# On the Reaction of Consumption Expenditures to Electricity Price Shocks

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# Motivation and research question

- **Why?** Substantial and very heterogeneous electricity price changes in Swiss municipalities in 2023 and 2024 Google trends
- **What?** Quantify the impact of these price changes on consumption expenditures
- **How?** Use transactional payment data to estimate reaction of consumption expenditures

# Electricity market in Switzerland

- Heavily regulated
- Households cannot choose supplier
- Prices are announced in advance and fixed for a full year
  Illustration
- More than 600 electricity providers
- Large heterogeneities across electricity providers leading to substantial price differences Price components

# Electricity price – Temporal dimension

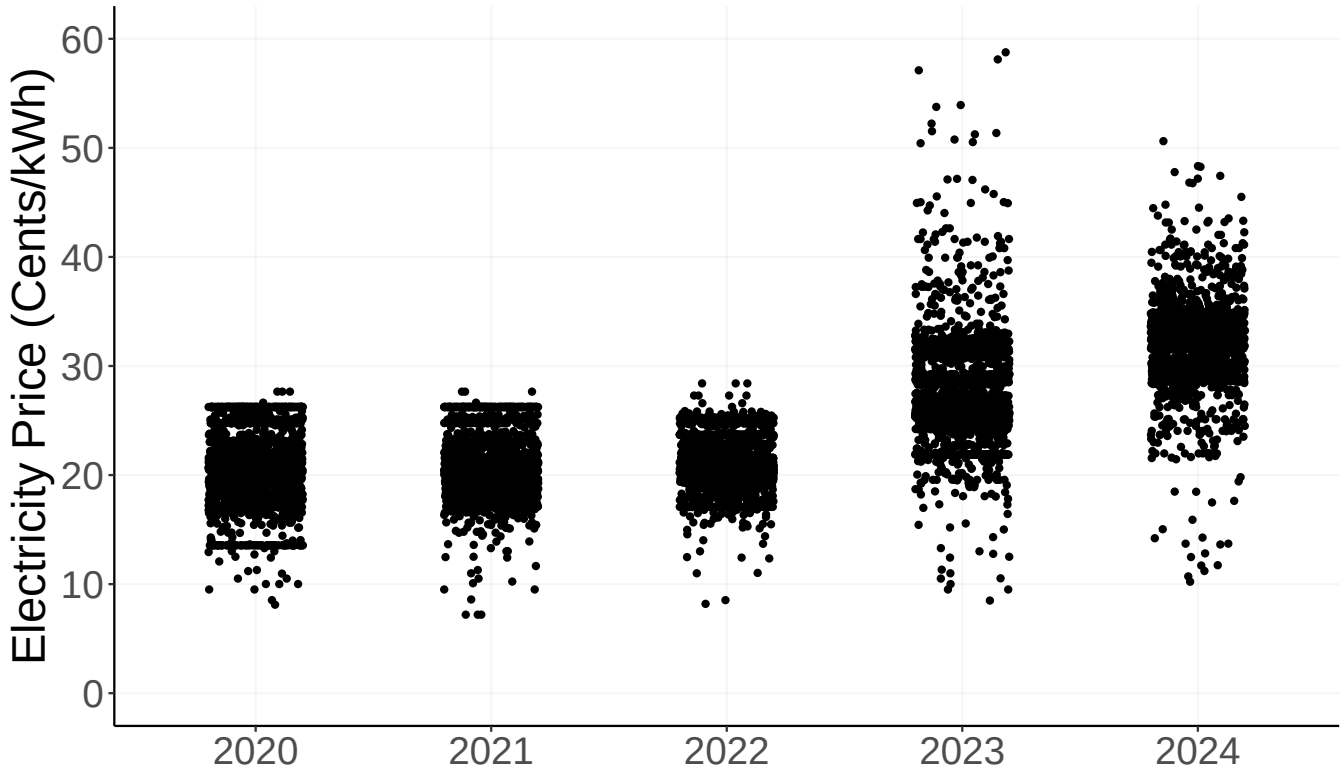



Figure: Variation of electricity price level across municipalities

Growth

# Electricity price – Spatial dimension

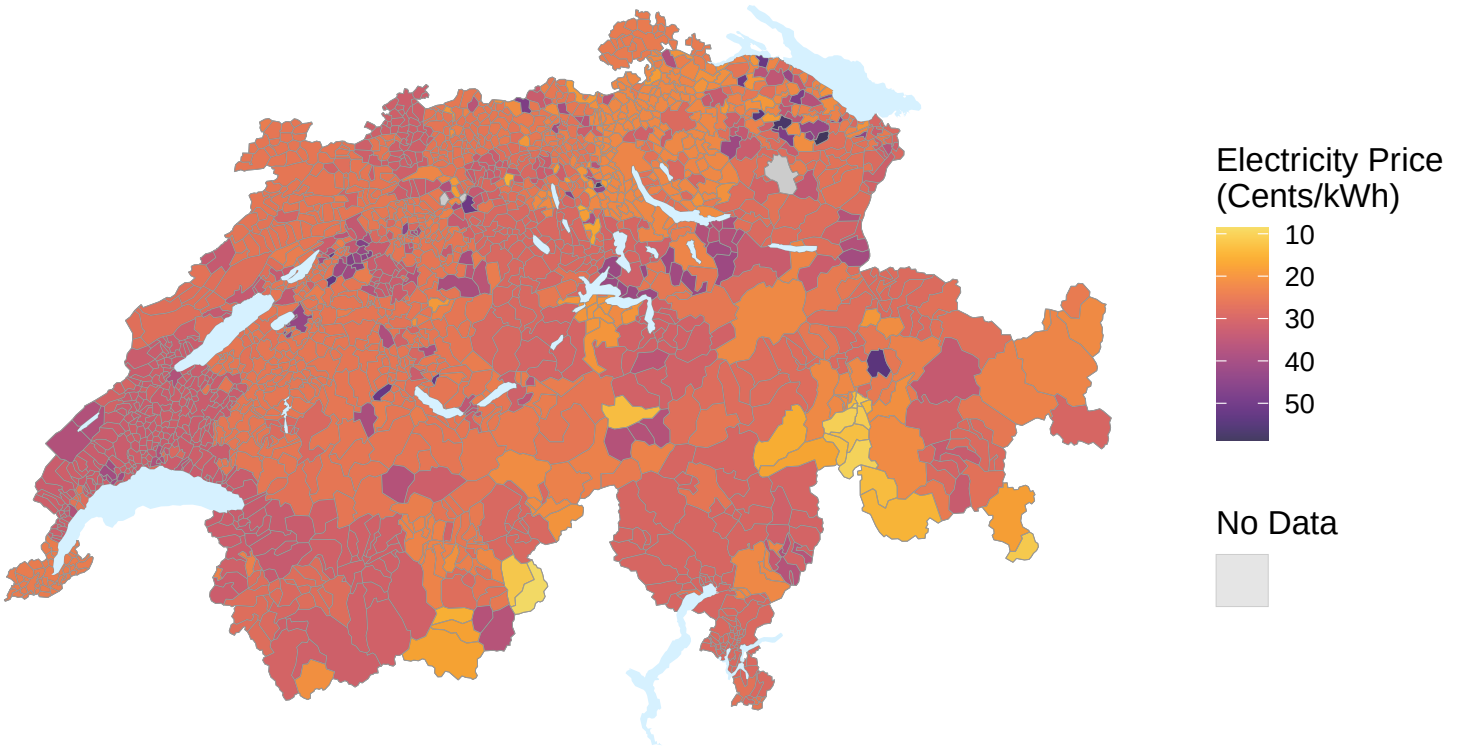



Figure: Electricity price in 2023

Growth

# Electricity price – Predictability

- Electricity price changes uncorrelated to location, size, and wealth of a municipality Location Size
- Price relative to other municipalities cannot explain future relative price Relative change

## Bottom line

Size of electricity price changes in 2023 and 2024 came as a surprise

# Transactional payment data – Description

- Provided by Worldline Schweiz AG
- Majority of digital payments in Switzerland included
- Various information around the payment included
- Place of residence of the cardholder must be inferred

# Transactional payment data – Sample

- Restrict sample to cards active for at least two full years
- Active: At least ten transactions per year under consideration and at least one transaction in the year before and the year after
- For example, for spending growth in 2023, cards must have at least ten transactions in 2022 and 2023 and at least one transaction in 2021 and 2024

Illustration

# Transactional payment data – Summary statistics

| | Count | Mean | Std. | P25 | P50 | P75 |
|---|---|---|---|---|---|---|
| **Spending** | | | | | | |
| 2022 | 2,160,497 | 7,513 | 7,641 | 2,473 | 5,561 | 10,373 |
| 2023 | 1,785,881 | 7,032 | 7,419 | 2,064 | 4,925 | 9,797 |
| 2024 | 3,597,276 | 6,935 | 7,344 | 2,097 | 4,962 | 9,652 |
| **Growth (%)** | | | | | | |
| 2022 | 2,160,497 | 5.39 | 62.76 | -25.01 | 3.69 | 34.57 |
| 2023 | 1,785,881 | 3.17 | 67.64 | -29.16 | 1.13 | 33.24 |
| 2024 | 3,597,276 | 2.60 | 69.37 | -29.99 | -0.41 | 31.26 |

Table: Summary statistics of yearly spending

# Baseline analysis

- Estimate reaction of consumption expenditures to electricity price shocks:

$$\Delta \ln(C_{i,j,t}) = \beta \Delta \ln(P_{j,t}) + \alpha_j + \gamma_t + u_{i,j,t} \quad (1)$$

- $i$ is a cardholder in municipality $j$ at time $t$

- Consider heterogeneities across consumption categories, durability, and cardholder income

# Total effect

| | (1) | (2) |
|---|---|---|
| Total | -0.023*** | |
| | (0.008) | |
| 2022 | | -0.043 |
| | | (0.100) |
| 2023 | | -0.016 |
| | | (0.015) |
| 2024 | | -0.028 |
| | | (0.033) |
| Observations | 7,529,392 | 7,529,392 |
| Municipality fixed effects | Yes | Yes |
| Time fixed effects | Yes | Yes |

Table: Output of regression (1) using yearly data

# Effect by categories

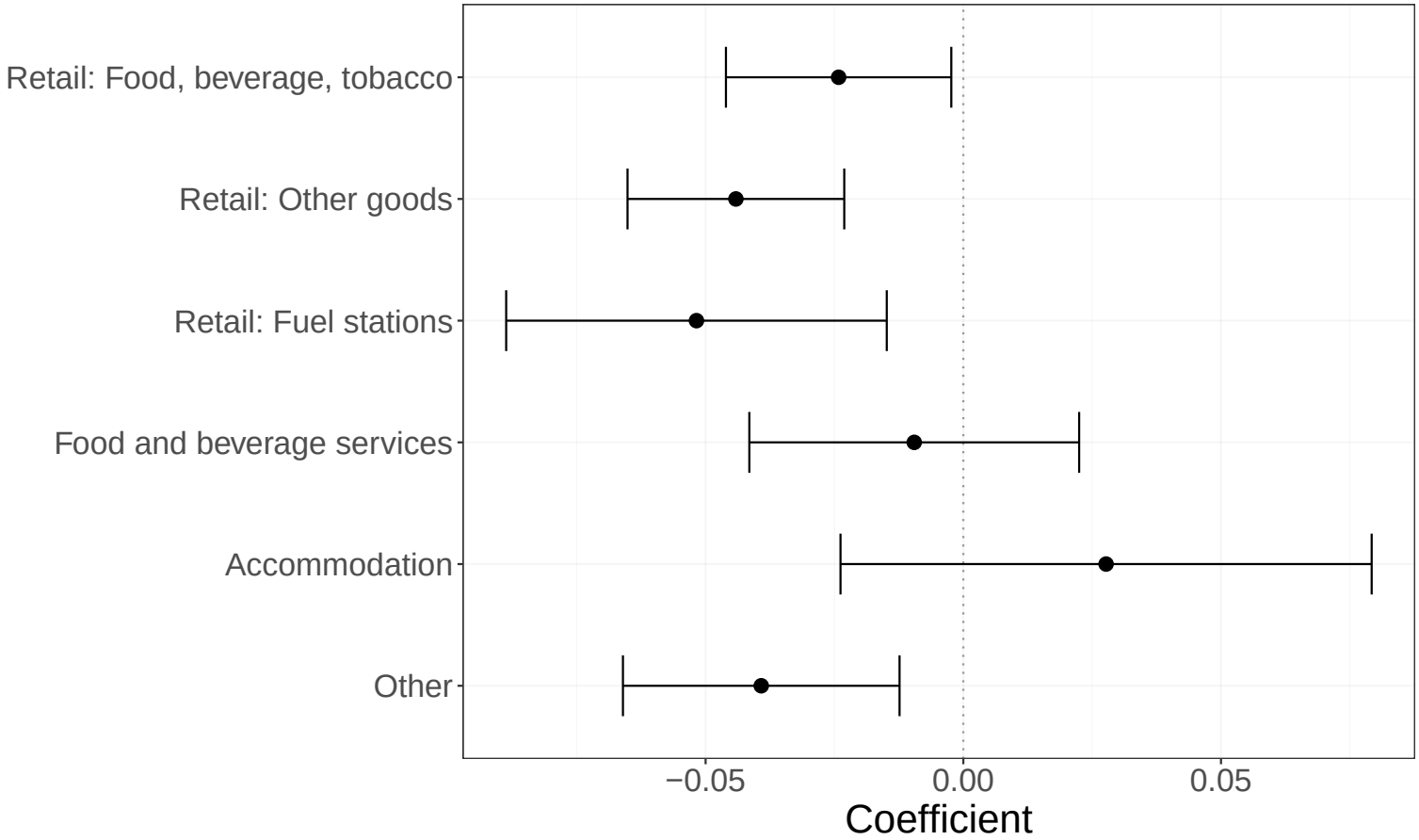



Figure: Coefficient of regression (1) by category with 95% confidence interval

# Effect by durability

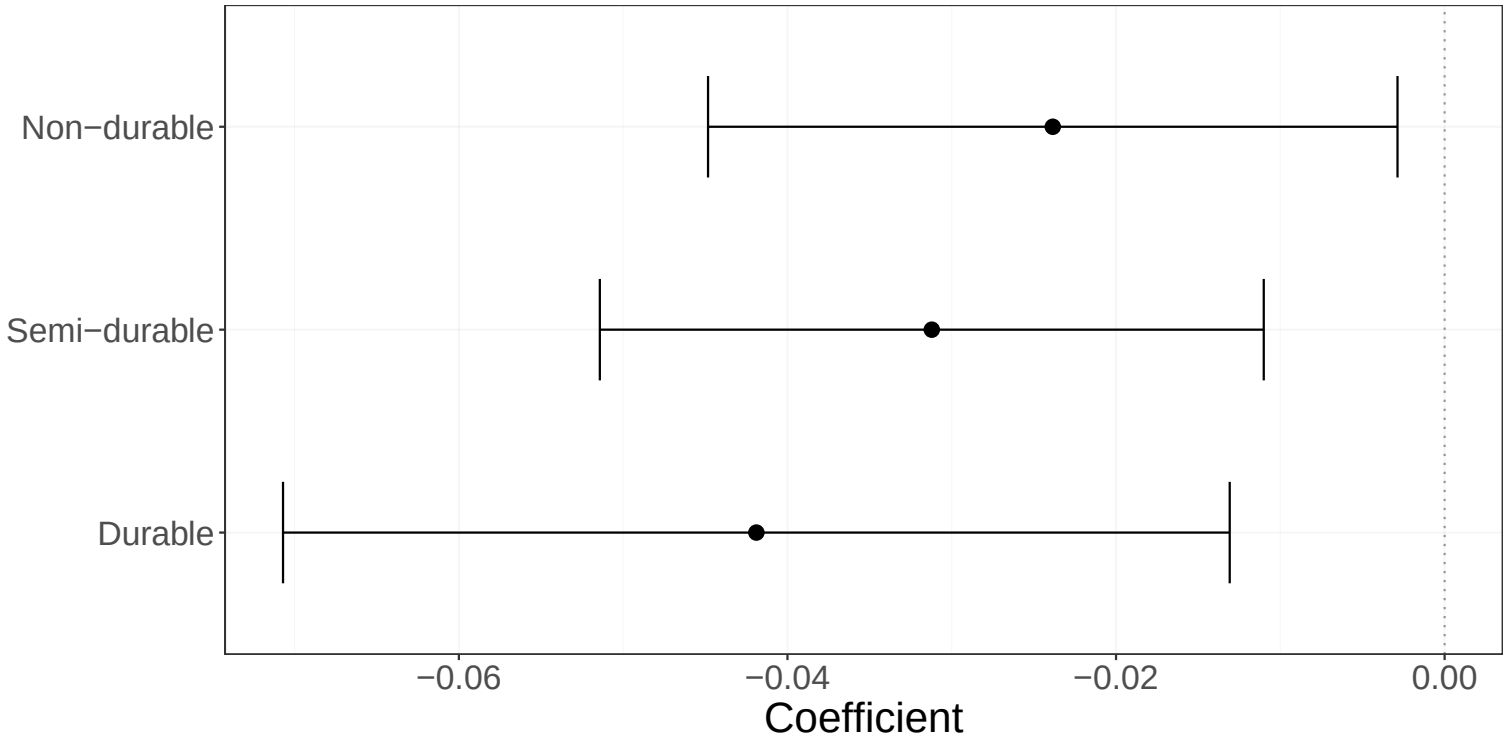



Figure: Coefficient of regression (1) by durability with 95% confidence interval

# Effect over time

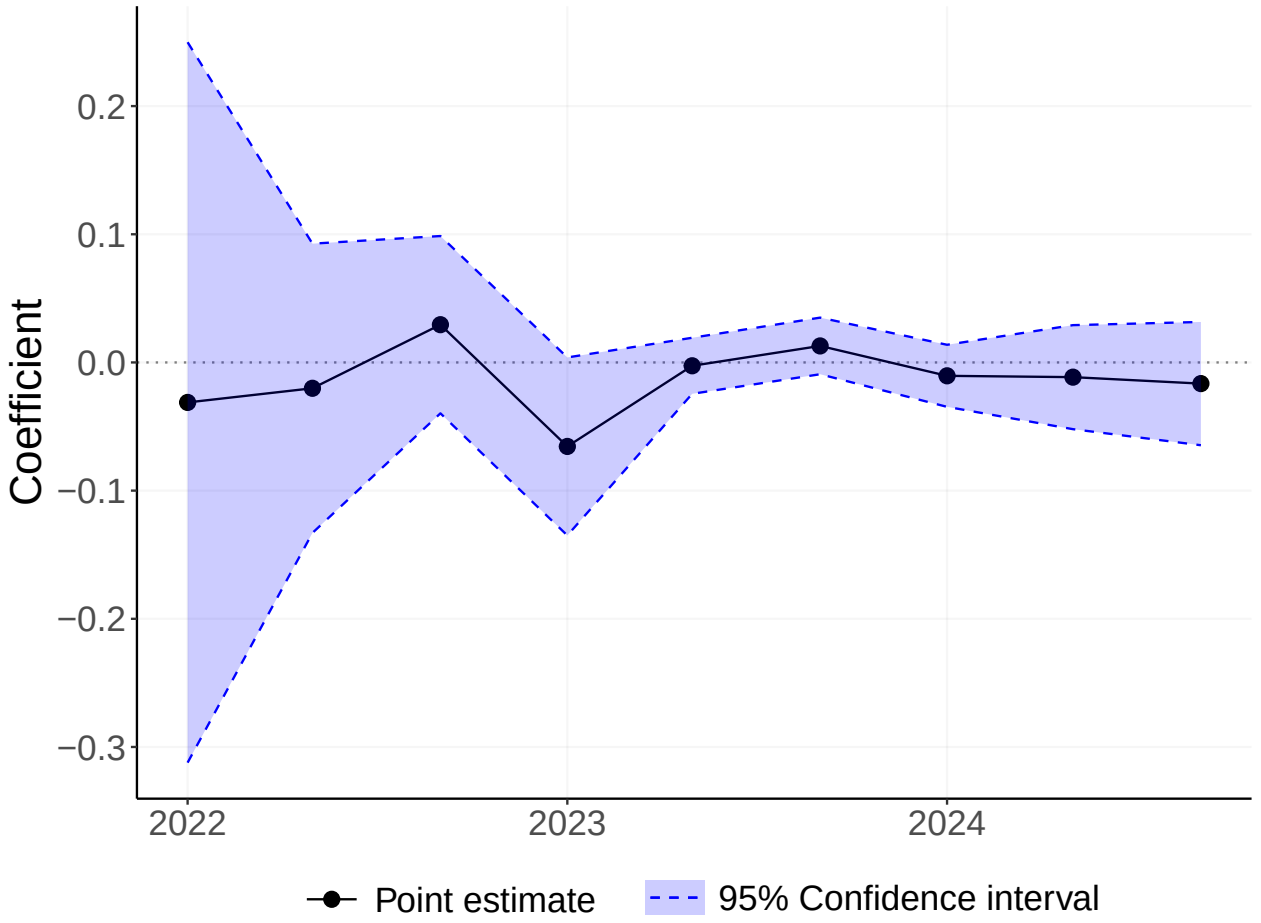



Figure: Coefficient of regression (1) by trimester with 95% confidence interval

# Effect by cardholder income

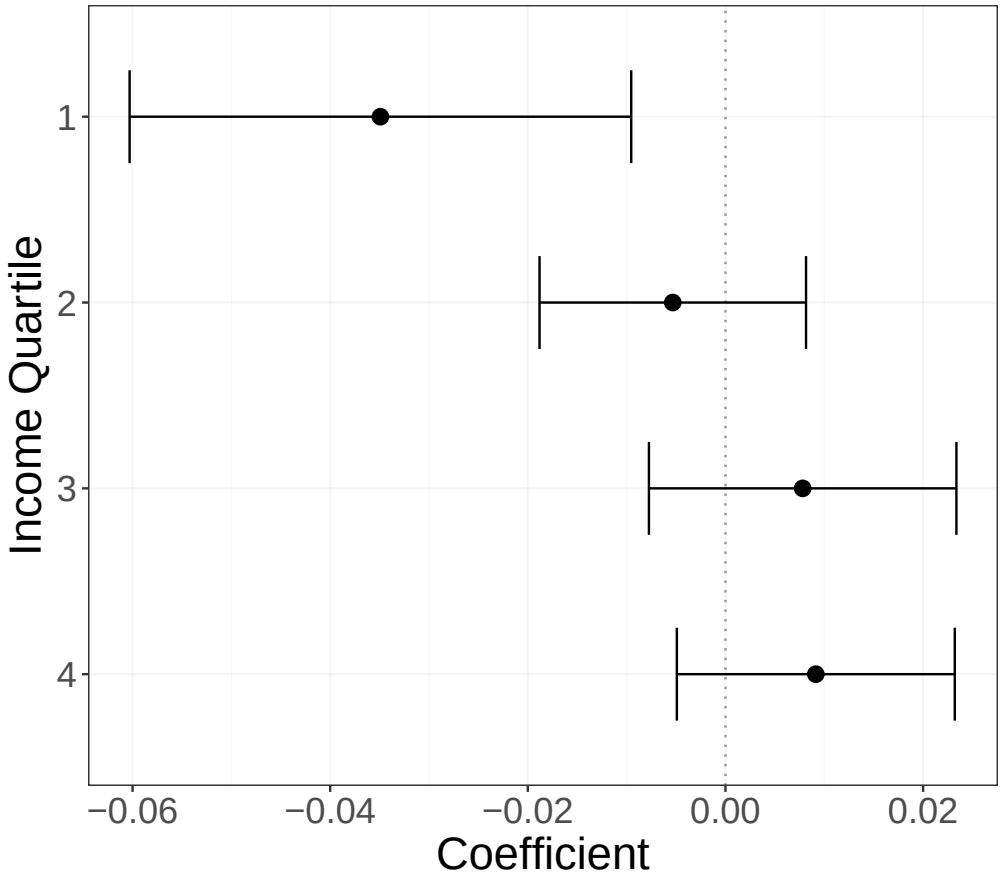



Figure: Coefficient of regression (1) by income quartile with 95% confidence interval

# Structural analysis

- Estimate reaction of consumption expenditures around announcement and implementation of the new electricity price
- Structural interpretation of the results in terms of the intra- and intertemporal elasticity of substitution

# Theoretical consumption evolution

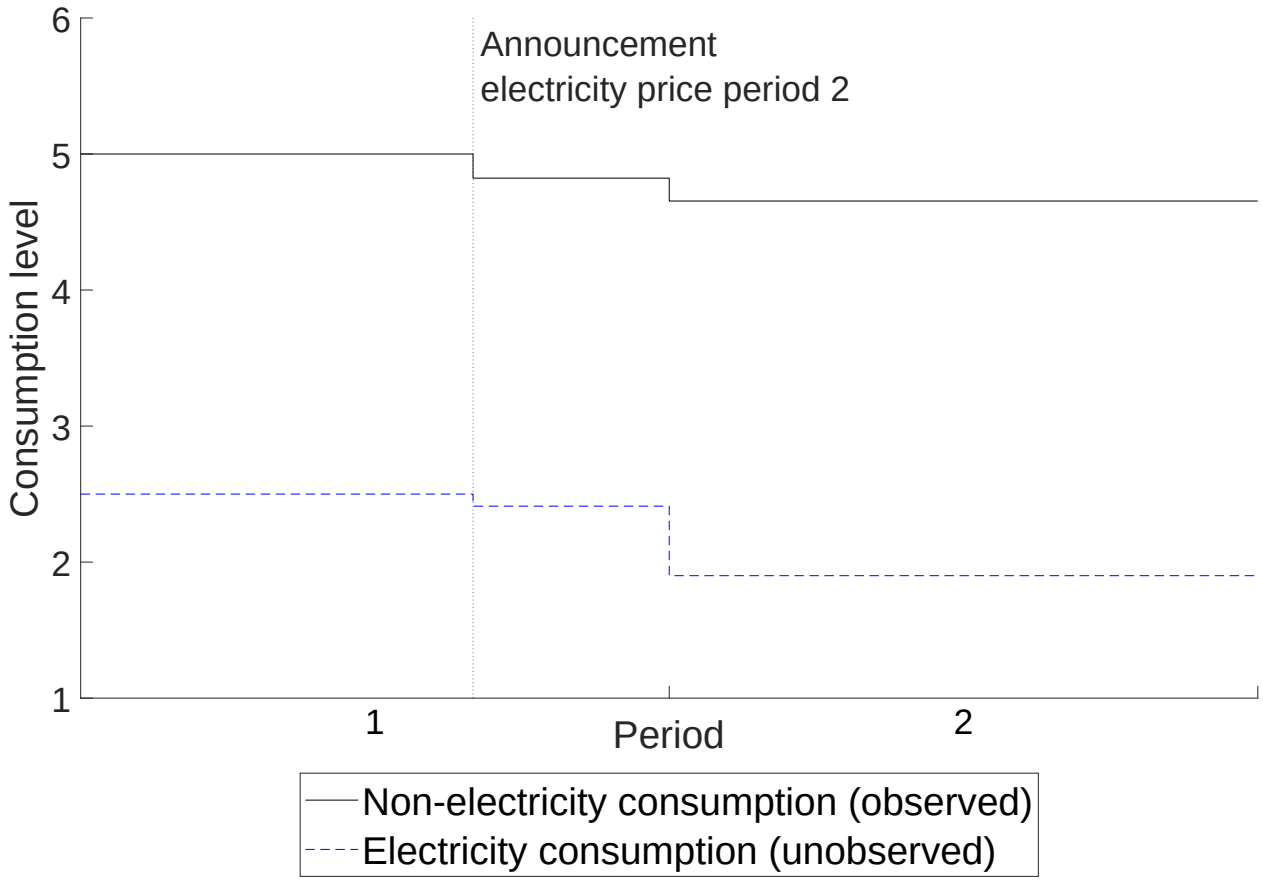



Figure: Evolution of electricity and non-electricity consumption

# Structural interpretation (preliminary)

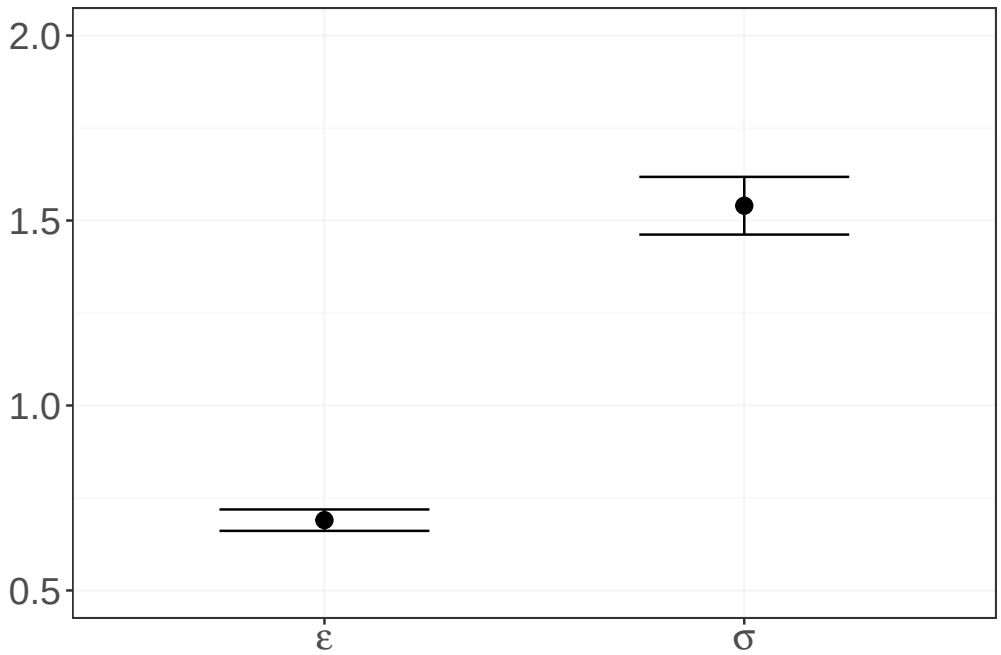



Figure: Estimates of the intratemporal ($\varepsilon$) and intertemporal ($\sigma$) elasticity of substitution for 2023 with 95% confidence interval.

# Summary

- Substantial electricity price changes in 2023 and 2024
- Size of price changes unpredictable
- Use of transactional payment data to estimate consumption expenditures on an individual level
- Negative relation between electricity price shocks and consumer spending growth, driven by lowest income quartile and spending on durables

# Appendix

# Interest in electricity prices

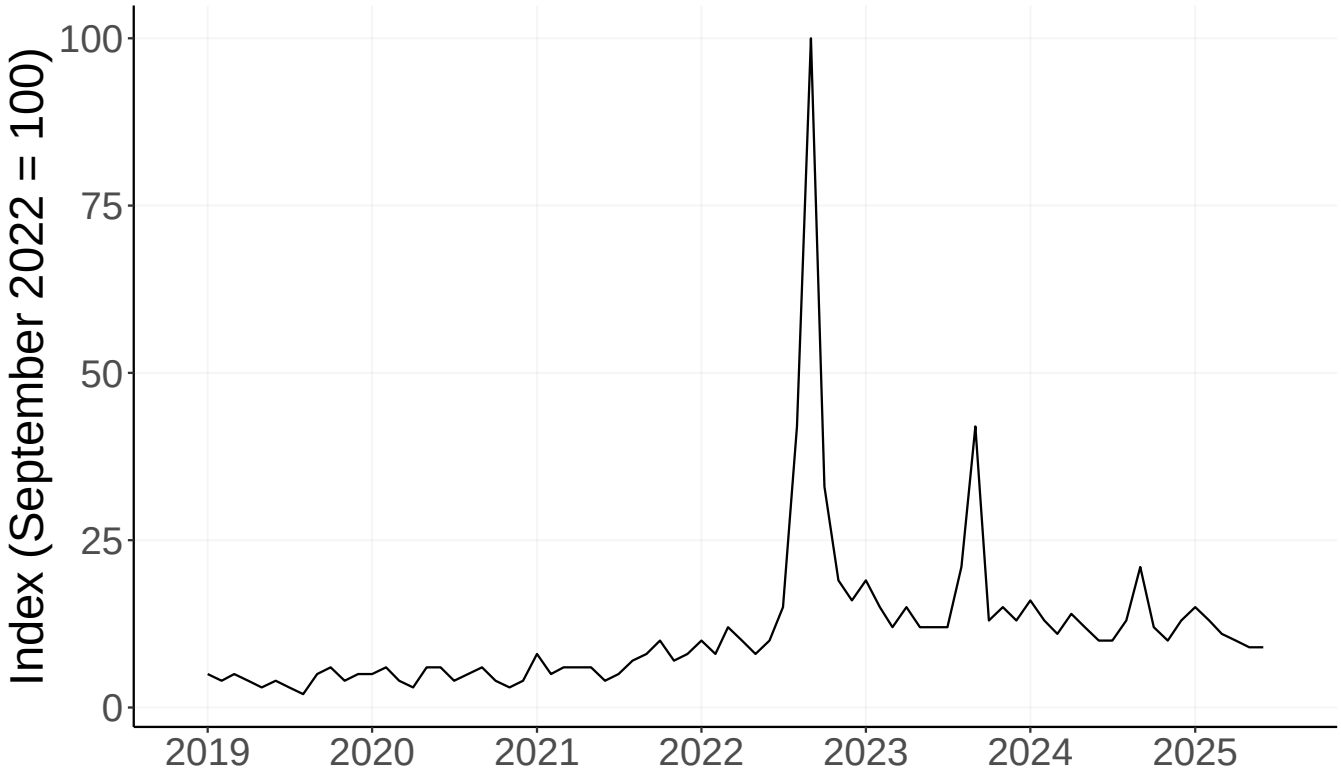



Figure: Google trends for electricity price in Switzerland

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# Electricity prices in Switzerland

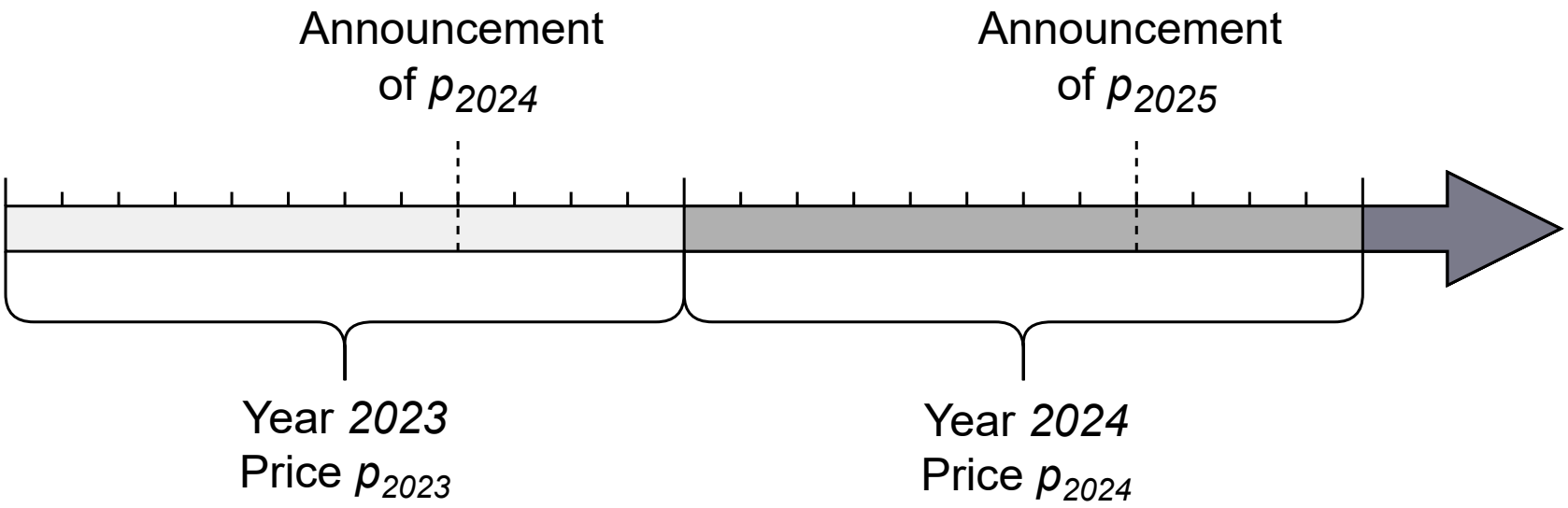



Figure: Timeline of electricity prices in Switzerland

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# Electricity price components

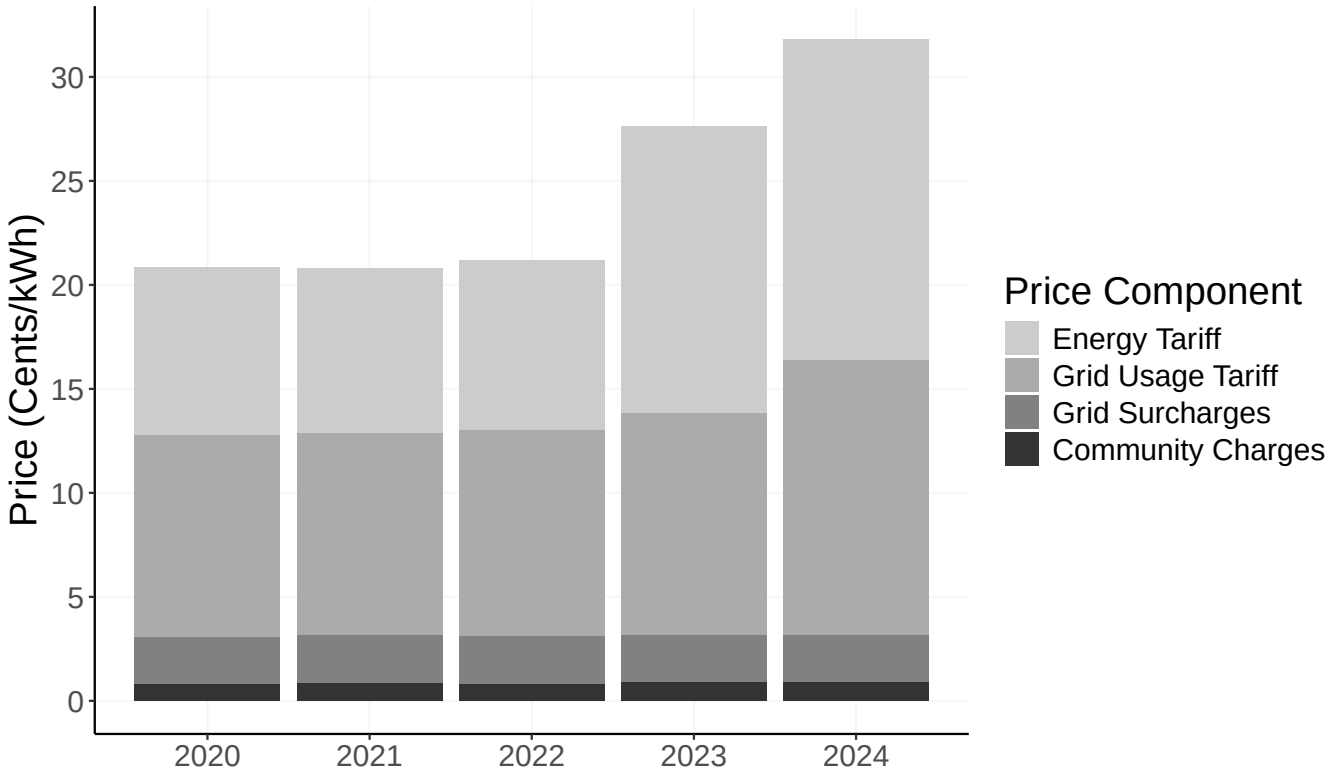



Figure: Mean electricity price across municipalities

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# Electricity price growth – Temporal dimension

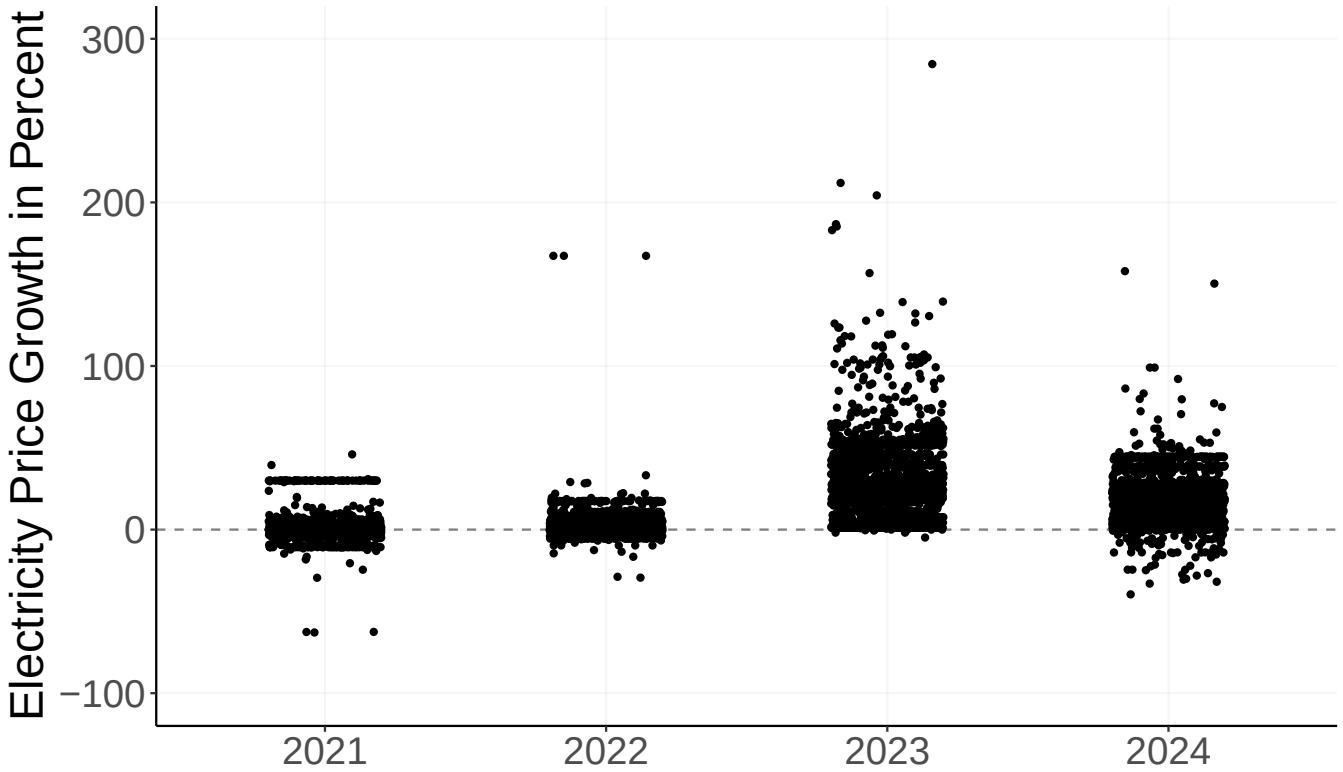



Figure: Variation of electricity price growth across municipalities

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# Electricity price growth – Spatial dimension

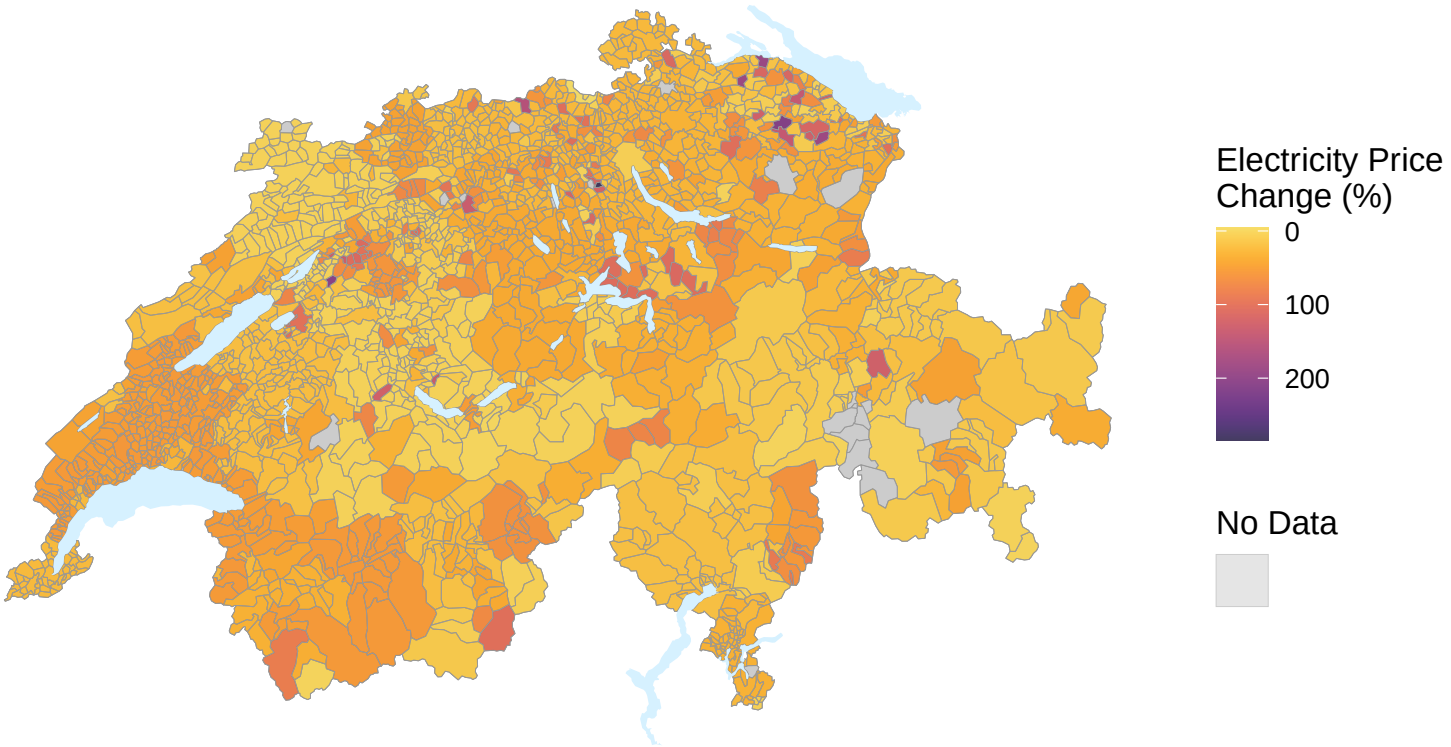



Figure: Electricity price change in 2023

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# Electricity price growth – Region

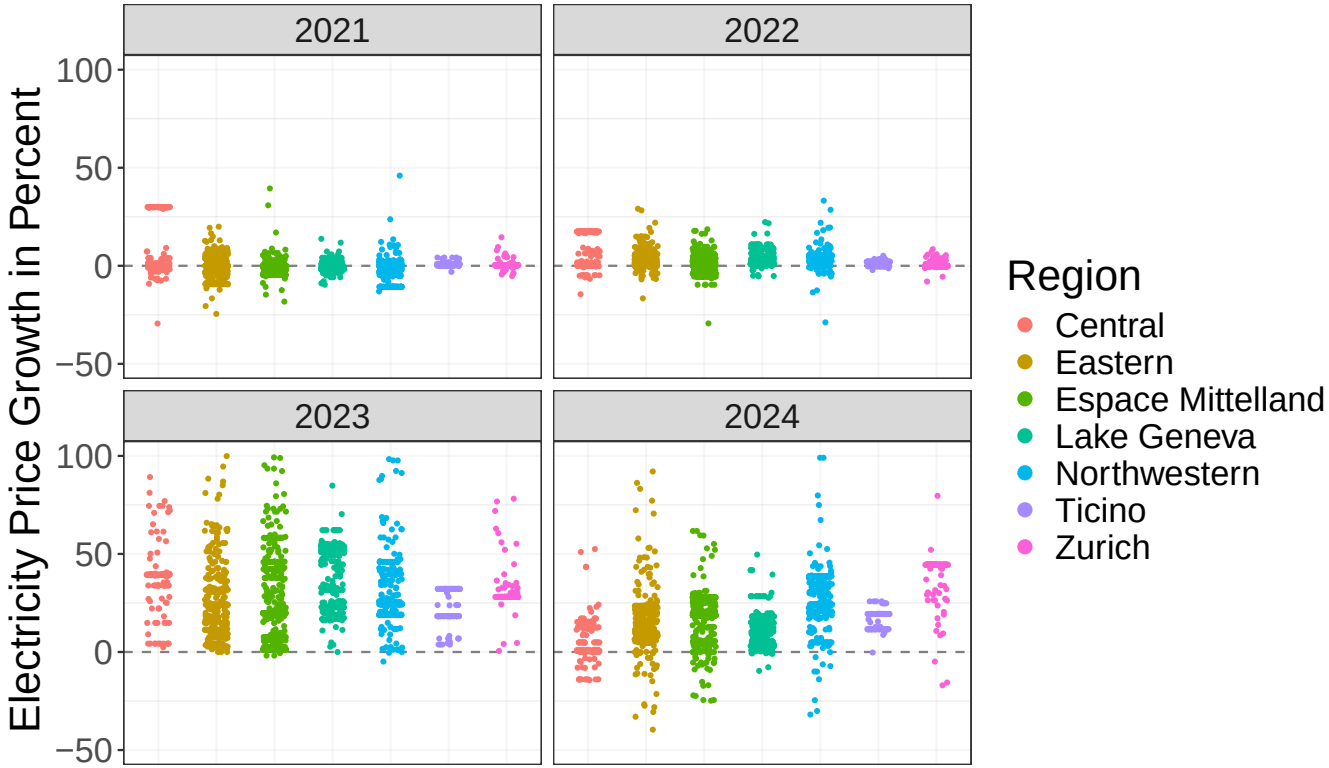



Figure: Variation of electricity price growth by region

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# Electricity price growth – Size

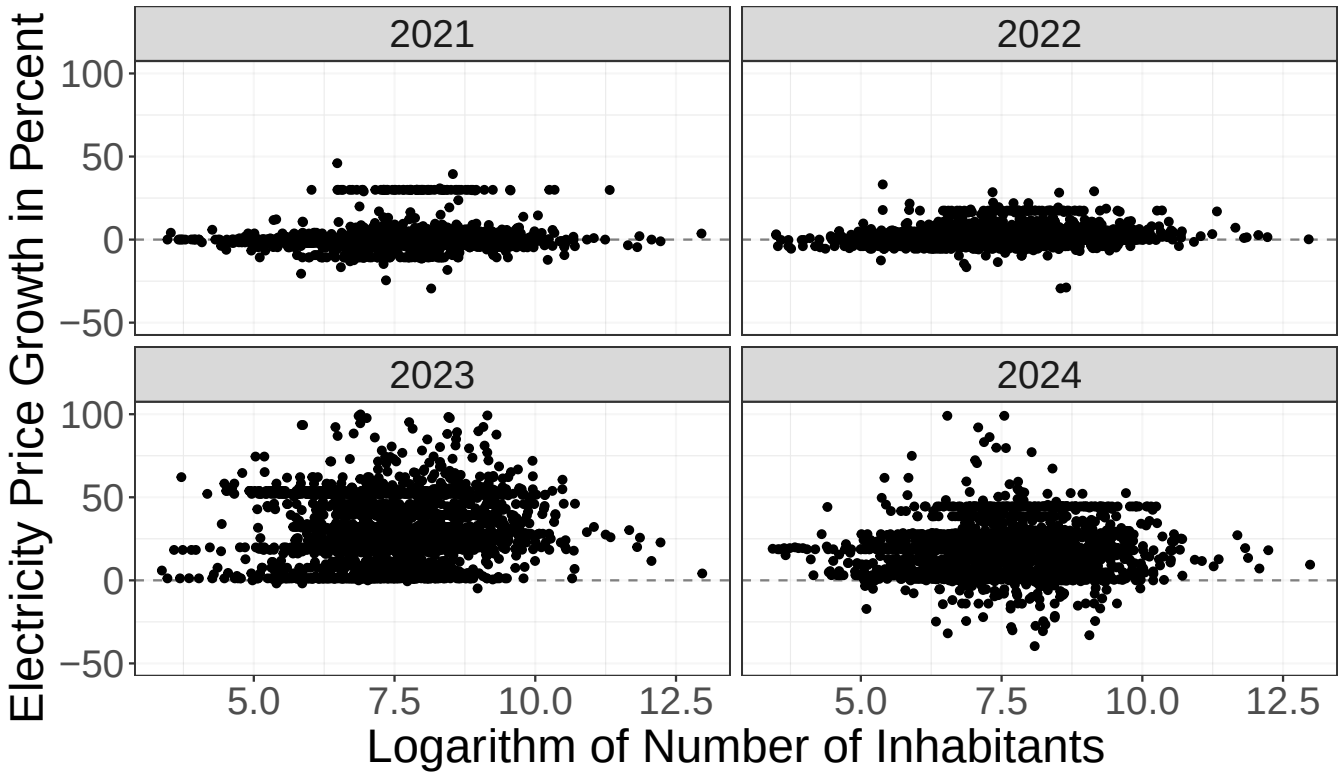



Figure: Electricity price change and number of inhabitants

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# Relative electricity price changes

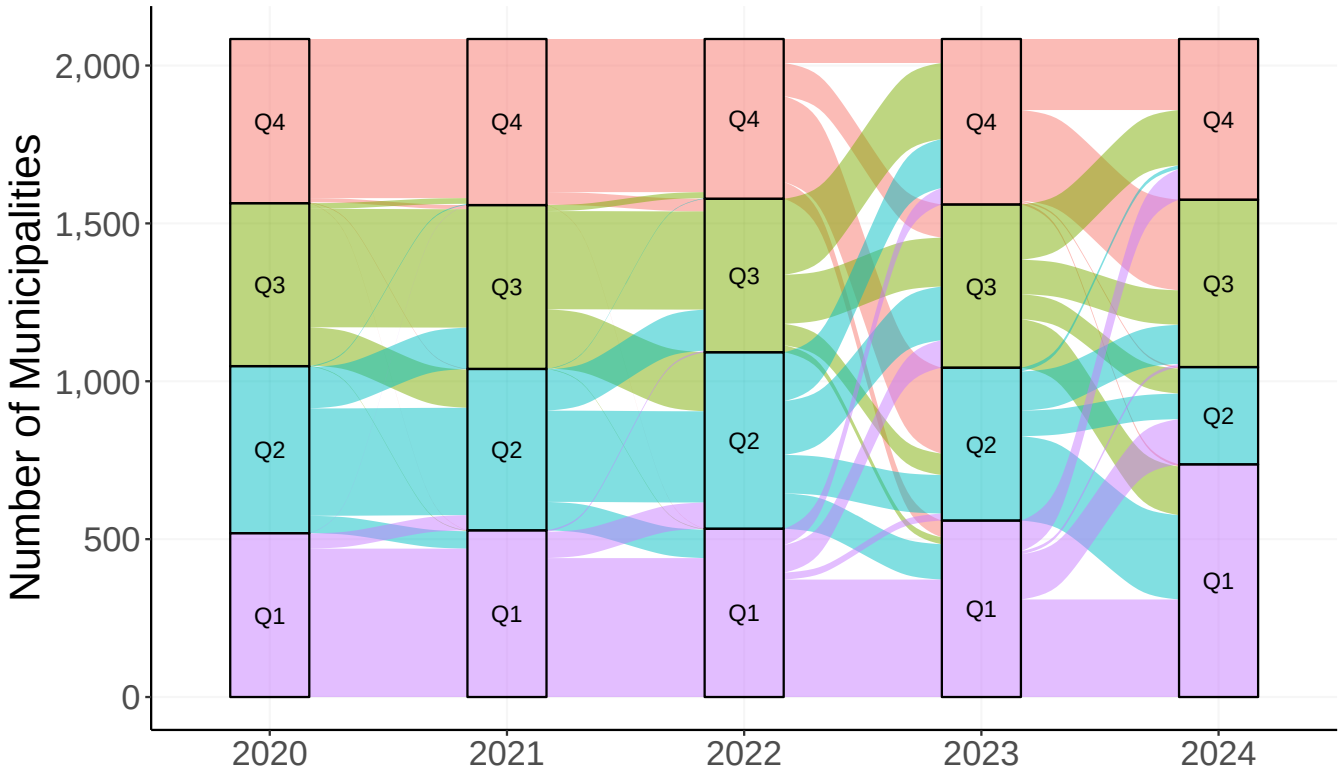



Figure: Alluvial plot of electricity price over years

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# Sample construction

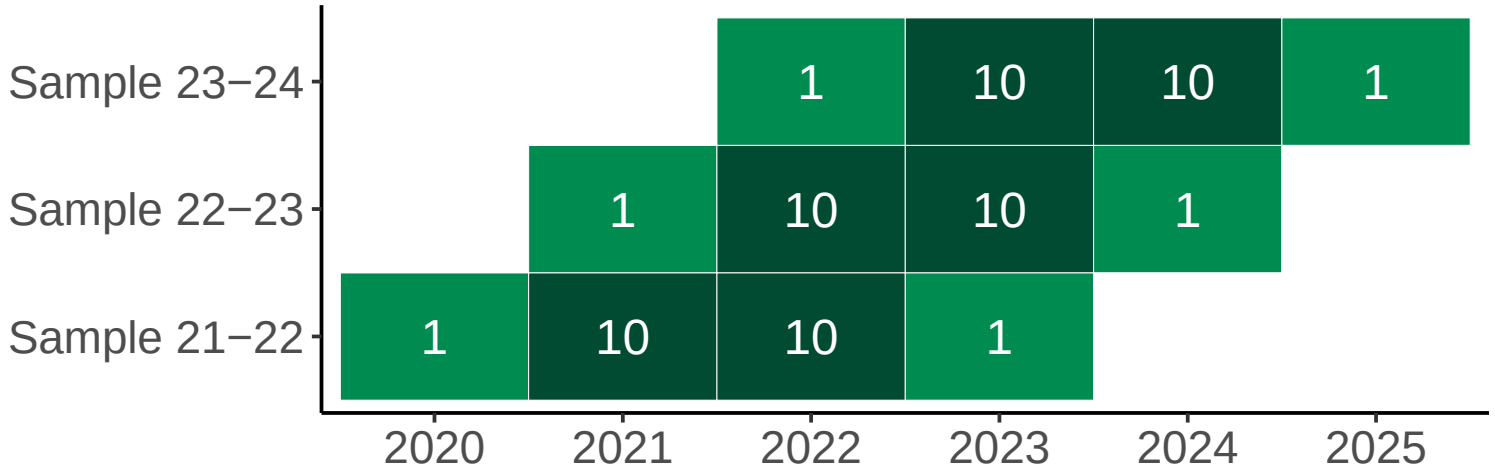



Figure: Minimum number of transactions per year for each card to be included in a certain sample

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