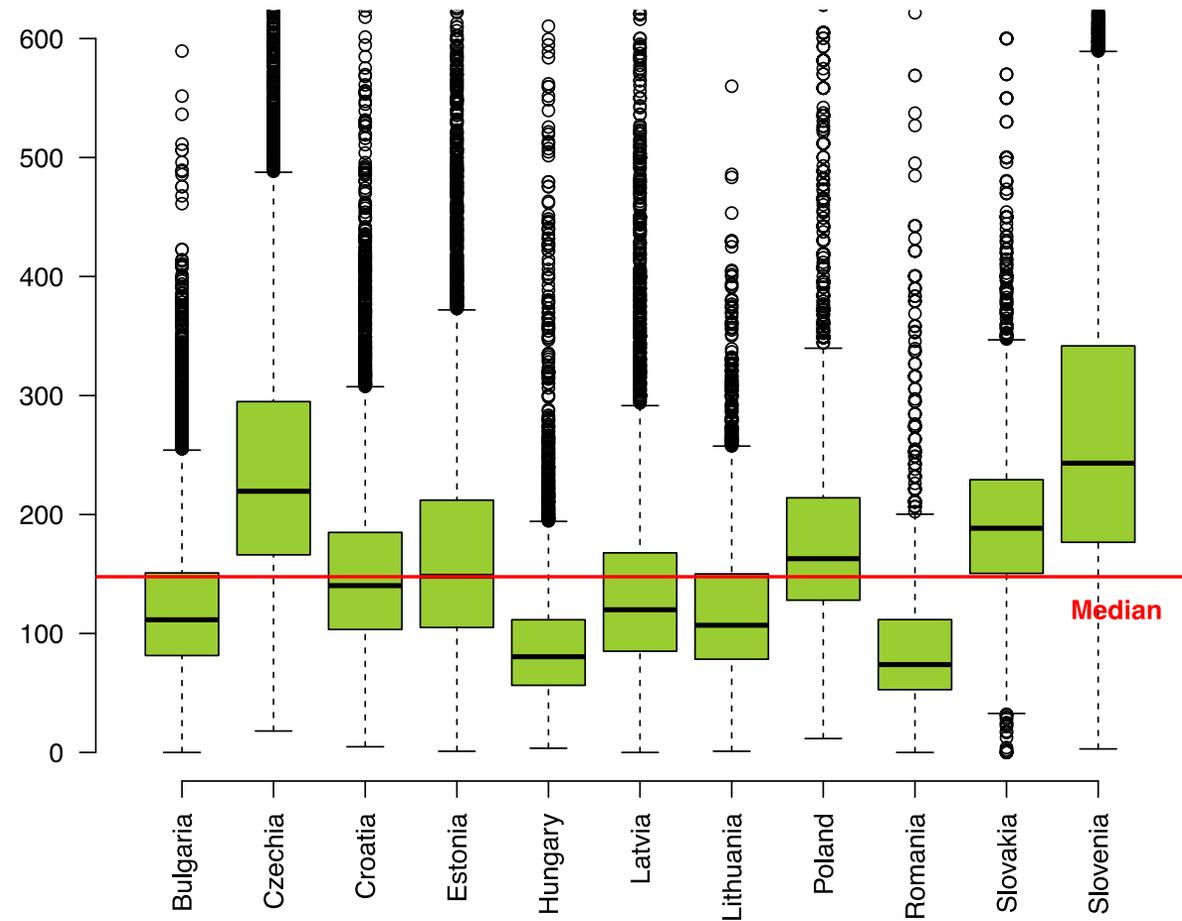
Country	Observations
Bulgaria	7292
Czechia	8498
Estonia	6343
Croatia	7560
Hungary	5769
Lithuania	5032
Latvia	5763
Poland	14621
Romania	7354
Slovenia	8287
Slovakia	5460

Variable description	Frequency, in %
Indoor facilities (two variables, such as <ul style="list-style-type: none"> <li data-bbox="315 229 1977 272">• Yes (both toilet and bath or shower are present in an accommodation) 	83.34
Number of rooms (bathroom, toilet, corridor, lobby, veranda, a kitchen used only for cooking, utility room, and rooms used for business purposes only are excluded) <ul style="list-style-type: none"> <li data-bbox="315 365 1977 408">• Below 2 <li data-bbox="315 408 1977 451">• Below 4 <li data-bbox="315 451 1977 494">• Above 4 	35.32 32.79 31.87
Household size (persons recorded in personal register files count as household members) <ul style="list-style-type: none"> <li data-bbox="315 544 1977 586">• Small (up to 2 members) <li data-bbox="315 586 1977 629">• Medium (3-4 members) <li data-bbox="315 629 1977 672">• Large (more than 5 members) 	70.89 20.62 8.47
Household type (dependent children are children aged 17 and less and economically inactive children aged between 18-24 living with parents) <ul style="list-style-type: none"> <li data-bbox="315 811 1977 853">• One-person <li data-bbox="315 853 1977 896">• Pensioner (households consisting of 2 adults, one of whom is aged 65 and more) <li data-bbox="315 896 1977 939">• With children (all types of households, including single-parent and others with dependent children) <li data-bbox="315 939 1977 1039">• Without children (households consisting of 2 adults, both aged below 65, and other households without dependent children) 	45.02 15.22 25.51 14.23
Tenure status <ul style="list-style-type: none"> <li data-bbox="315 1120 1977 1163">• Owner (outright owner and owner paying a mortgage) <li data-bbox="315 1163 1977 1206">• Tenant (households renting accommodation at market price, reduced price, or having it for free) 	78.87 21.12
Building type <ul style="list-style-type: none"> <li data-bbox="315 1272 1977 1315">• Single-family (detached, semi-detached, or terraced houses) <li data-bbox="315 1315 1977 1358">• Blocks (apartments or flats and other types of accommodation) 	60.73 39.26

Distribution of income



Distribution of housing costs



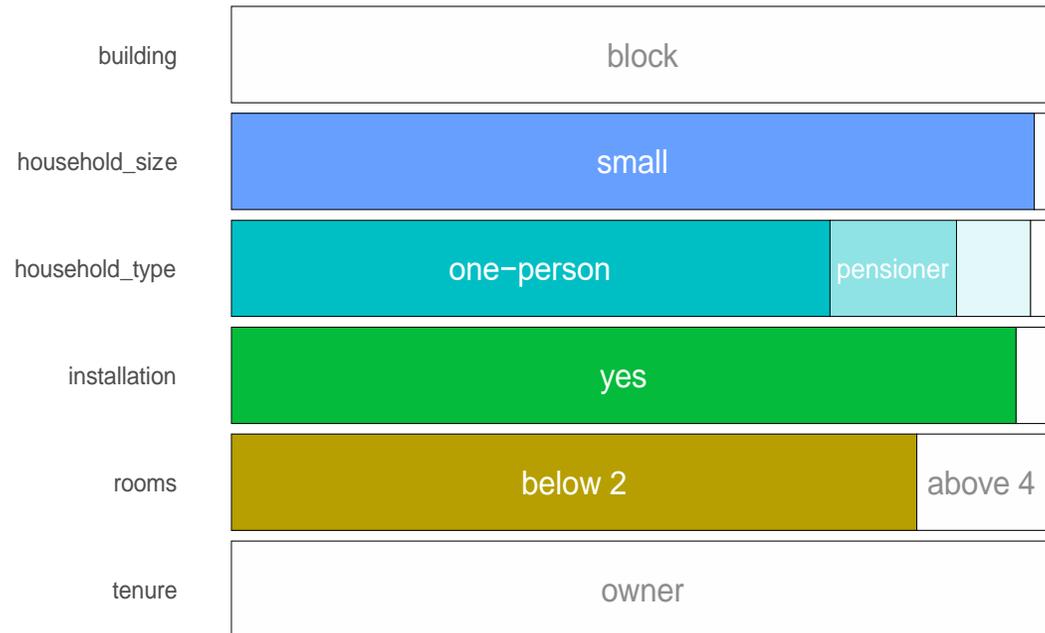
Results – energy poverty

Country	Energy poverty
Bulgaria	29.64
Czechia	16.43
Estonia	23
Croatia	27.1
Hungary	16.51
Lithuania	23.8
Latvia	27.34
Poland	22.14
Romania	26.39
Slovenia	20.08
Slovakia	16.94

Profiles 1 & 2

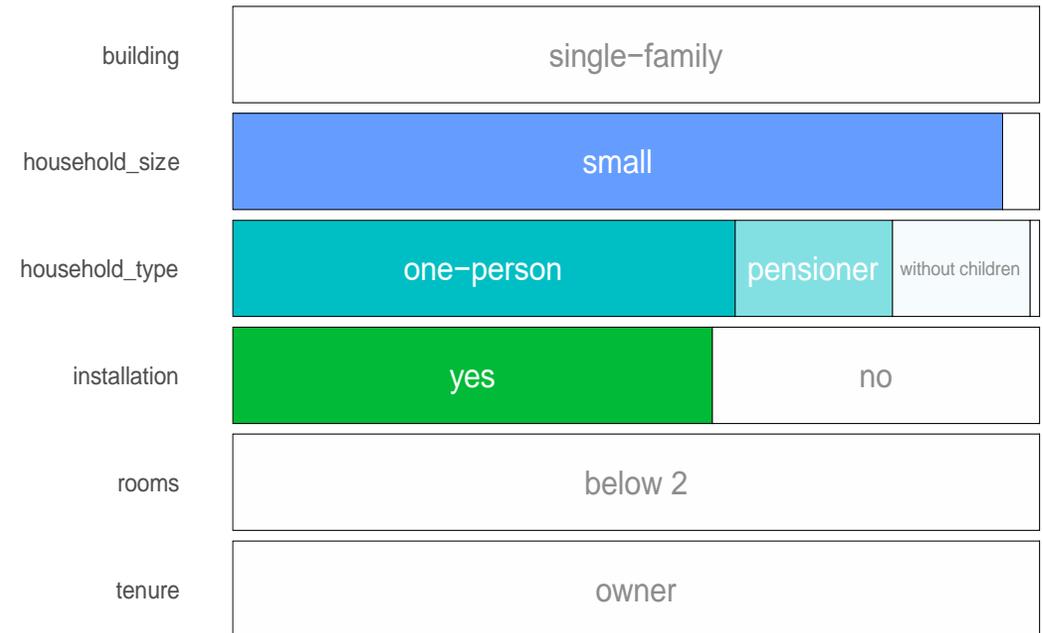
Frequency of categorical levels in df::GroupOne

Gray segments are missing values



Frequency of categorical levels in df::GroupTwo

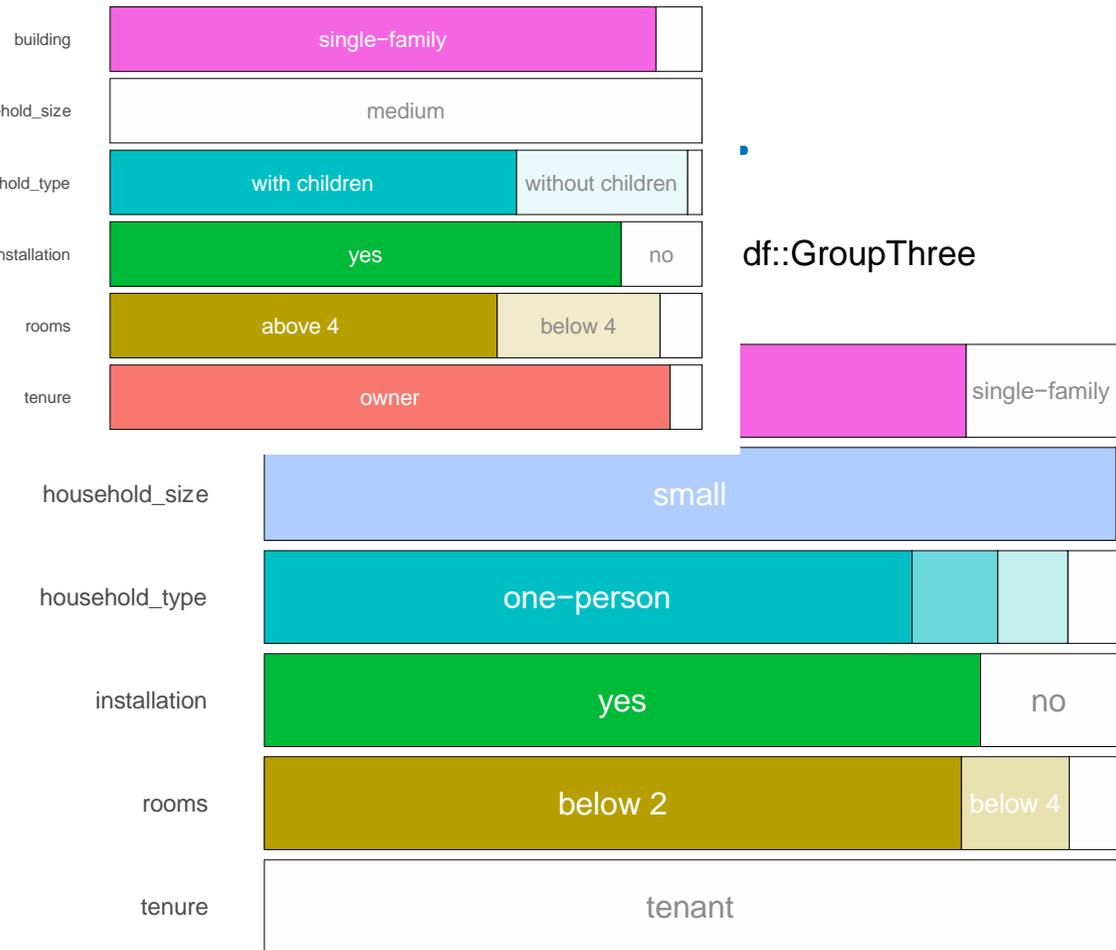
Gray segments are missing values



1. One-person household, owner living in a small apartment
2. One-person household, owner living in a small single-family house

Frequency of categorical levels in df::GroupFour

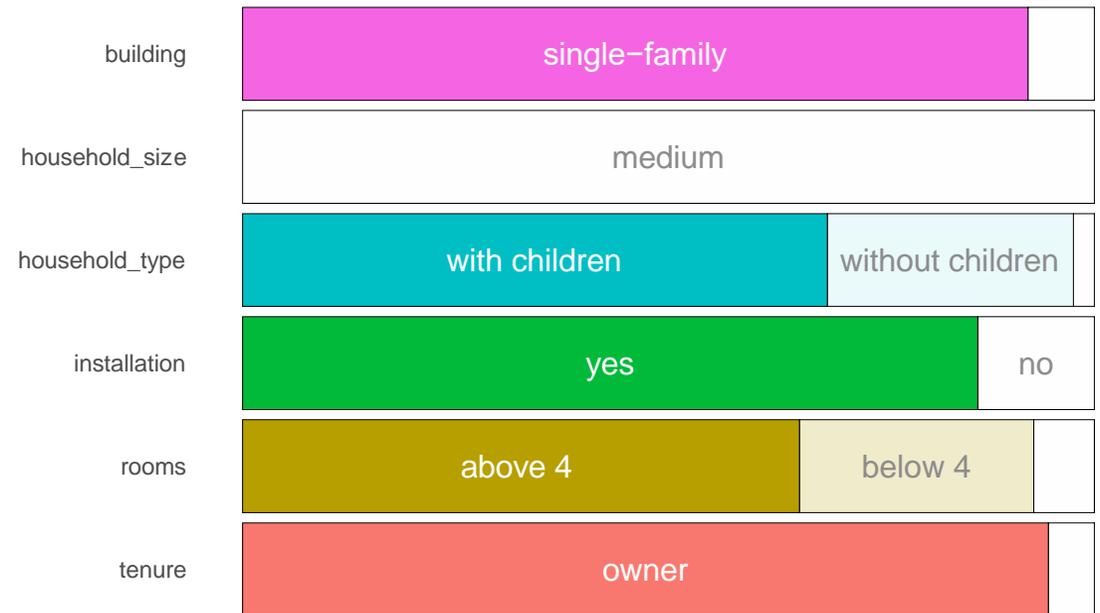
Gray segments are missing values



df::GroupThree

Frequency of categorical levels in df::GroupFour

Gray segments are missing values

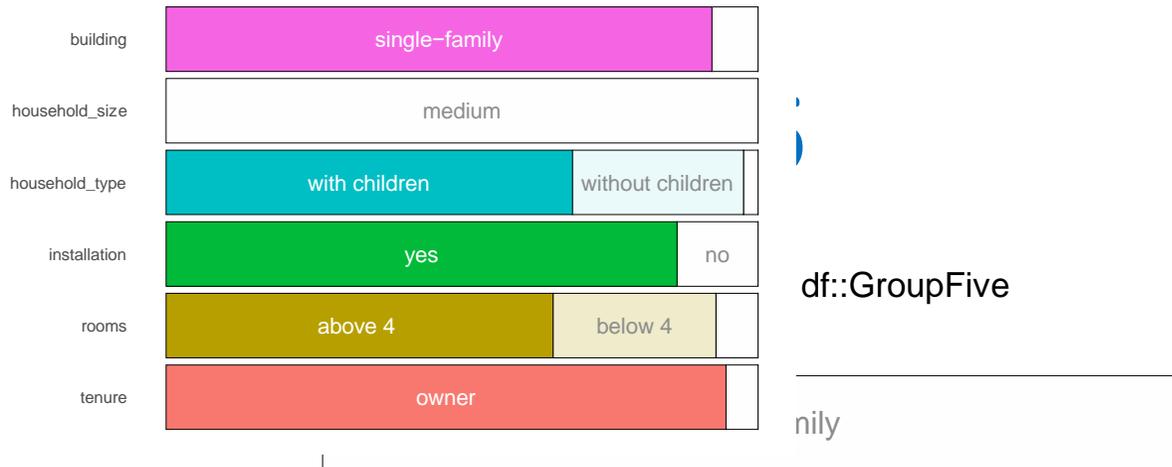


3. One-person household renting a small apartment

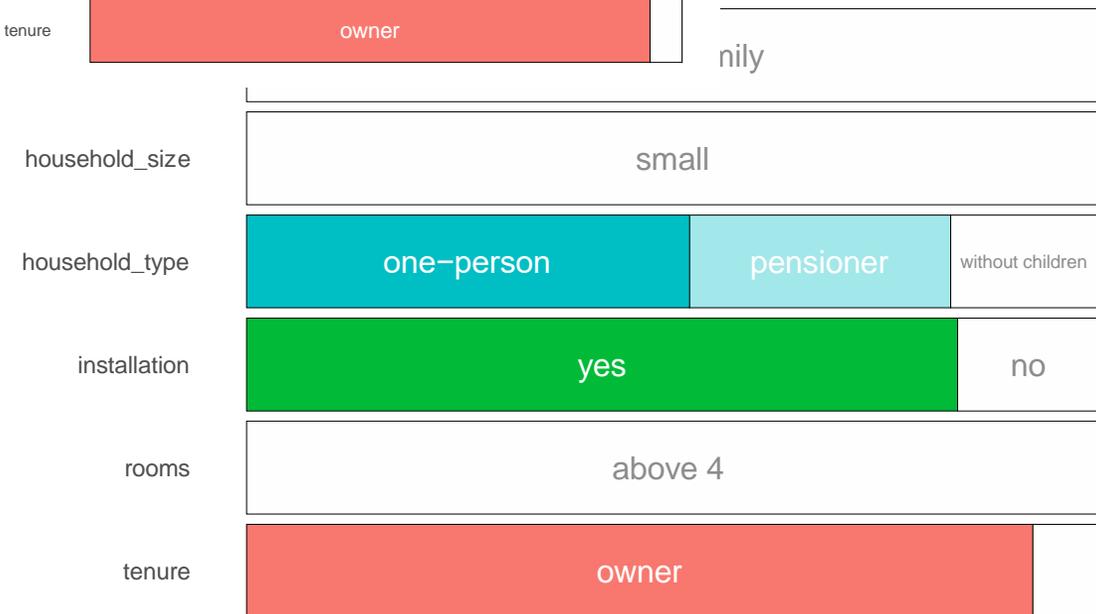
4. Medium-sized household with children, owners of a large single-family building

Frequency of categorical levels in df::GroupFour

Gray segments are missing values

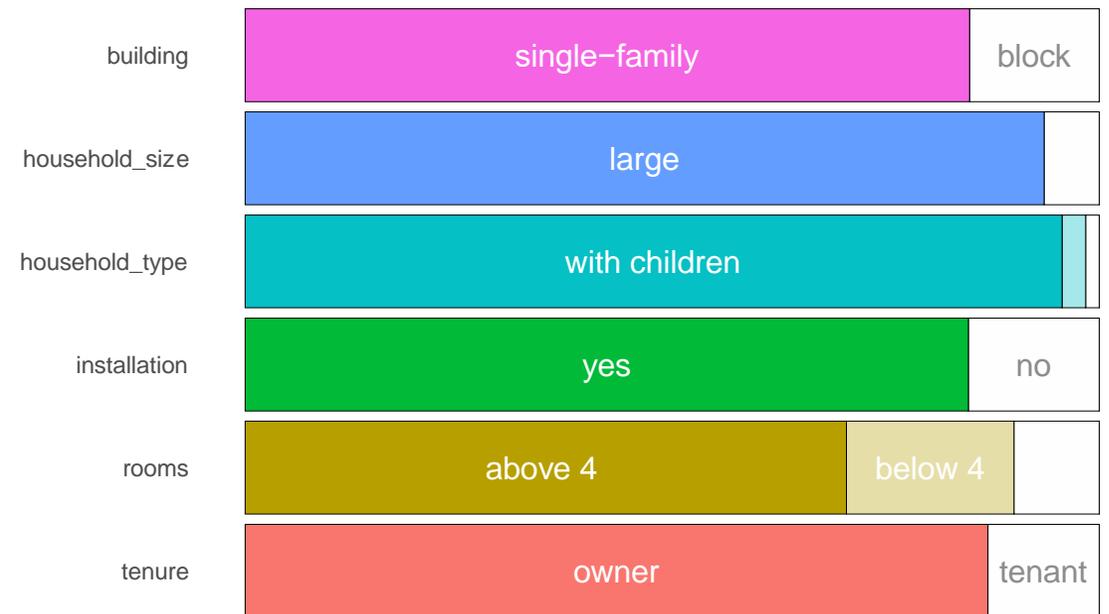


df::GroupFive



Frequency of categorical levels in df::GroupSix

Gray segments are missing values

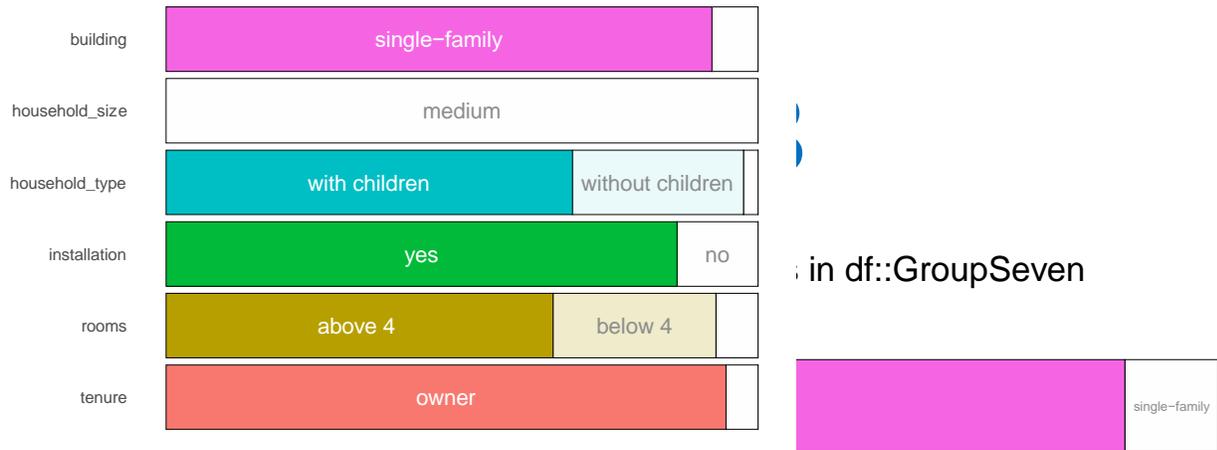


5. One-person household, owner of a super-large single-family building

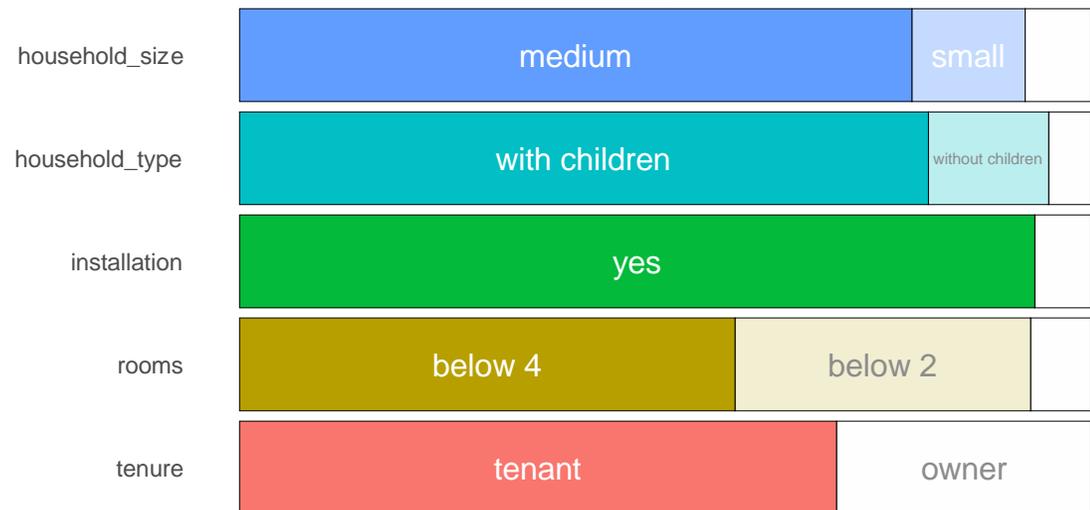
6. Large households with children, owners of a large single-family house

Frequency of categorical levels in df::GroupFour

Gray segments are missing values

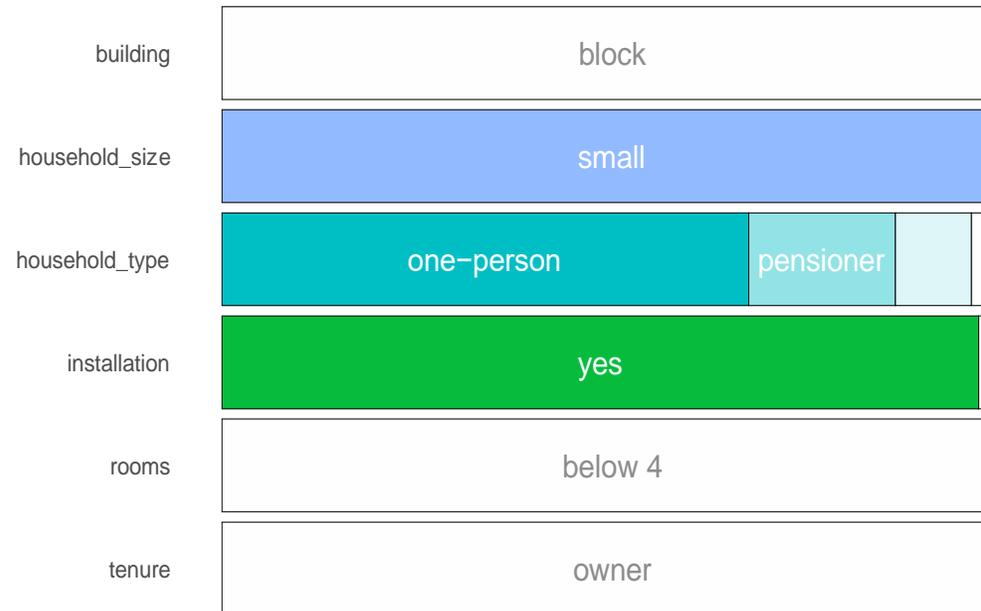


in df::GroupSeven



Frequency of categorical levels in df::GroupEight

Gray segments are missing values

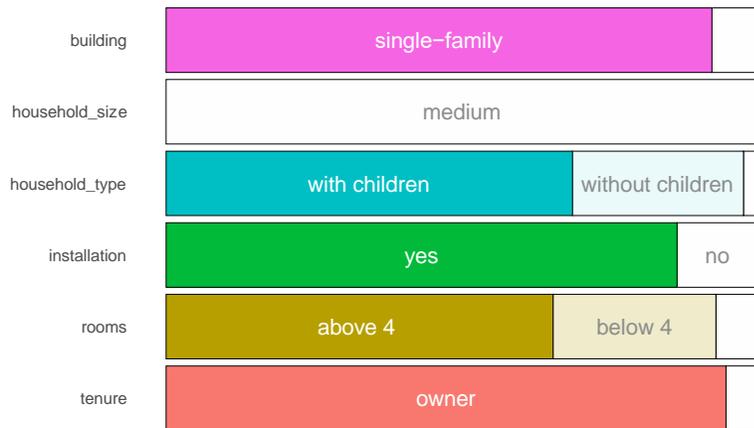


7. Medium-sized household with children renting a medium-sized apartment

8. One-person household, owner living in a large apartment

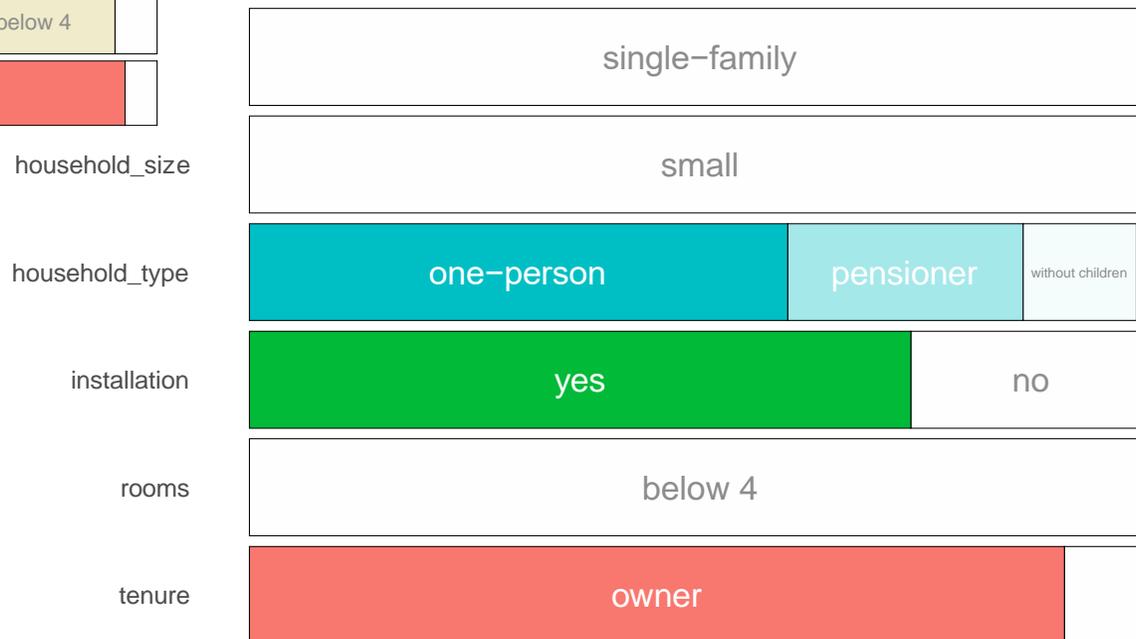
Frequency of categorical levels in df::GroupFour

Gray segments are missing values



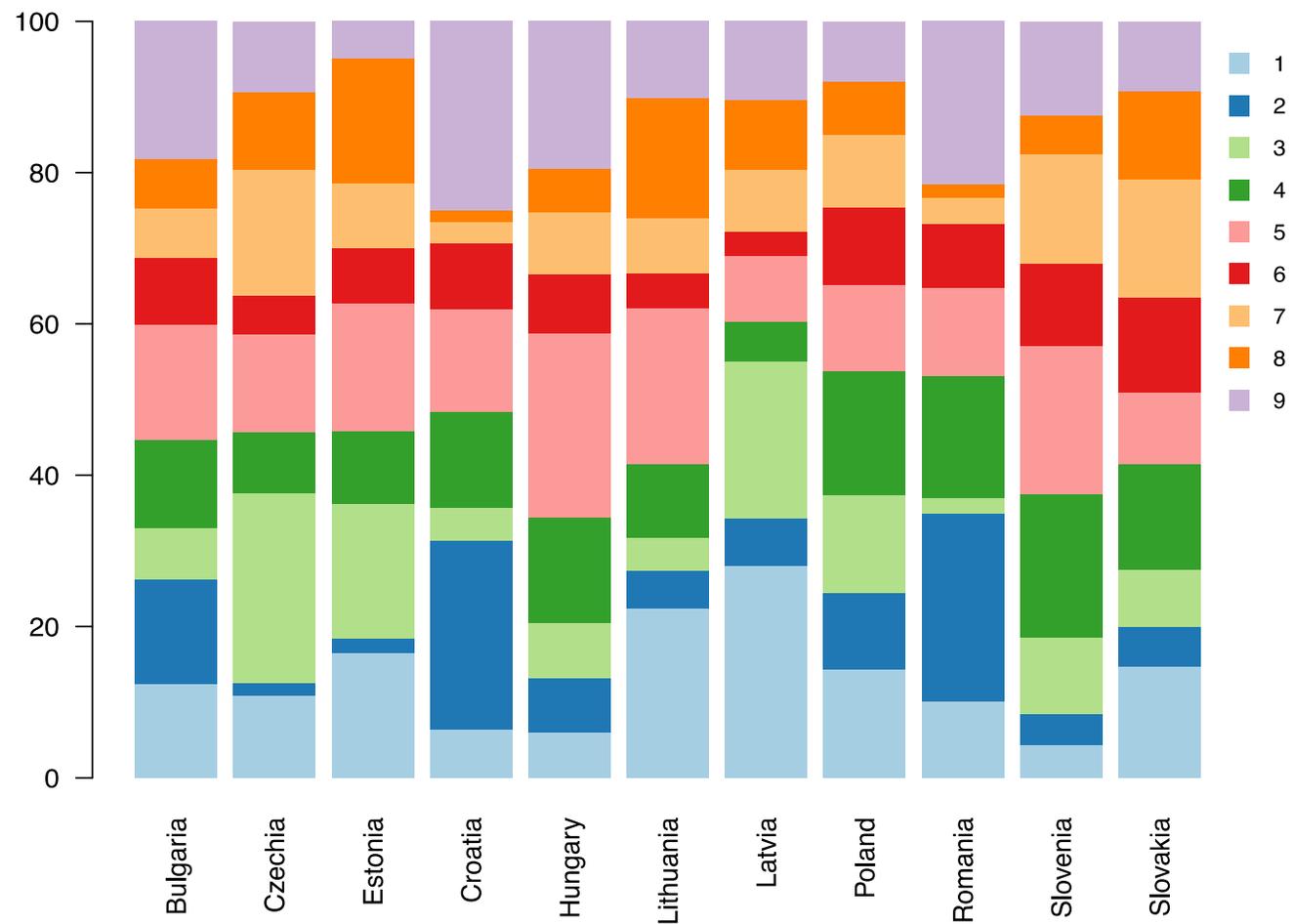
Frequency of categorical levels in df::GroupNine

Gray segments are missing values

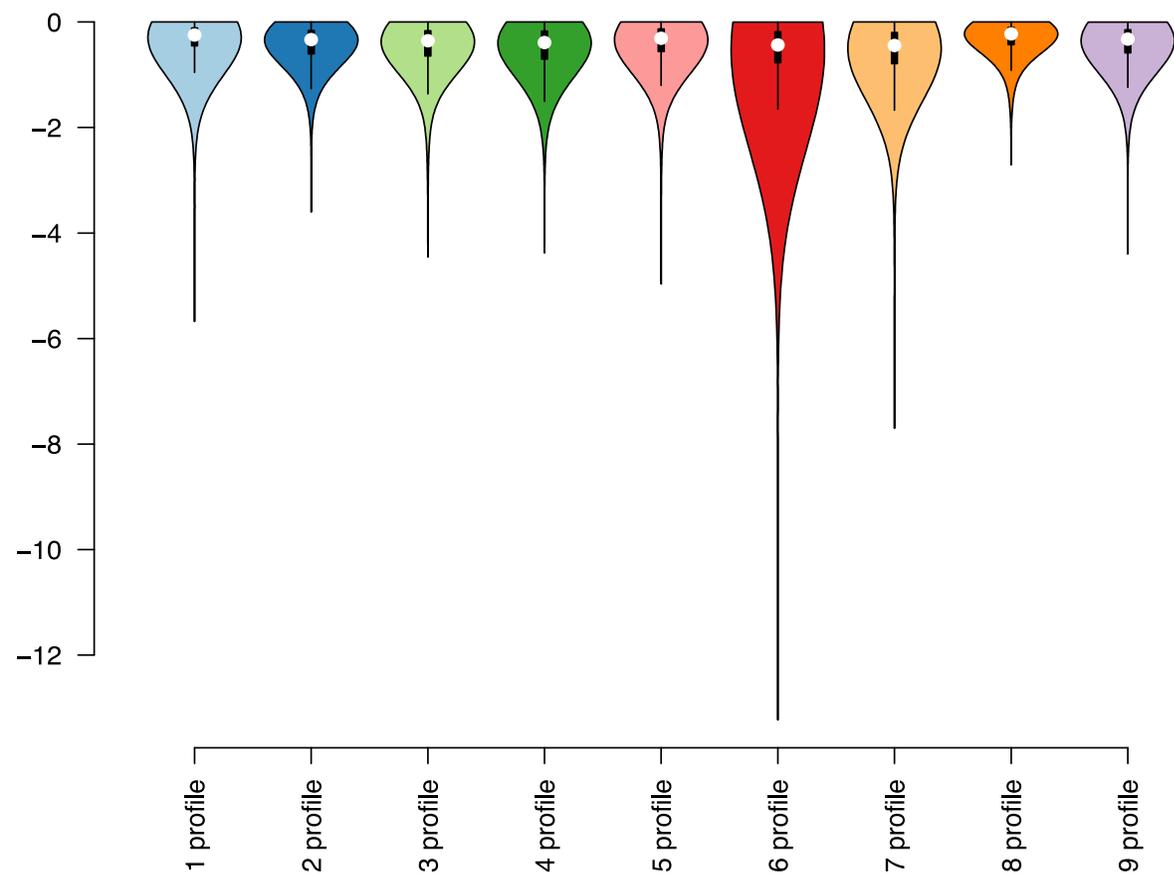


9. One-person household, owner of a large single-family building

Distribution of energy poverty profiles



Distribution of energy poverty depth



Conclusions

- In total 81061 households from 11 CEE countries are examined, of which 18331 (22.6%) are estimated to be at risk of energy poverty
- 9 energy poverty profiles common to all CEE countries are obtained in the partitioning around medoids clustering procedure
- Vulnerability factors include low income, tenant status, large space area, living in single-family buildings, dependent children
- Medians of the energy poverty depth vary between -0.44 and -0.22 being the highest in the seventh group

Acknowledgment

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