

On the Reaction of Consumption Expenditures to Electricity Price Shocks

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Novel Financial Data for Research
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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

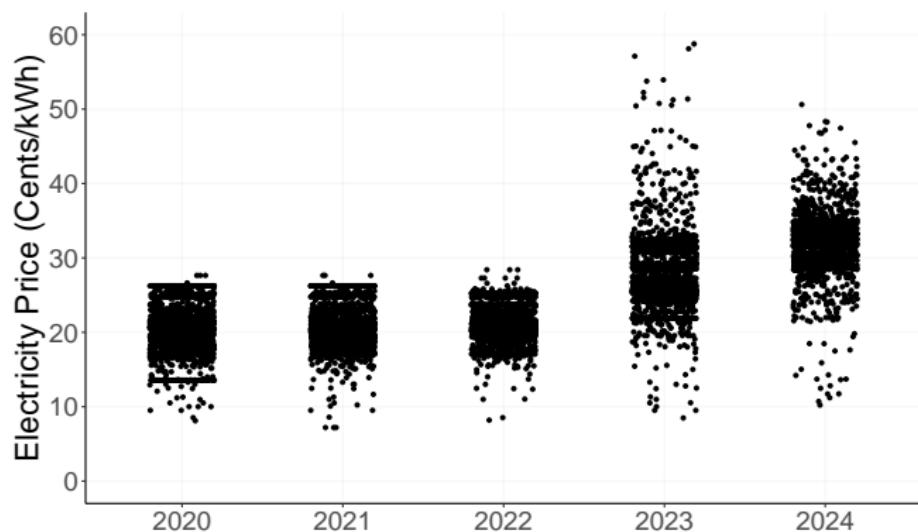


Figure: Variation of electricity price level across municipalities

Growth

Electricity price – Spatial dimension

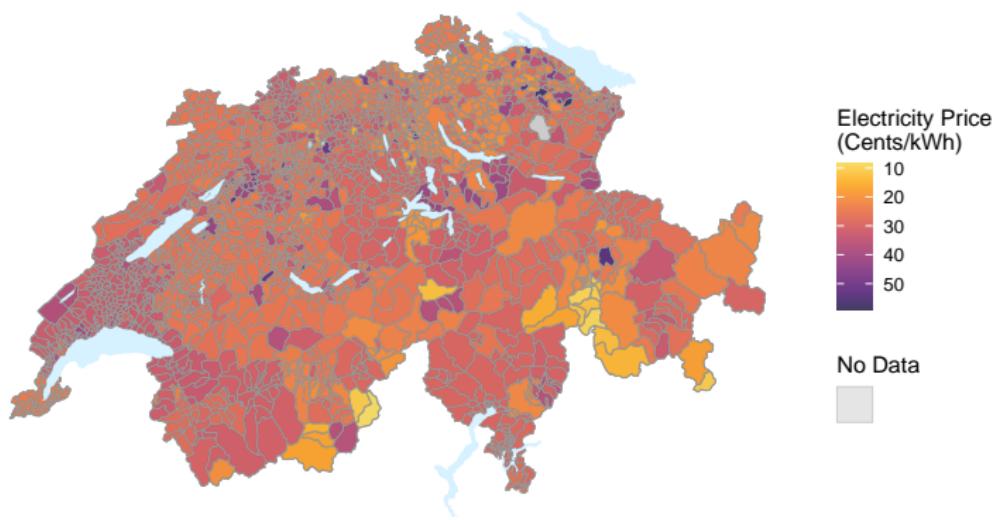


Figure: Electricity price in 2023

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 and statistics

- 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 [Illustration](#)

	Count	Mean	Std.	P25	P50	P75
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 growth in percent by card

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	-0.037*** (0.012)	
2023		-0.047 (0.030)
2024		-0.021 (0.028)
Observations	5,378,932	5,378,932
Municipality fixed effects	Yes	Yes
Time fixed effects	Yes	Yes

Table: The effect of changes in electricity prices on total consumption expenditure growth

Monthly

Effect by categories

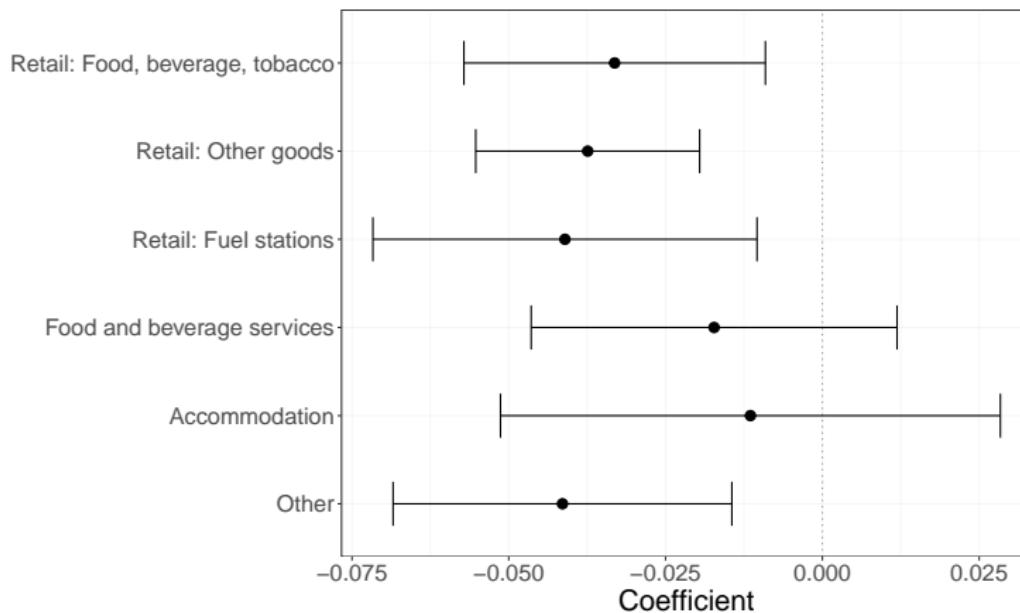


Figure: The effect of changes in electricity prices on consumption expenditure growth by category with 95% confidence interval

Durability

Effect by cardholder income

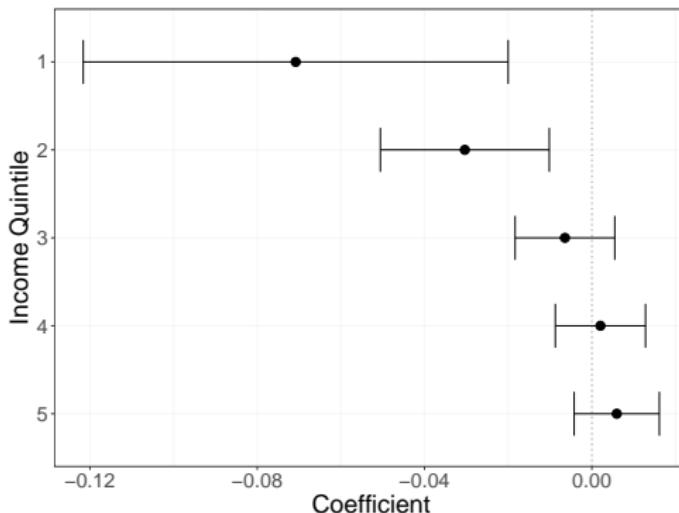


Figure: The effect of changes in electricity prices on consumption expenditure growth by permanent income quintile with 95% confidence interval

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

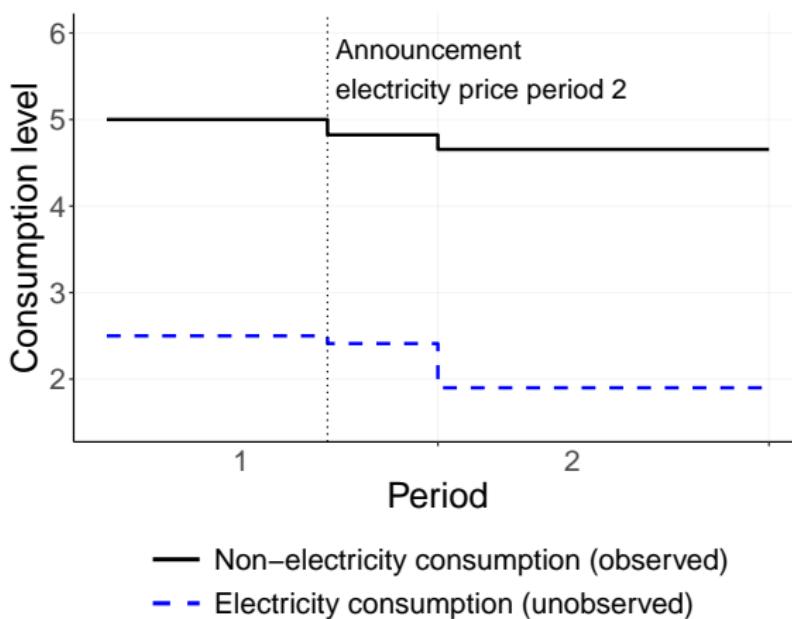


Figure: Evolution of electricity and non-electricity consumption

Structural interpretation

	ε	σ
Estimate	0.630 (0.002)	1.582 (0.007)
Observations	2,184,171	2,184,171

Table: Non-linear least squares estimates for the intratemporal (ε) and the inverse of the intertemporal (σ) elasticity of substitution. Standard errors are calculated using bootstrapping with 1,000 repetitions and are reported in parentheses.

Structural interpretation by income quintile

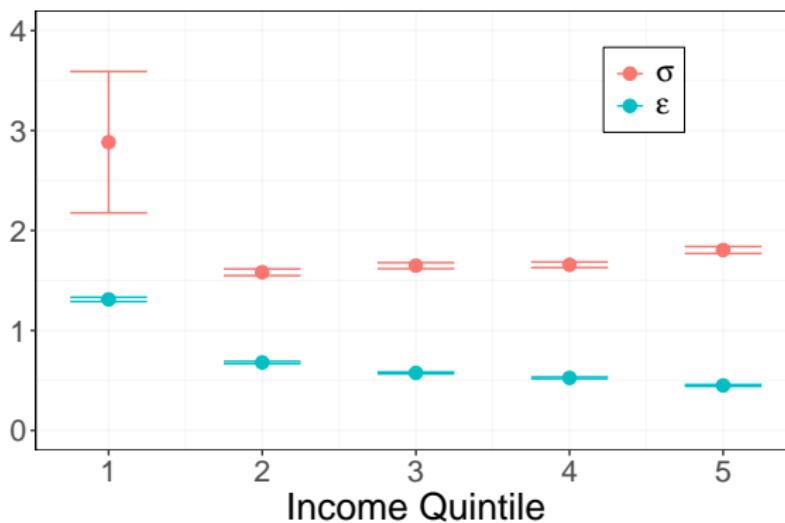


Figure: Estimates of the intratemporal (ε) and the inverse of the intertemporal (σ) elasticity of substitution by permanent income quintile with its 95% confidence intervals.

Summary

- Substantial and unpredictable electricity price changes in 2023 and 2024
- 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 lower permanent income quintiles
- Structural analysis suggests lower intertemporal elasticity of substitution for lowest permanent income quintile

Appendix

Interest in electricity prices

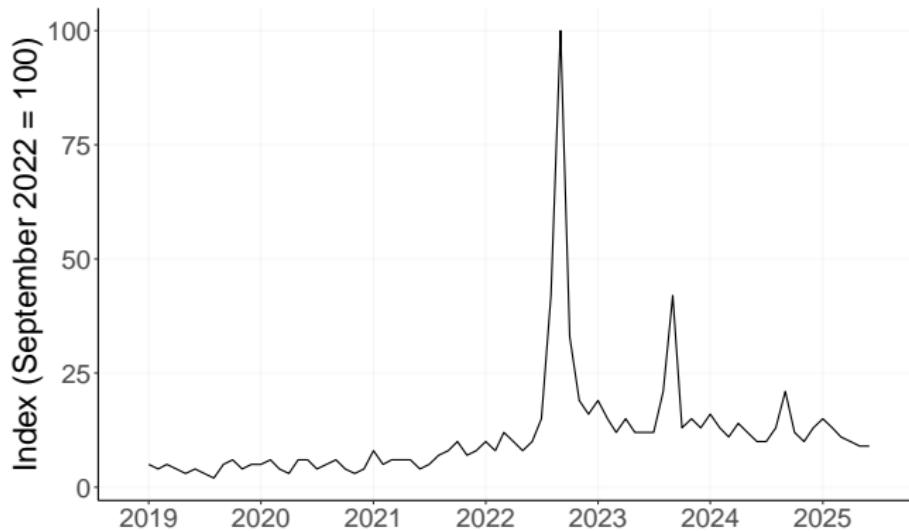


Figure: Google trends for electricity price in Switzerland

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Electricity prices in Switzerland

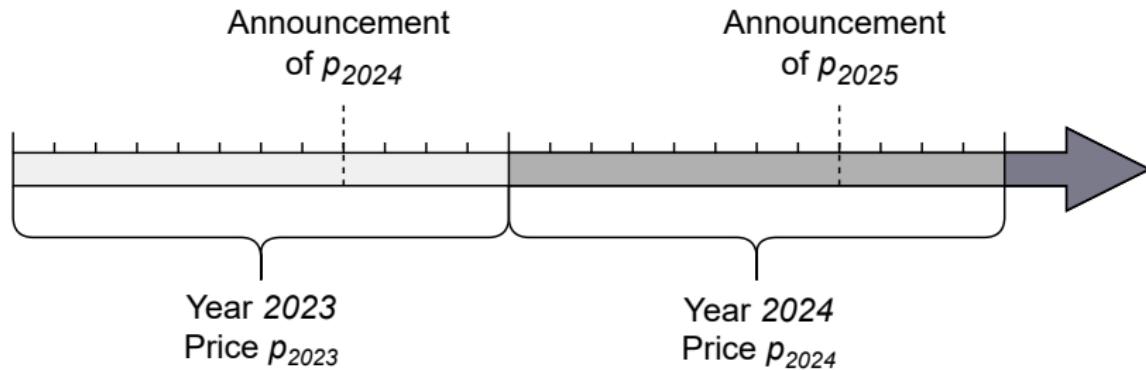


Figure: Timeline of electricity prices in Switzerland

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Electricity price components

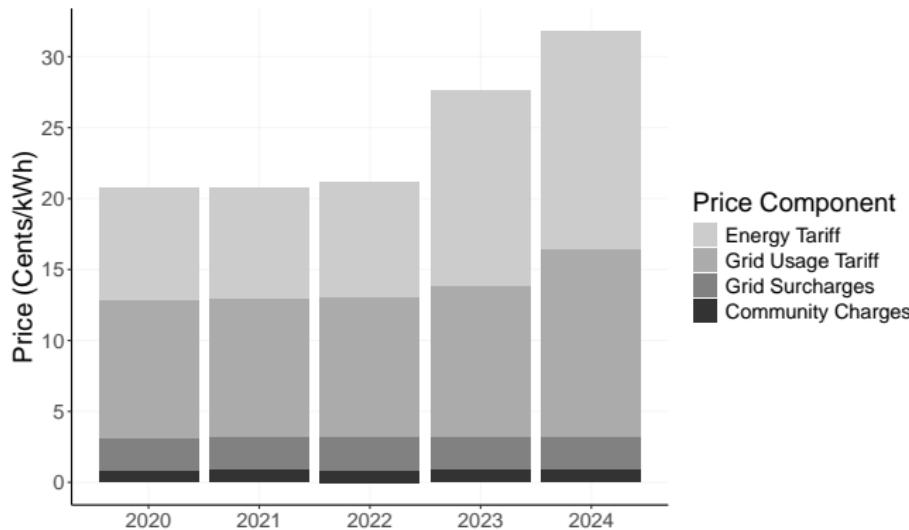


Figure: Mean electricity price across municipalities

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Electricity price growth – Temporal dimension

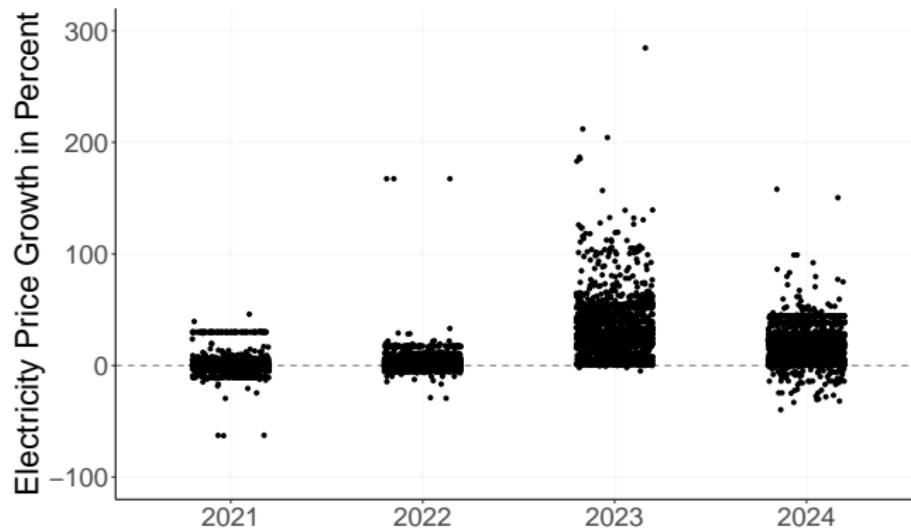


Figure: Variation of electricity price growth across municipalities

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Electricity price growth – Spatial dimension

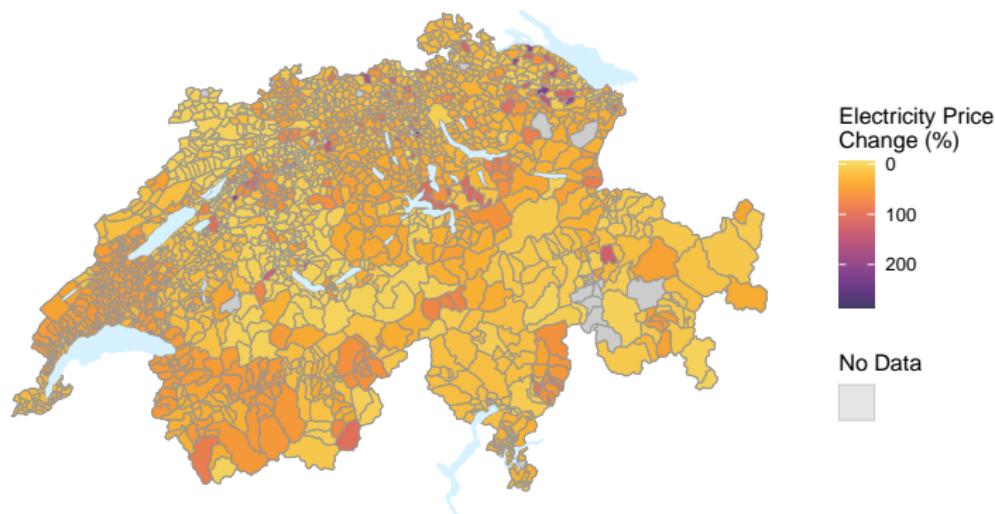


Figure: Electricity price change in 2023

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Electricity price growth – Region

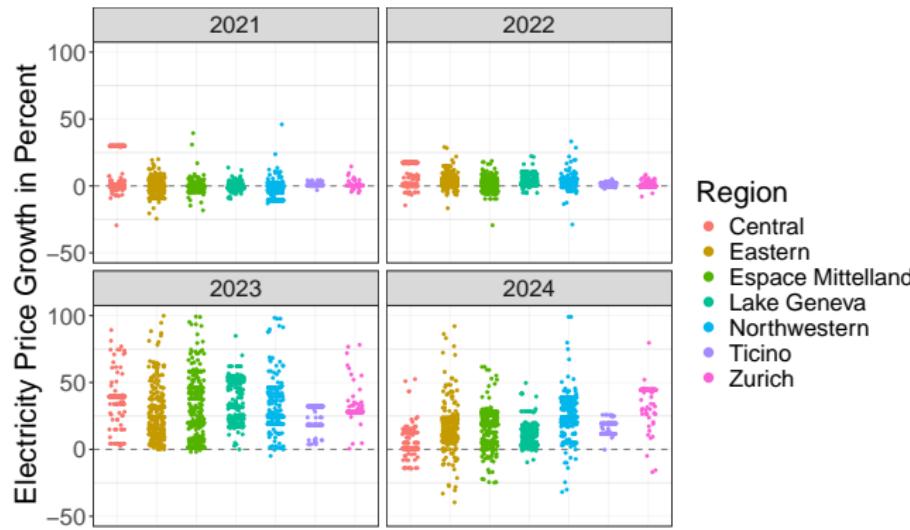


Figure: Variation of electricity price growth by region

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Electricity price growth – Size

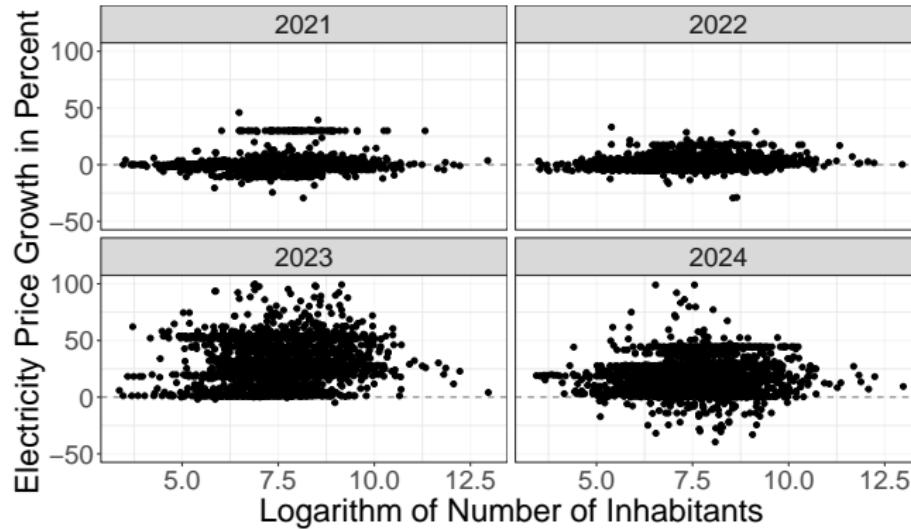


Figure: Electricity price change and number of inhabitants

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Relative electricity price changes

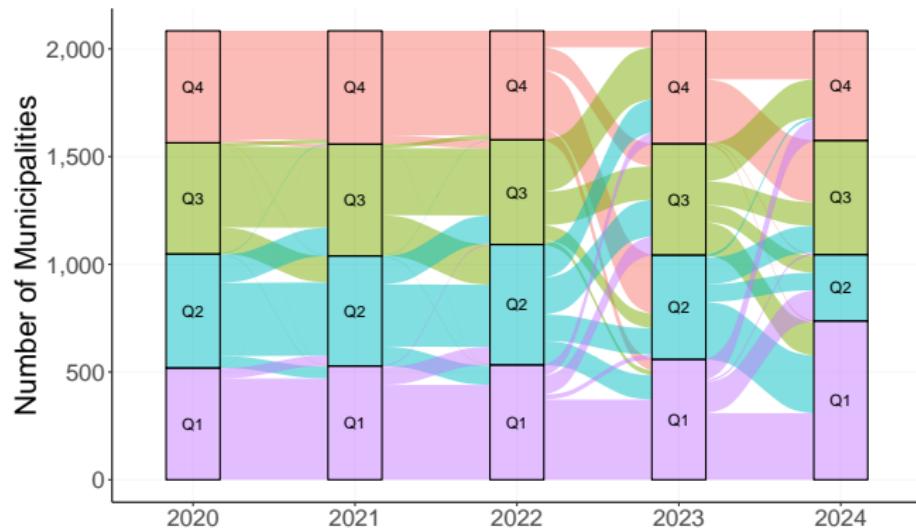


Figure: Alluvial plot of electricity price over years

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Sample construction

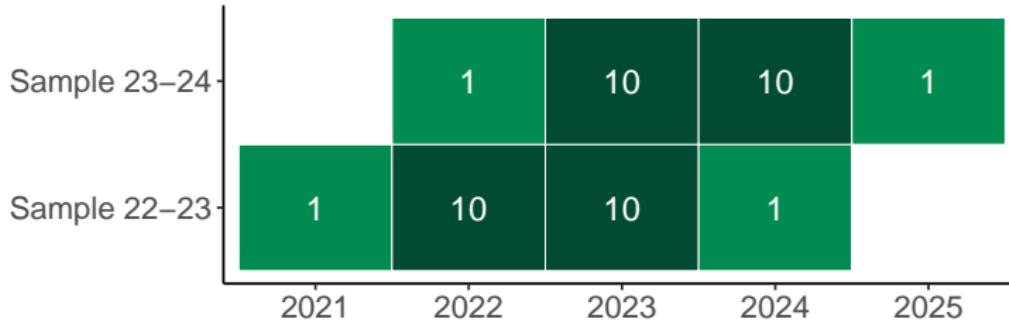


Figure: Minimum number of transactions per year for each card to be included in a certain sample

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Effect over time

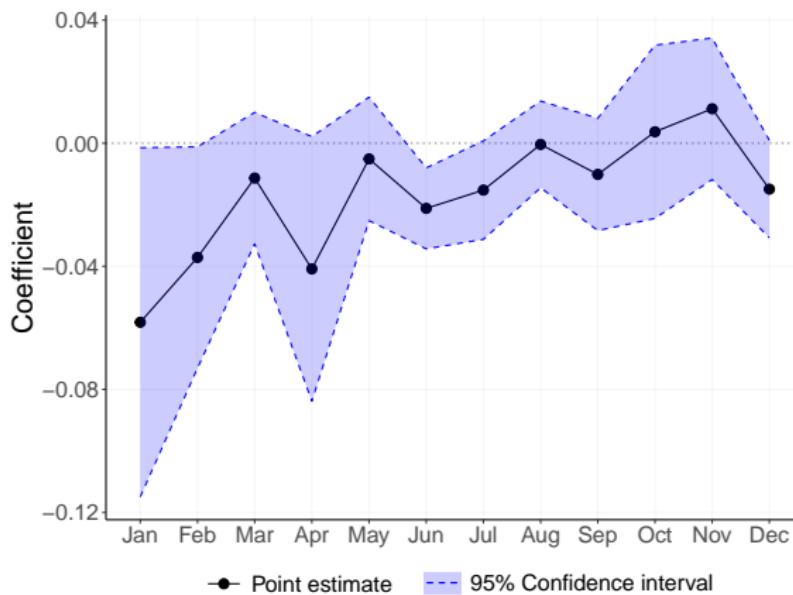


Figure: The effect of changes in electricity prices on consumption expenditure growth by month with 95% confidence interval

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Effect by durability

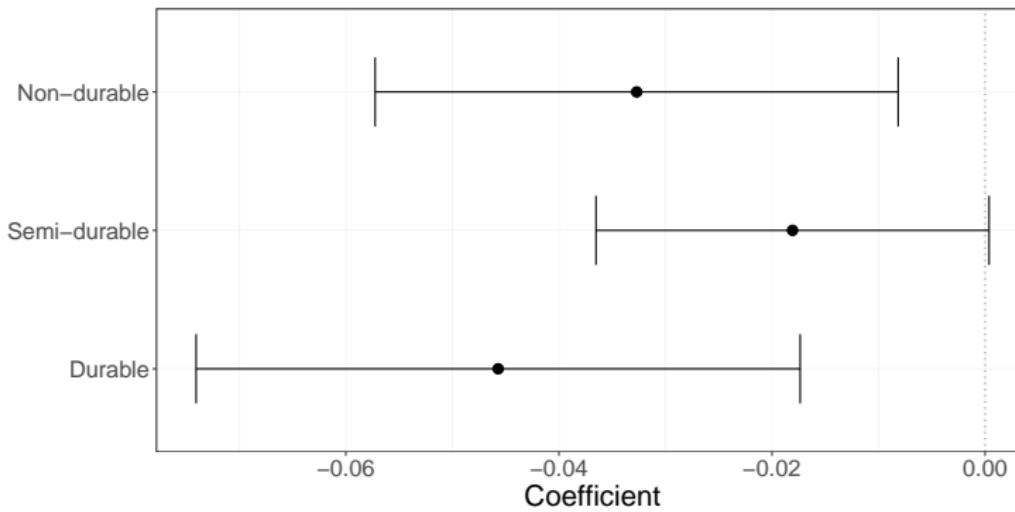


Figure: The effect of changes in electricity prices on consumption expenditure growth by durability with 95% confidence interval

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