UNIVERSITÄT BERN

The Effect of the Energy Crisis 2021-2023 on the Financial Situation of the Households

CAS Applied Data Science

Mayra Spizzo und David von Holzen

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Outline

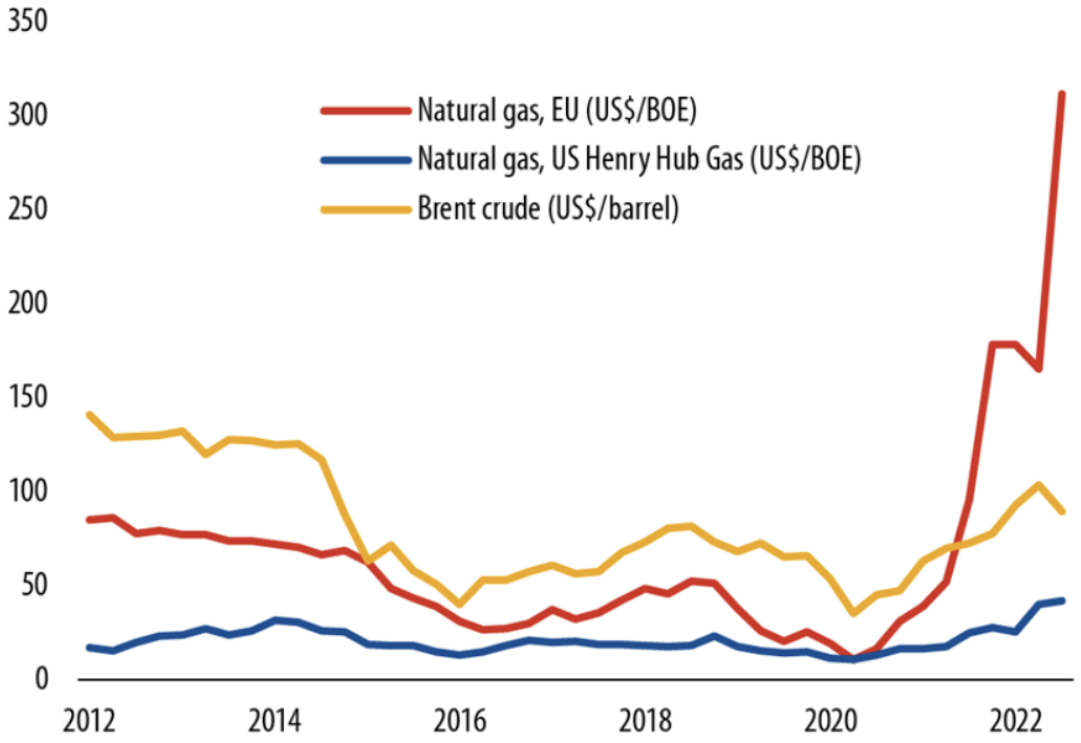
- Topic & Relevance
- Research Question
- Data Acquisition & Cleaning
- Descriptive Statistics
- Part 1: Analysis & Conclusion
- Part 2: Analysis & Conclusion
- Part 3: Analysis & Conclusion
- Evaluation / Discussion

Global Energy Crisis 2021 - 2023

European gas hit hardest

The recent rise in global oil prices and US natural gas prices is relatively modest compared with the gas price increases in Europe.

(real prices, quarterly average, US$ a barrel)



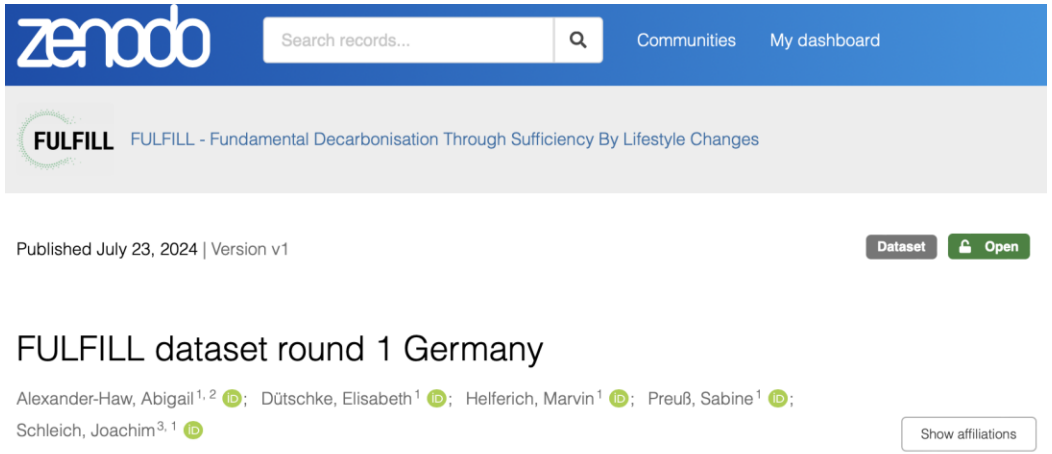
Sources: IMF PCPS; US Bureau of Labor Statistics; and IMF staff calculations.
Note: The consumer price index is rebased as 2021=100. BOE = barrel of oil equivalent.

- Global energy crisis in the aftermath of the COVID-19 pandemic
- Rise of natural gas prices 2021 and 2022
- Energy sources such as natural gas became more expensive
- Higher energy costs for the private households

Research Question

- Generally:
  - Did the global energy crisis lead to an increase of the income inequality respectively of the poverty rate because of the higher energy costs?
- Specifically:
  - Do households with lower income have a higher probability living in a building with natural gas as energy source and were therefore financially more strongly affected by the global energy crisis?

Data Acquisition: Data Source

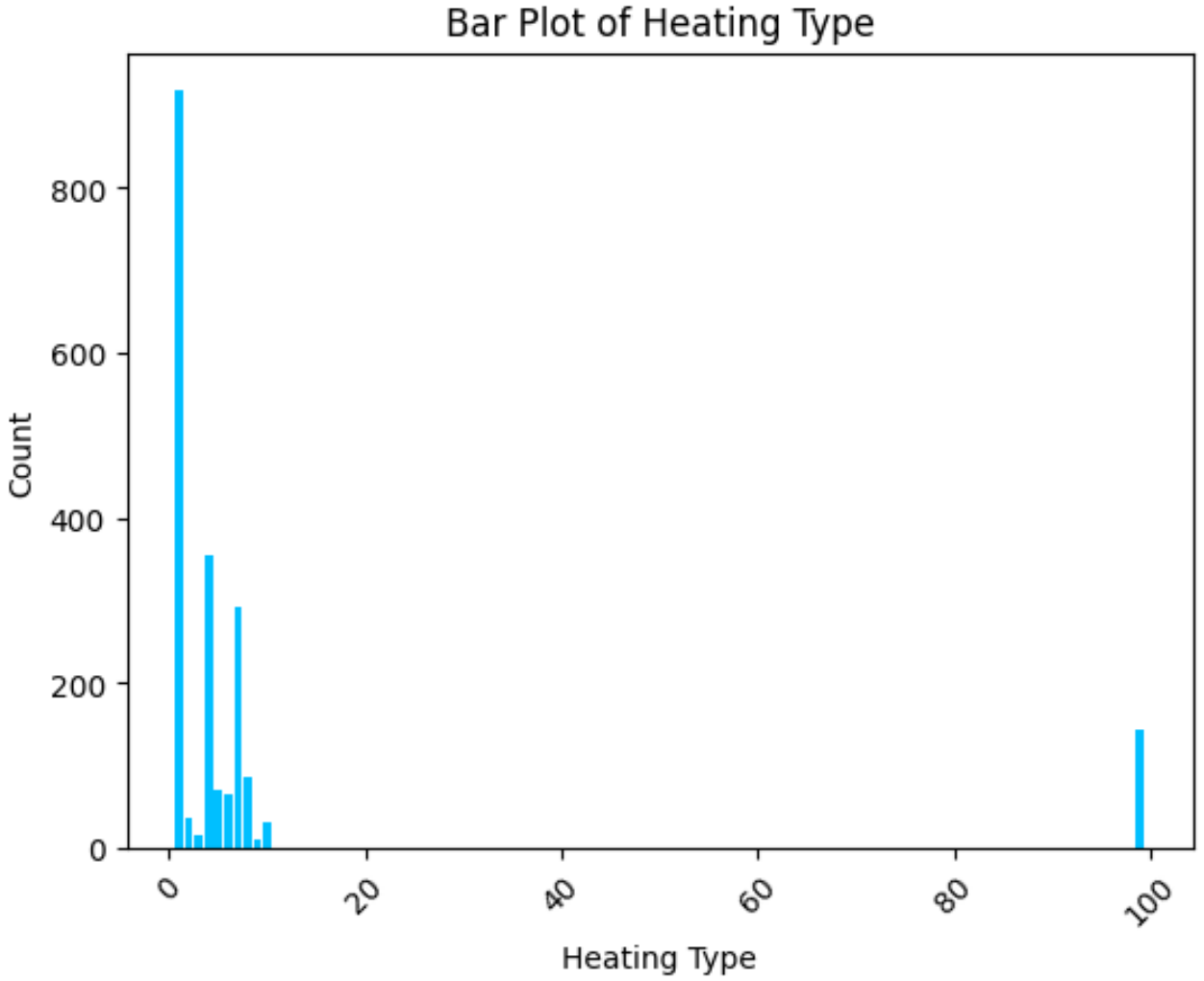


- Dataset from Zenodo
- Survey from Germany with around 2'000 observations
- Gathered in 2022 in August & September
- Project "Fundamental Decarbonisation Through Sufficiency By Lifestyle Changes" (FULFILL)
  - Quantitative Assessement of Carbon Footprint

Data Acquisition: Variables

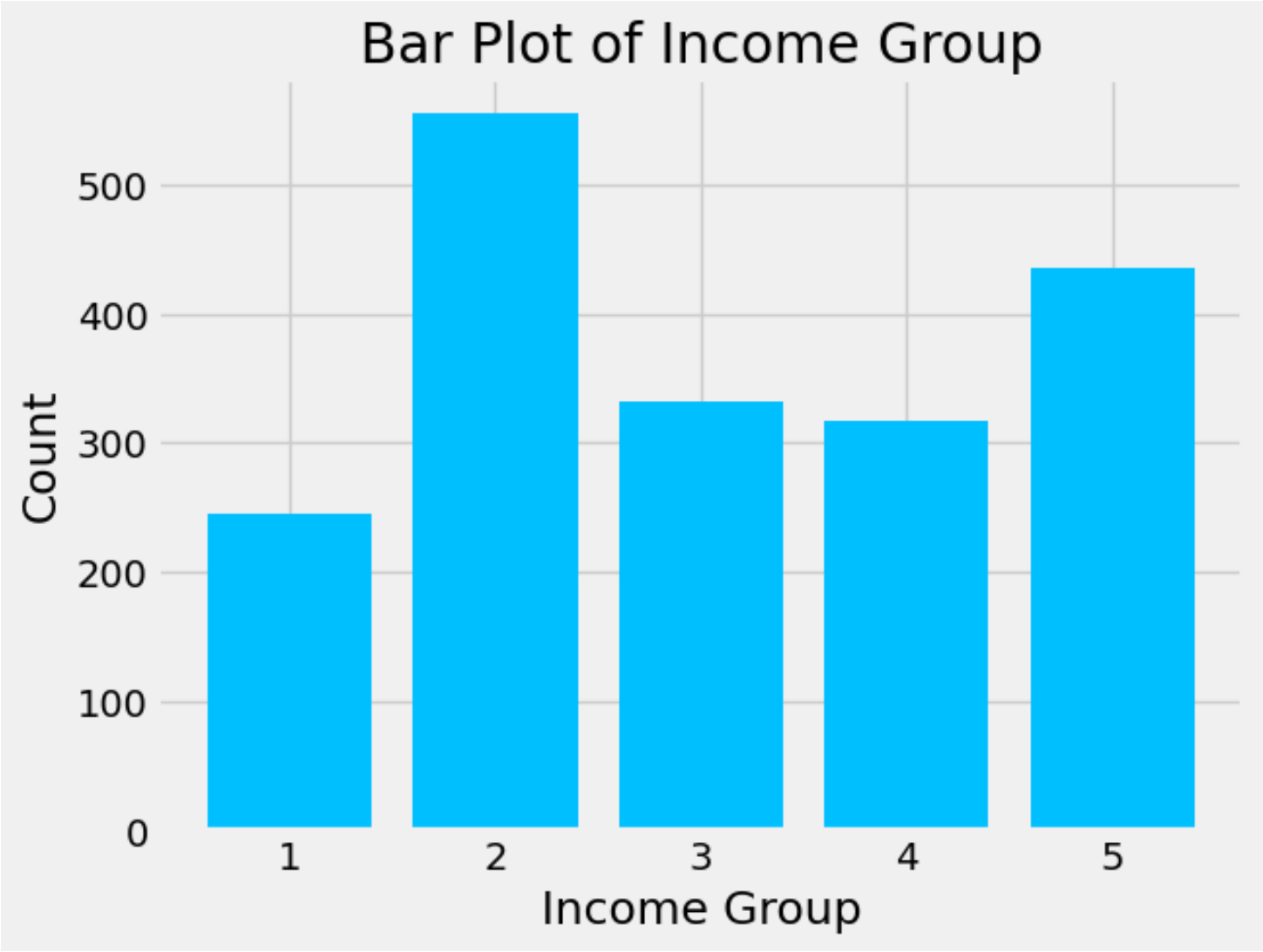
Variable Name	Data Type	Characteristics
Income Group	Categorical	1: < 15'600 €
		2: 15'600 – 31'200 €
		3: 31'200 – 43'200 €
		4: 43'200 – 60'000 €
		5: > 60'000 €
Heating Type	Categorical	1: Natural Gas
		2: Liquefied Petroleum Gas
		3: Biogas
		4: Heating Oil
		5: Electricity
		6: Electric Heat Pump
		7: District Heating
		8: Wood/Biomass
		9: Solar Thermal Energy
		10: Others
		99: Do not know

Data Cleaning

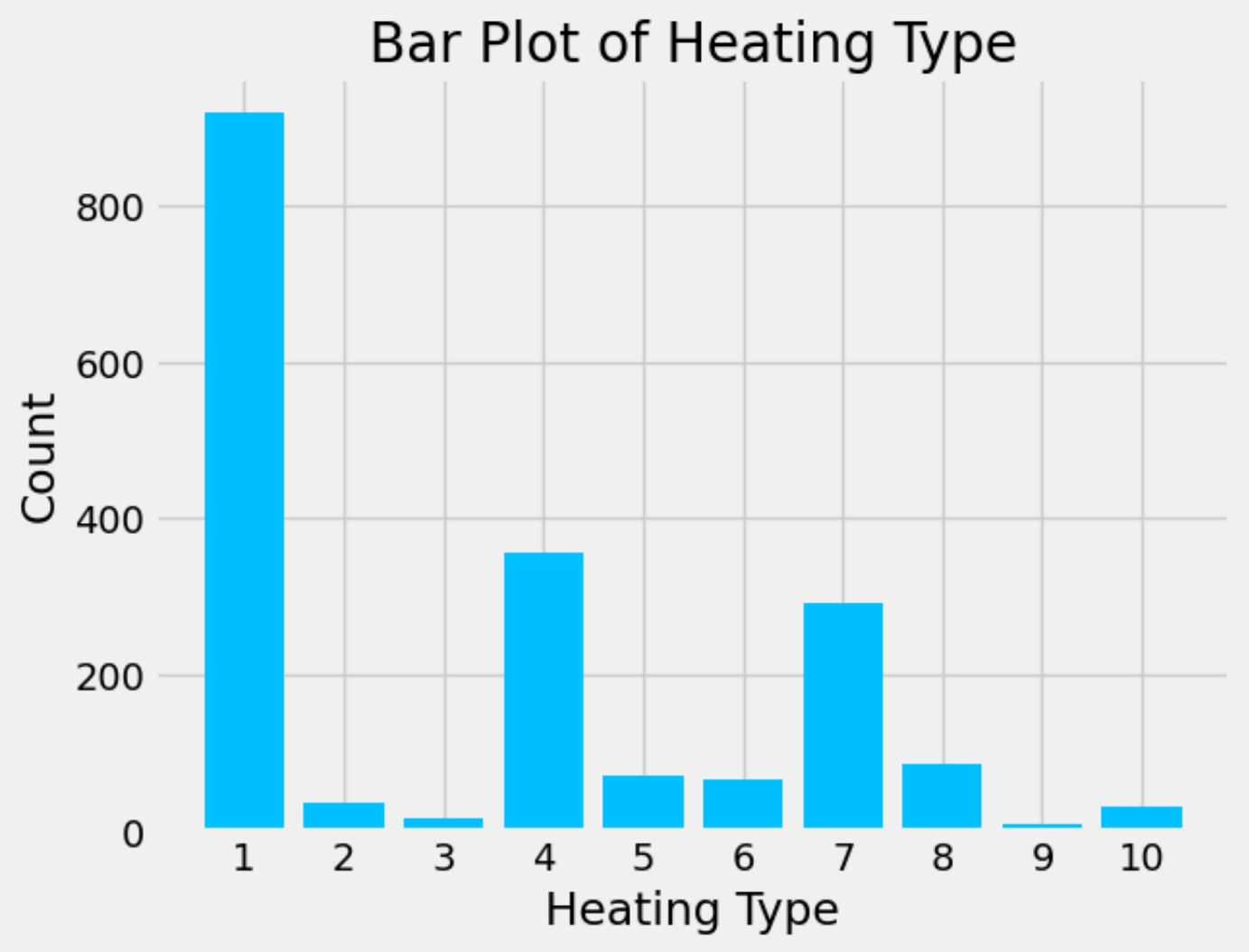


- Heating Type: 144 missing values
- Income Group: no missing values
- Heating type: dummy variable for analysis
- Subsetting Variables

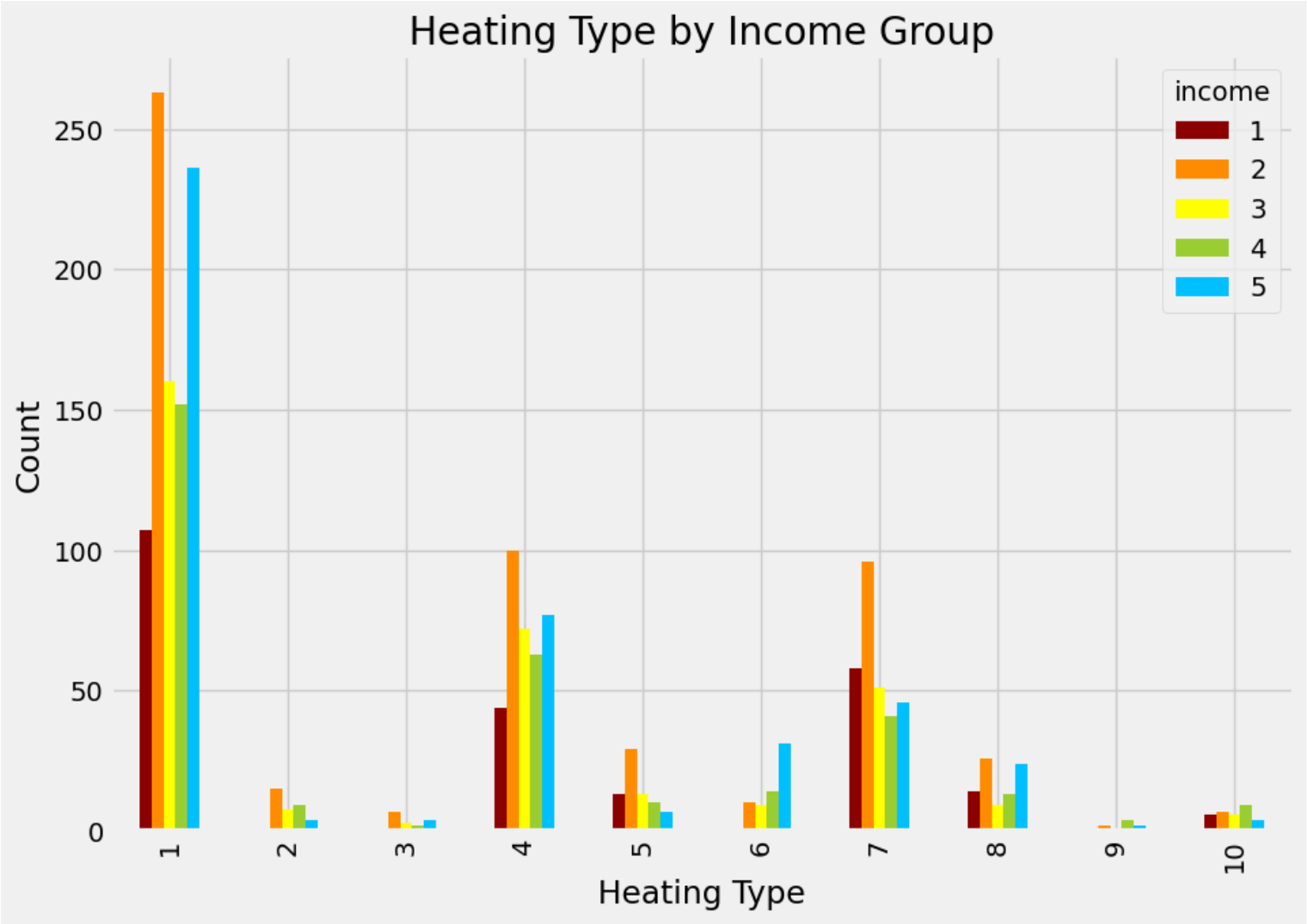
Descriptive Statistics: Income Group



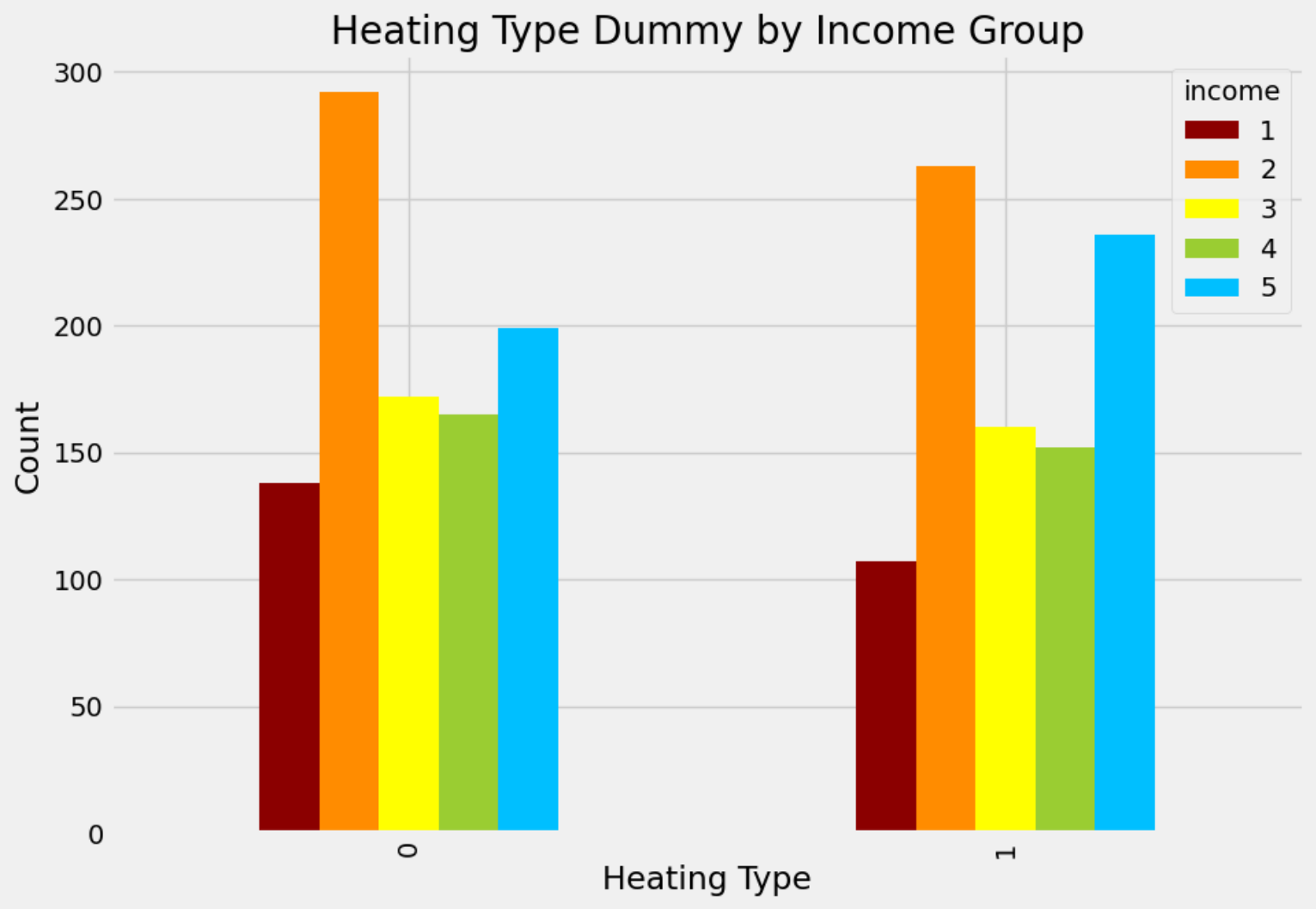
Descriptive Statistics: Heating Type



Descriptive Statistics: Heating Type by Income Group



Descriptive Statistics: Heating Type Dummy



Part 1: Analysis & Conclusion

H1: People with lower income live more frequently in houses with natural gas as energy source.

- One categorical outcome variable: Heating type (dummy-coded for the heat type natural gas)
- One categorical independent variable: Income

- Pearson’s Chi-Squared Test

Part 1: Analysis & Conclusion

H1: People with lower income live more frequently in houses with natural gas as energy source.

Assumptions of the Pearson’s Chi-Squared Test:

- ✓ Interdependence
- ✓ Categorical data (nominal or ordinal)
- ✓ Expected frequencies > 5
- ✓ Big enough dataset
- ✓ Degrees of freedom > 1

Part 1: Analysis & Conclusion

H1: People with lower income live more frequently in houses with natural gas as energy source.

Results of the Pearson’s Chi-Squared Test (significance level: 0.05):

- X-squared: 8.334229
- Degrees of freedom: 4
- P-value: 0.08007433

The null hypothesis can not be rejected.

There is not a significant association between the two variables.

Part 2: Analysis & Conclusion

H2: People with lower income live more frequently in older houses (which are not that good isolated and therefore need more energy to heat).

- One categorical outcome variable: Building age
- One categorical independent variable: Income

- Pearson’s Chi-Squared Test

✓ Assumptions are fulfilled

Part 2: Analysis & Conclusion

H2: People with lower income live more frequently in older houses (which are not that good isolated and therefore need more energy to heat).

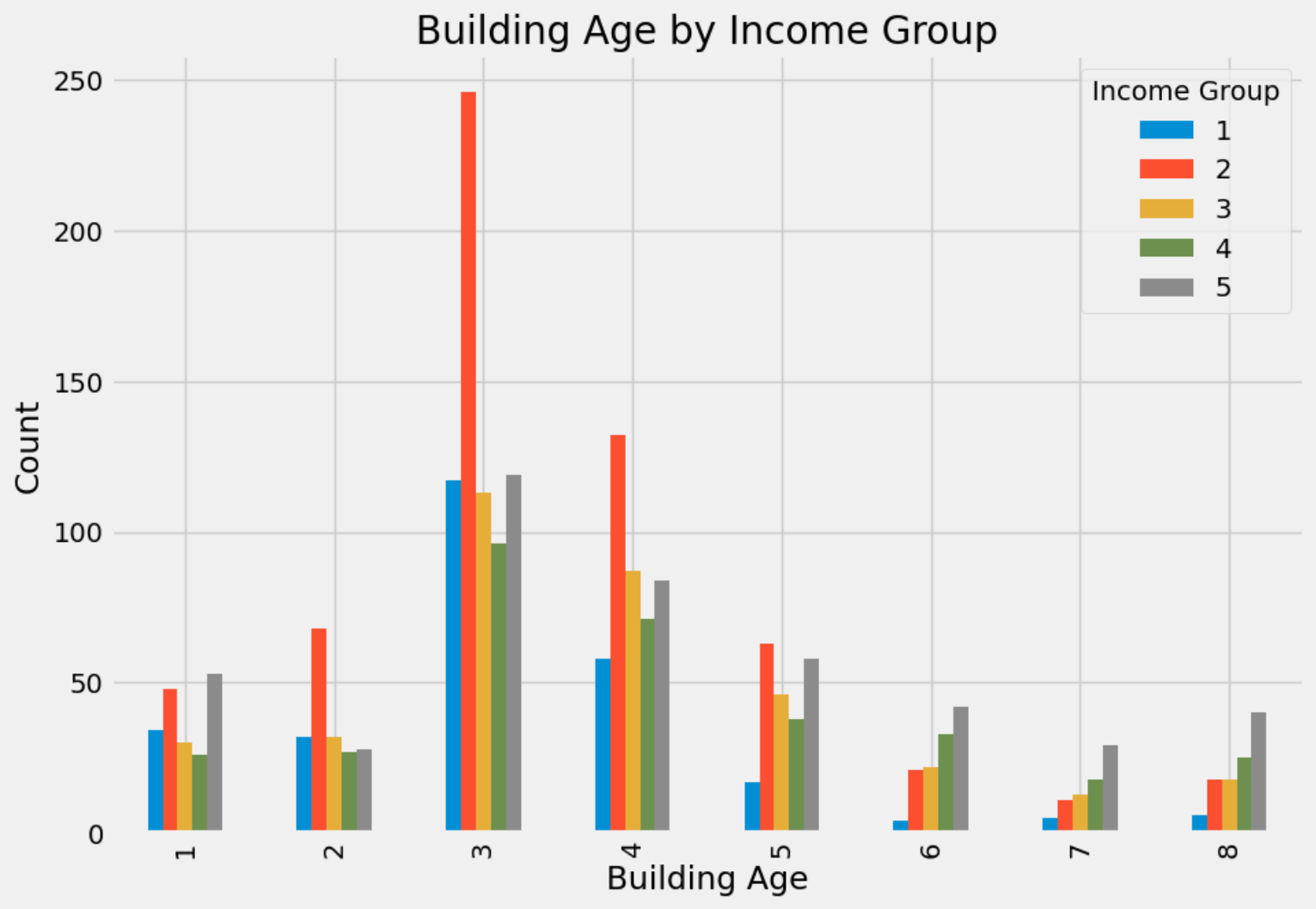
Results of the Pearson’s Chi-Squared Test:

- X-squared: 131.1222
- Degrees of freedom: 28
- P-value: 2.775407e-15

The null hypothesis can be rejected.

There is a significant association between the two variables building age and income.

Part 2: Analysis & Conclusion



Part 3: Analysis & Conclusion

H3: People with lower income live more frequently in houses that are not renovated.

- One categorical outcome variable: Building renovation (dummy-coded)
- One categorical independent variable: Income

- Pearson’s Chi-Squared Test

✓ Assumptions are fulfilled

Part 3: Analysis & Conclusion

H3: People with lower income live more frequently in houses that are not renovated.

Results of the Pearson's Chi-Squared Test (significance level: 0.05):

- X-squared: 6.970153
- Degrees of freedom: 4
- P-value: 0.1374739

The null hypothesis can not be rejected.

There is not a significant association between the two variables.

Evaluation / Discussion

- Heating type: Widespread use of natural gas
- Renovation: Possibly buildings from the middle class
- Would be better to have the income variable as a continuous variable
- Further analysis: Investigation of multiple countries