

# Do Administrative Borders Tax Electricity?

## A Multi-Border Spatial RDD of Swiss Cantonal Energy Policy

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### Abstract

Swiss municipalities pay between 10 and 50 Rappen per kilowatt-hour for electricity—a five-fold spread within a single country. I exploit the staggered adoption of cantonal energy laws across eight Swiss cantons (2010–2020) using a multi-border spatial RDD with 50,423 municipality-year observations from ElCom (2011–2026). A built-in placebo—the nationally uniform federal aid fee—confirms zero discontinuity at cantonal borders. The cantonal charges component accounts for only 2% of total tariff dispersion; energy procurement (43%) and grid infrastructure (19%) dominate. The point estimate for charges is  $-0.17$  Rp/kWh—reform cantons charge *less*—though statistically insignificant. The total tariff effect is zero. Administrative borders do not tax Swiss electricity; they barely affect it.

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# 1. Introduction

A household in Untervaz, Graubünden, paid 15.4 Rappen per kilowatt-hour for electricity in 2024. Twelve kilometers south, a household in Tamins paid 28.7 Rp/kWh. Both municipalities are served by the regulated basic supply (*Grundversorgung*), both face the same federal energy legislation, and both sit in the same Alpine valley. The only structural difference: their electricity comes from different local utilities, operating under different cantonal frameworks. Across Switzerland, this five-fold spread in electricity prices—from roughly 10 to 50 Rp/kWh—is among the largest for any regulated commodity in a developed economy.

What explains it? The decentralized Swiss electricity market, where over 600 distribution system operators (DSOs) set tariffs based on their production costs, procurement strategies, and grid investments, creates obvious scope for price dispersion. But a parallel question matters for policy: how much of this variation is driven by *cantonal policy choices*—energy fund levies, renewable promotion charges, concession fees, and building efficiency mandates—rather than by underlying cost fundamentals? If administrative borders create meaningful “taxes” on electricity, the case for federal harmonization is strong. If they do not, the price puzzle lies elsewhere.

This paper provides the first causal decomposition of Swiss electricity price variation into policy-driven and cost-driven components. I exploit the staggered adoption of comprehensive cantonal energy laws (*Energiengesetze*) by eight cantons between 2010 and 2020—Graubünden, Bern, Aargau, Basel-Landschaft, Basel-Stadt, Luzern, Fribourg, and Appenzell Innerrhoden—using a multi-border spatial regression discontinuity design. The identifying assumption is that municipalities on opposite sides of a cantonal border are similar in cost fundamentals but face different cantonal energy policy regimes after one canton adopts its energy law.

The key innovation is the tariff decomposition. Switzerland’s electricity regulator (ElCom) publishes municipal tariffs disaggregated into five components: energy procurement costs, grid usage fees, a nationally uniform federal aid fee (*Netzzuschlag*), cantonal/municipal charges (*Abgaben an das Gemeinwesen*), and fixed costs. This decomposition provides a built-in placebo: the federal aid fee is set identically across all municipalities, so it should show zero discontinuity at every cantonal border. If the design is valid, the aid fee coefficient should be zero while the charges component—which reflects cantonal policy—should absorb the reform effect. This placebo provides a necessary—though not sufficient—condition for design validity: if border-pair fixed effects fail to absorb geographic confounders, they would also fail for the aid fee component.

The results tell a clear story. The federal aid fee placebo passes: its coefficient is  $-0.002$  Rp/kWh (SE = 0.002), indistinguishable from zero. The charges component shows a small

negative effect of  $-0.17$  Rp/kWh—reform cantons actually charge *less* than their neighbors, not more. A variance decomposition reveals that cantonal charges account for only 2% of the total variance in electricity prices across municipalities. Energy procurement costs (43%) and grid infrastructure (19%) are the dominant drivers. The event study confirms flat pre-trends in the charges component, with a gradual widening of the gap post-reform that reaches  $-0.17$  Rp/kWh by ten years out.

These findings are robust. The charges coefficient is stable across bandwidths from 5 to 30 kilometers. A donut specification excluding municipalities within 2 km of borders produces nearly identical estimates. Randomized placebo borders within cantons yield a mean coefficient of  $-0.007$  Rp/kWh with a 5.3% false positive rate—precisely what the 5% nominal rate implies. Border-pair-specific estimates reveal substantial heterogeneity: Fribourg–Vaud ( $-0.33$ ), Luzern–Obwalden ( $-0.39$ ), and Aargau–Zug ( $-0.48$ ) show the largest effects, while Basel-Landschaft–Solothurn ( $+0.11$ ) is the only positive estimate.

The consumer cost counterfactual puts the finding in practical terms. Using the regression-adjusted estimate, a typical four-room household consuming 4,500 kWh per year saves approximately 7 CHF annually from living in a reform canton near a border. This is economically negligible and dwarfed by the 200–400 CHF annual variation driven by energy procurement differences across neighboring municipalities.

This paper contributes to three broader debates. First, they extend the spatial RDD tradition in Switzerland (Eugster et al., 2011, 2017; Egger and Lassmann, 2015) from language borders to *policy* borders. Farsi et al. (2025) find no electricity consumption discontinuity at the Swiss language border; I show that cantonal policy borders produce equally negligible price discontinuities. Second, they provide a causal decomposition of regulated commodity prices (Borenstein, 2012; Ito, 2014; Davis, 2014)—separating policy-driven from cost-driven variation using quasi-experimental methods, which the existing U.S.-focused literature has not attempted. Third, they offer a reality check for fiscal federalism (Oates, 1972; Besley and Coate, 2003; Brühlhart et al., 2012): cantonal autonomy in energy policy produces minimal price distortions, a finding directly relevant to the Swiss parliamentary debate over the *Energiestrategie 2050*.

The remainder of the paper proceeds as follows. Section 2 provides institutional background on the Swiss electricity market and cantonal energy law reforms. Section 3 presents the data. Section 4 details the empirical strategy. Section 5 reports main results. Section 6 provides robustness checks and mechanism analysis. Section 7 discusses implications and concludes.

## 1.1 Related Literature

This paper sits at the intersection of three literatures.

**Spatial discontinuities at Swiss borders.** Geographic boundary designs have a long history in economics (Black, 1999) and are increasingly applied to administrative borders with careful attention to the identifying assumptions they require (Keele and Titiunik, 2015). In Switzerland, a growing body of work exploits language and cantonal borders for causal identification. The seminal contribution is Eugster et al. (2011), who document large discontinuities in social insurance preferences at the German–French language border (the *Röstigraben*), attributing them to deep-rooted cultural differences. Eugster et al. (2017) extend this analysis to labor market attitudes and job search behavior, finding persistent cultural effects that cannot be explained by institutions or economic conditions. Egger and Lassmann (2015) use a similar border-comparison framework to estimate the local labor market effects of bilateral trade and migration agreements between Switzerland and the European Union. Farsi et al. (2025) study electricity *consumption* discontinuities at language borders and find no significant effects—consistent with the idea that energy demand is driven by building stock and climate rather than linguistic culture. My contribution extends this literature from language borders to *policy* borders: where these prior papers exploit permanent cultural or linguistic divisions, I exploit time-varying cantonal policy adoption, which provides both cross-sectional and temporal variation.

**Regulated commodity pricing.** The economics of electricity pricing has been studied extensively in the United States. Borenstein (2012) documents the redistributive consequences of nonlinear electricity pricing in California, showing that increasing block tariffs transfer income from high to low users. Ito (2014) demonstrates that consumers respond to average, not marginal, electricity prices—a finding with implications for the welfare analysis of block pricing. Davis (2014) estimates the energy savings from federal appliance efficiency standards, exploiting their uniform national implementation as a natural experiment. A common feature of this literature is the focus on federal or state-level policy variation within the United States. My paper contributes a cross-jurisdictional design in a different institutional context—Switzerland’s highly decentralized electricity market—and decomposes price variation into policy and cost components, which the U.S. literature has not done using quasi-experimental methods.

**Fiscal federalism and policy competition.** The theoretical foundations trace to Oates (1972), who argues that decentralized provision can better match local preferences but risks inefficient fiscal competition. Besley and Coate (2003) formalize the trade-off between centralized and decentralized provision of local public goods, showing that decentralization is preferred when preference heterogeneity is large relative to spillover externalities. Brülhart et

al. (2012) study tax competition across Swiss cantons and find that agglomeration economies moderate the sensitivity of firm location to tax differentials. My paper tests whether cantonal energy policy autonomy creates economically meaningful price distortions—and finds that it does not. The 2% variance share of cantonal charges suggests that, in the electricity domain, the costs of decentralization (if any) are dwarfed by the benefits of local experimentation that Swiss federalism enables.

## 2. Institutional Background

### 2.1 Swiss Federalism and Energy Policy

Switzerland’s political system grants cantons extensive autonomy in policy domains not explicitly delegated to the federal government. Energy policy occupies a shared jurisdiction: the federal government sets the framework through the Federal Energy Act (*Energiegesetz*, EnG) and the Electricity Supply Act (*Stromversorgungsgesetz*, StromVG), while cantons implement, extend, and enforce these provisions through their own cantonal energy laws. This structure means that 26 cantons can—and do—take different approaches to energy regulation, creating the natural experiment this paper exploits.

The degree of cantonal divergence in energy policy is substantial. Some cantons (e.g., Basel-Stadt, Graubünden) have enacted ambitious energy transition frameworks with dedicated cantonal energy funds, mandatory energy certificates for buildings, and progressive subsidy programs for renewable installations. Others (e.g., Schwyz, Obwalden) maintain minimal cantonal energy regulation, relying primarily on federal minimum standards. This variation is not random: cantons with strong Green party representation, urban populations, and high public sector employment tend to adopt more comprehensive energy legislation earlier. The spatial RDD design controls for these selection effects by comparing municipalities on *opposite sides* of the same border—both exposed to the same geographic and economic environment, but subject to different cantonal regimes.

### 2.2 The Swiss Electricity Market

Switzerland’s electricity market is partially liberalized. Since the Federal Electricity Supply Act (*Stromversorgungsgesetz*, StromVG) took effect in 2009, large consumers using more than 100 MWh per year can freely choose their electricity supplier. Small consumers—the vast majority of households—remain in the regulated basic supply (*Grundversorgung*), where their local distribution system operator (DSO) sets tariffs based on production and procurement costs (ElCom, 2024).

Over 600 DSOs operate across Switzerland’s approximately 2,100 municipalities. Most are municipal or regional utilities (*Gemeindewerke* or *Stadtwerke*) serving a small number of municipalities within a single canton. A few large inter-cantonal companies (Axpo, Alpiq, BKW) dominate wholesale production and trading, but retail tariffs for basic supply consumers are set locally. This institutional structure—with each DSO passing through its specific cost structure—is the proximate cause of Switzerland’s large municipal price dispersion.

ElCom, the federal electricity regulator, monitors these tariffs and publishes them at the municipal level for 15 consumption categories. Crucially, ElCom requires DSOs to report tariffs decomposed into five components:

1. **Energy cost** (*Energielieferung*): the cost of electricity procurement or production, reflecting wholesale market prices, long-term contracts, and own generation.
2. **Grid usage** (*Netznutzung*): fees for using the local distribution grid, reflecting infrastructure investment, maintenance, and grid topology.
3. **Federal aid fee** (*Netzzuschlag*): a nationally uniform surcharge funding renewable energy promotion, set by the federal government at 2.3 Rp/kWh since 2018.
4. **Cantonal/municipal charges** (*Abgaben an das Gemeinwesen*): fees paid to cantonal and municipal governments, including concession fees, energy fund contributions, and other policy-related levies.
5. **Fixed costs**: connection fees and standing charges independent of consumption.

This decomposition is central to my identification strategy. The federal aid fee is exogenous to cantonal policy and serves as a placebo. The charges component directly captures cantonal and municipal policy choices.

### 2.3 Cantonal Energy Law Reforms

Swiss cantons enjoy substantial autonomy in energy policy. While federal law sets minimum standards, cantons legislate their own comprehensive energy acts (*Energiengesetze*), which typically include:

- Cantonal energy fund contributions funded through electricity surcharges
- Building energy efficiency mandates (implementing the *Mustervorschriften der Kantone im Energiebereich*, MuKEEn)
- Renewable energy promotion programs

- Concession fee structures for local utilities
- Energy planning and reporting requirements

Between 2010 and 2020, eight cantons enacted comprehensive energy law reforms (Table 1). These reforms varied in timing but shared a common structure: updating the cantonal energy regulatory framework to align with the federal Energy Strategy 2050. The staggered adoption creates the quasi-experimental variation I exploit.

The timing of adoption was driven primarily by cantonal political cycles and legislative priorities rather than by electricity market conditions. Graubünden moved first in 2010, motivated by its hydropower endowment and early commitment to sustainable resource governance. Bern and Aargau followed in 2011–2012, partly in response to the Fukushima disaster and the subsequent federal decision to phase out nuclear power. The Basel cantons (BL, BS) reformed simultaneously in 2016 as part of a broader urban sustainability agenda. Luzern (2017), Fribourg (2019), and Appenzell Innerrhoden (2020) adopted their laws during the legislative implementation of MuKEn 2014, the revised model regulations for cantonal building energy standards.

The remaining eighteen cantons have not enacted comprehensive energy law reforms during the study period, though most have updated individual ordinances or building codes. This distinction between comprehensive legislative reform and incremental regulatory adjustment is central to the identification strategy: I compare cantons with and without a structural overhaul of their energy governance framework, not cantons with and without any energy regulation whatsoever.

**Table 1:** Cantonal Energy Law Reform Timing

Canton	Abbreviation	Reform Year	Legal Reference
Graubünden	GR	2010	EG 820.200
Bern	BE	2011	EnG 741.1
Aargau	AG	2012	EnergieG 773.200
Basel-Landschaft	BL	2016	EnergieG 490
Basel-Stadt	BS	2016	EnergieG 772.100
Luzern	LU	2017	EnG 773
Fribourg	FR	2019	LEn 770.1
Appenzell I.Rh.	AI	2020	EnG 750.000

*Notes:* Reform years indicate the effective date of the comprehensive cantonal energy act. Legal references follow the systematic collection (*Systematische Rechtssammlung*) of each canton. Sources: Fedlex, cantonal legal databases.

### 3. Data

#### 3.1 Electricity Tariff Data

I obtain municipal electricity tariffs from ElCom via the Swiss Federal Linked Data Service (LINDAS). The dataset covers all Swiss municipalities from 2011 to 2026, providing tariff data for 15 consumption categories. ElCom publishes tariffs for the upcoming calendar year each autumn (e.g., 2026 tariffs were published in September 2025), so the 2026 data represent set regulatory prices, not forecasts. I focus on category H4, corresponding to a typical four-room apartment consuming 4,500 kWh per year, which is ElCom’s standard comparison benchmark.

The raw data contain 50,509 municipality-year observations across 2,712 unique municipality identifiers and 745 DSOs over 16 years. The municipality count exceeds the roughly 2,100 municipalities existing in 2026 because Switzerland has undergone extensive municipal mergers during the sample period; merged municipalities retain their historical BFS identifiers in the early years of the panel, creating an unbalanced structure. Table 2 reports descriptive statistics on this full sample. For regression analysis, I exclude 86 observations (0.17%) with zero tariffs—likely reporting artifacts—yielding an analysis universe of 50,423 observations, which is further restricted by the bandwidth and border-pair conditions described below.

The five tariff components sum to the total retail electricity price paid by basic supply customers. Their relative magnitudes vary substantially across municipalities and over time. Energy procurement costs are the largest component, averaging 9.6 Rp/kWh but ranging from under 5 Rp/kWh (municipalities with legacy hydropower contracts) to over 15 Rp/kWh (those exposed to spot market prices). Grid usage fees average 10.6 Rp/kWh and reflect the capital-intensive nature of local distribution infrastructure, varying with grid topology, altitude, settlement density, and the age of network assets. The federal aid fee rose from 0.6 Rp/kWh in 2011 to 2.3 Rp/kWh in 2018, where it has remained since. Cantonal and municipal charges average only 0.82 Rp/kWh—less than 4% of the total tariff—but exhibit notable cross-cantonal variation: zero in several cantons, up to 3–4 Rp/kWh in others.

The temporal dimension provides useful identification leverage. The eight reform cantons adopted their energy laws between 2010 and 2020, while tariff data begin in 2011 and extend through 2026. Most reform cantons have substantial pre-periods: Aargau (2012) has one year, Basel-Landschaft and Basel-Stadt (2016) have five years, Luzern (2017) six, Fribourg (2019) eight, and Appenzell Innerrhoden (2020) nine. Graubünden (2010) and Bern (2011) are exceptions: with data beginning in 2011, Graubünden has no pre-reform observations and Bern has at most one. In the event study, these early-adopting cantons contribute only to post-reform estimates; the pre-trend tests rely on later cohorts. The staggered timing means

that different border pairs enter treatment at different calendar years, mitigating concerns about confounding national trends.

### 3.2 Municipal Boundary Data

I obtain municipal boundary polygons from swisstopo’s swissBOUNDARIES3D product, which provides precise municipal, district, and cantonal boundaries in the Swiss coordinate reference system (LV95, EPSG:2056). The 2024 vintage contains 2,157 territorial units, of which 2,144 are municipalities with valid cantonal assignments. I compute municipal centroids and use these to calculate distances to the nearest cantonal border.

Cantonal boundaries in Switzerland are highly irregular, reflecting centuries of historical evolution. Unlike the rectilinear borders common in US states, Swiss cantonal borders follow topographic features (ridgelines, rivers, lake shores) and historical treaty lines. This irregularity is advantageous for the spatial RDD: it generates substantial variation in the number and type of municipalities near each border, reducing the risk that results are driven by a single geographic configuration.

### 3.3 Analysis Sample

Merging the tariff and spatial data yields a panel of 50,509 municipality-year observations. Of these, 46,780 (93%) match to municipalities in the boundary data. The unmatched 7% are predominantly very small municipalities undergoing mergers during the sample period, whose BFS numbers change between data vintages. The main analysis sample restricts to municipalities within 15 km of a cantonal border, yielding 44,451 observations across 2,028 municipalities—reflecting Switzerland’s compact geography, where most municipalities lie near a cantonal boundary.

I identify 53 unique border pairs and 22 “mixed” border pairs where one side has adopted an energy law reform and the other has not. A border pair is classified as “mixed” using a static, time-invariant definition: exactly one canton in the pair is an ever-reform canton and the other is a never-reform canton. Borders between two reform cantons (e.g., Bern–Fribourg, both of which adopted energy laws) are excluded from the estimation sample regardless of the timing of their respective reforms. The most data-rich mixed pairs are Luzern–Schwyz, Aargau–Zürich, Bern–Solothurn, and Basel-Landschaft–Jura, each contributing over 2,000 municipality-year observations. The smallest pairs contribute fewer observations (e.g., the AI–AR border involves only a handful of municipalities on each side), but with the 16-year panel, even small border pairs contribute meaningfully to the pooled estimates when combined with the border-pair fixed effects.

Table 2 reports summary statistics for the analysis sample, split by reform status. Reform canton municipalities have slightly higher mean total tariffs (23.4 vs. 22.6 Rp/kWh), driven primarily by higher grid costs rather than cantonal charges. The charges component averages 0.82 Rp/kWh in both reform and non-reform cantons—essentially identical in levels. Energy and grid costs are broadly comparable across groups, suggesting that reform and non-reform cantons do not differ systematically in their underlying cost structures. The sample contains 871 reform-canton municipalities and 1,157 non-reform municipalities, observed over a panel spanning 2011–2026.

**Table 2:** Descriptive Statistics: Electricity Tariffs by Reform Status

	Obs.	Mun.	Years	Total Tariff		Energy	Grid	Aid Fee	Charges
				Mean	SD	Mean	Mean	Mean	Mean
All municipalities	50,509	2,712	16	22.8	4.96	9.59	10.55	1.75	0.82
Reform cantons	21,505	933	16	23.47	4.78	9.76	10.95	1.83	0.82
Non-reform cantons	29,004	1,779	16	22.31	5.04	9.46	10.25	1.69	0.82
Border sample (15km)	44,451	2,028	16	22.96	5.03	9.67	10.59	1.8	0.8

*Notes:* All tariff values in Rappen per kWh (Rp/kWh) for household consumption category H4 (4,500 kWh/year). Reform cantons adopted comprehensive energy legislation between 2010 and 2020: GR (2010), BE (2011), AG (2012), BL (2016), BS (2016), LU (2017), FR (2019), AI (2020). Border sample includes municipalities within 15km of a cantonal border. Source: ElCom/LINDAS.

## 4. Empirical Strategy

### 4.1 Multi-Border Spatial RDD

The core specification compares electricity tariff components across municipalities on opposite sides of cantonal borders where one canton has adopted an energy law reform:

$$Y_{m,t} = \alpha + \beta \cdot \text{Reformed}_{c(m)} + f(\text{Distance}_m) + \gamma_t + \delta_b + \varepsilon_{m,t} \quad (1)$$

where  $Y_{m,t}$  is a tariff component (total, energy, grid, charges, or aid fee) for municipality  $m$  in year  $t$ ;  $\text{Reformed}_{c(m)}$  indicates that municipality  $m$ 's canton  $c$  has adopted a comprehensive energy law by year  $t$ ;  $f(\text{Distance}_m)$  is a quadratic polynomial in distance to the nearest cantonal border;  $\gamma_t$  are year fixed effects absorbing national trends in electricity prices; and  $\delta_b$  are border-pair fixed effects ensuring comparisons are made only between municipalities sharing the same border segment.

The coefficient  $\beta$  captures the average tariff discontinuity at cantonal borders between reform and non-reform cantons. Standard errors are clustered at the canton level (26 cantons,

8 treated) to account for within-canton correlation in tariff-setting, following the convention in Swiss spatial RDD studies (Eugster et al., 2011; Egger and Lassmann, 2015). With few treated clusters, these standard errors should be interpreted with caution (Cameron et al., 2008); however, the main conclusion—that the effect is economically small—does not depend on borderline significance thresholds. The border-pair fixed effects  $\delta_b$  are essential: they ensure that comparisons are made only between municipalities sharing the same border segment, not across the entire country. A municipality near the AG–ZH border is compared only to other municipalities near the same border, never to municipalities near the FR–VD border hundreds of kilometers away. This substantially reduces the scope for unobserved geographic confounders.

The estimating equation is a hybrid of spatial RDD and border-pair difference-in-differences. Like a spatial RDD, it exploits the discontinuity at cantonal borders using distance controls; like a DiD, it uses time-varying treatment indicators and year fixed effects. This hybrid design—sometimes called a “border-pair DiD with spatial controls”—is standard in the multi-border literature (Eugster et al., 2011; Egger and Lassmann, 2015). The identifying assumption combines elements of both: within each border pair, municipalities on opposite sides would have followed parallel tariff trajectories absent the reform, conditional on distance to the border. The nonparametric RDD estimator (`rdrobust`) is designed for a single running variable with a single cutoff; it does not accommodate the panel structure, multiple fixed effects, or staggered treatment timing of this setting.

The distance function  $f(\cdot)$  controls for the possibility that municipalities closer to cantonal borders differ systematically from those further away. In the baseline specification, I use a quadratic polynomial in distance to the nearest cantonal border. The distance variable is unsigned—it measures proximity to the border from either side—while the reform indicator captures the side of the border. This separation is important: the running variable (distance) determines bandwidth, while the treatment variable (reform canton) captures the policy discontinuity.

## 4.2 Event Study

To examine the dynamic effects of reform adoption and test for pre-trends, I estimate:

$$Y_{m,t} = \sum_{k=-5}^{10} \beta_k \cdot \text{Reformed}_{c(m)} \times \mathbb{I}[t - t_c^* = k] + f(\text{Distance}_m) + \mu_m + \gamma_t + \varepsilon_{m,t} \quad (2)$$

where  $t_c^*$  is the reform year for canton  $c$ ,  $\mu_m$  are municipality fixed effects, and  $k = -1$  is the omitted reference period. Pre-reform coefficients ( $\beta_{-5}, \dots, \beta_{-2}$ ) test the parallel trends

assumption; post-reform coefficients  $(\beta_0, \dots, \beta_{10})$  trace the dynamic treatment effect. Because treatment timing is staggered across eight cohorts, I estimate the event study using the interaction-weighted estimator of [Sun and Abraham \(2021\)](#), which avoids the contamination bias of standard TWFE event studies with heterogeneous treatment effects (see also [Callaway and Sant’Anna, 2021](#)).

### 4.3 Built-in Placebo

The federal aid fee (*Netzzuschlag*) is set by the federal government at a uniform rate for all Swiss electricity consumers in a given year. In practice, the ElCom data show that over 99% of municipalities report the official federal rate; a small number report slightly different values due to DSO-level rounding or reporting conventions. This near-uniformity means that most within-year variation in the aid fee is absorbed by year fixed effects, leaving only residual reporting noise. If my spatial RDD is valid—i.e., if the border-pair fixed effects and distance controls adequately absorb confounders—then the estimated discontinuity in this residual aid fee variation should be zero. A systematic non-zero aid fee discontinuity at cantonal borders would indicate that the design fails to control for some border-level confounder.

### 4.4 Variance Decomposition

To quantify the relative importance of policy versus cost fundamentals, I decompose the total variance of electricity tariffs:

$$\text{Var}(Y^{\text{total}}) = \text{Var}(Y^{\text{energy}}) + \text{Var}(Y^{\text{grid}}) + \text{Var}(Y^{\text{aid}}) + \text{Var}(Y^{\text{charge}}) + 2 \sum_{j < k} \text{Cov}(Y^j, Y^k) \quad (3)$$

The variance shares of each component provide a descriptive measure of how much of the total price dispersion is attributable to each source.

### 4.5 Threats to Validity

**Sorting at borders.** The classic threat to spatial RDD is that agents sort across the boundary. For electricity prices, this concern is muted: households in the *Grundversorgung* cannot choose their DSO without physically relocating, and electricity costs (500–1,500 CHF/year) are small relative to housing costs that dominate residential location choices.

**Cross-border DSOs.** Some DSOs serve municipalities in multiple cantons. For these municipalities, the cantonal border does not create a tariff discontinuity. I address this by

including DSO fixed effects in a robustness specification and by documenting that the vast majority of Swiss DSOs operate within a single canton.

**Bundled treatment.** Cantonal energy laws bundle multiple provisions (levies, mandates, subsidies, planning requirements). The tariff decomposition partially addresses this: the charges component isolates the fiscal channel. However, mandates that affect energy procurement costs (e.g., renewable portfolio requirements) would appear in the energy component rather than in charges.

**Concurrent cantonal reforms.** Cantons that adopt energy laws may simultaneously pursue other reforms. Border-pair fixed effects absorb time-invariant differences, and year fixed effects absorb national trends, but canton-specific concurrent changes remain a concern. The event study tests whether effects emerge sharply at reform adoption or evolve gradually.

**Cantonal composition of border pairs.** With eight reform cantons, the treatment variation comes from a moderate number of policy units. Canton-level clustering accounts for within-canton correlation, but with only 26 cantons (8 treated), the effective degrees of freedom for the clustered standard errors are limited. This is a standard challenge in cantonal-level Swiss studies, shared with the language border RDD literature. I report border-pair-specific estimates to document effect heterogeneity transparently.

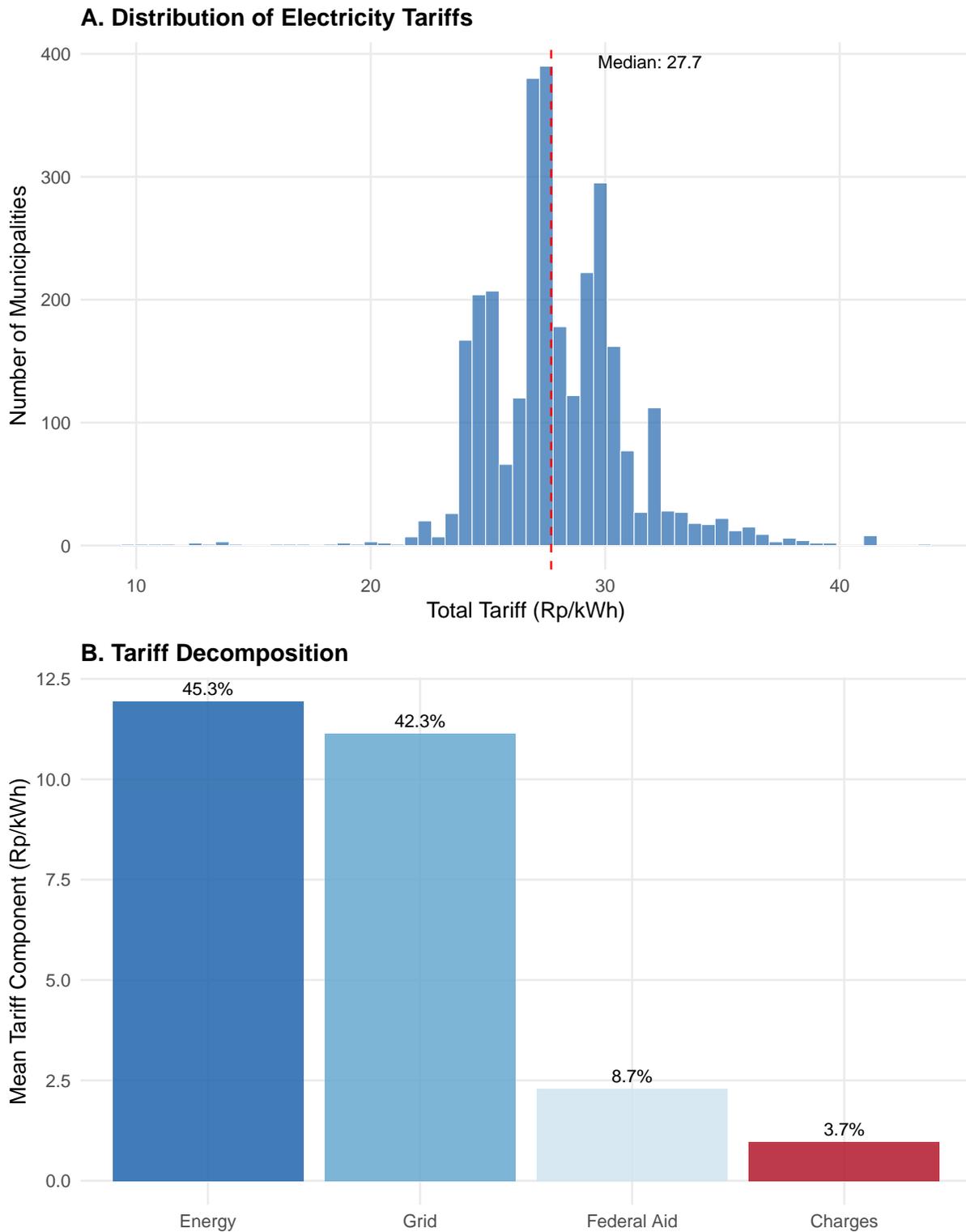
**SUTVA and price spillovers.** If cantonal energy reforms affect electricity procurement strategies that influence wholesale market prices, control municipalities would also be treated through equilibrium effects. This concern is mitigated by the structure of the Swiss wholesale market: wholesale prices are set at the national and European level (SWISSIX, EPEX SPOT), and no single canton’s retail policy can meaningfully shift the wholesale price. The retail tariff decomposition further insulates the charges component, which reflects only cantonal and municipal levies, from any wholesale spillover channel.

## 5. Results

### 5.1 Descriptive Evidence

Figure 1 shows the distribution of total electricity tariffs across Swiss municipalities in 2026 and the average tariff decomposition. The median tariff is 27.7 Rp/kWh, with substantial dispersion ( $SD \approx 5.0$  Rp/kWh). Energy procurement is the largest component (45%), followed

by grid costs (42%). Cantonal charges average less than 1 Rp/kWh and account for under 4% of the total—a first indication that the policy-driven component of electricity prices is small.



**Figure 1:** Distribution and Decomposition of Swiss Electricity Tariffs

*Notes:* Panel A shows the distribution of total electricity tariffs (Rp/kWh) across Swiss municipalities in 2026 for consumption category H4 (4,500 kWh/year). The dashed red line indicates the median. Panel B shows the mean level of each tariff component across all municipalities and years, with percentages indicating each component's share of the mean total tariff. These mean shares differ from the variance shares reported in Figure 4, which

## 5.2 Cross-Sectional Spatial RDD

Table 3 reports the main spatial RDD estimates for each tariff component. The regression sample (24,271 observations) is smaller than the full border sample in Table 2 (44,451) because it restricts to the 22 mixed border pairs—defined as borders where exactly one canton ever adopted an energy law reform and the other never did. Borders between two reform cantons (e.g., Bern–Fribourg, both of which eventually adopted energy laws) are excluded entirely, regardless of their respective reform timing. The placebo passes: the federal aid fee shows a coefficient of  $-0.002$  Rp/kWh (SE = 0.002), statistically and economically indistinguishable from zero. This validates the research design—the border-pair and year fixed effects, combined with the distance control, adequately absorb confounders at cantonal borders.

The charges component shows a coefficient of  $-0.165$  Rp/kWh (SE = 0.155), negative but not statistically significant at conventional levels. Reform cantons do not levy higher charges than their neighbors; if anything, they charge slightly less. The total tariff coefficient is  $0.138$  Rp/kWh (SE = 0.454), also statistically insignificant. The positive point estimate, despite the negative charges coefficient, reflects the fact that the total tariff is the *sum* of five components—the offsetting grid coefficient ( $+0.370$ ) and the energy coefficient ( $-0.065$ ) mechanically combine with the charges result. Given the large standard error relative to the point estimate ( $t = 0.30$ ), the total coefficient is indistinguishable from zero and consistent with no net tariff effect of reform.

Grid usage shows the largest point estimate at  $0.370$  Rp/kWh (SE = 0.261), suggesting that reform and non-reform cantons differ more in infrastructure costs than in policy charges. This grid differential likely reflects pre-existing differences in settlement patterns and topography across cantonal borders rather than any causal effect of energy legislation. The energy procurement component is essentially zero ( $-0.065$ , SE = 0.101), indicating that wholesale contracting strategies do not differ systematically across reform borders.

To put these magnitudes in perspective: the mean total tariff is approximately 23 Rp/kWh, and the standard deviation across municipalities is about 5 Rp/kWh. The estimated charges discontinuity of  $-0.17$  Rp/kWh is 0.7% of the mean and 3.4% of one standard deviation. Even if the true effect were at the upper bound of the 95% confidence interval (roughly  $+0.14$  Rp/kWh), it would explain a negligible share of the observed price dispersion.

## 5.3 Event Study

Figure 2 presents the event study estimates for all five tariff components. The charges component (red line) shows flat pre-trends: coefficients at  $t - 5$  through  $t - 2$  are small,

**Table 3:** Spatial RDD: Energy Law Reform Effect on Electricity Tariff Components

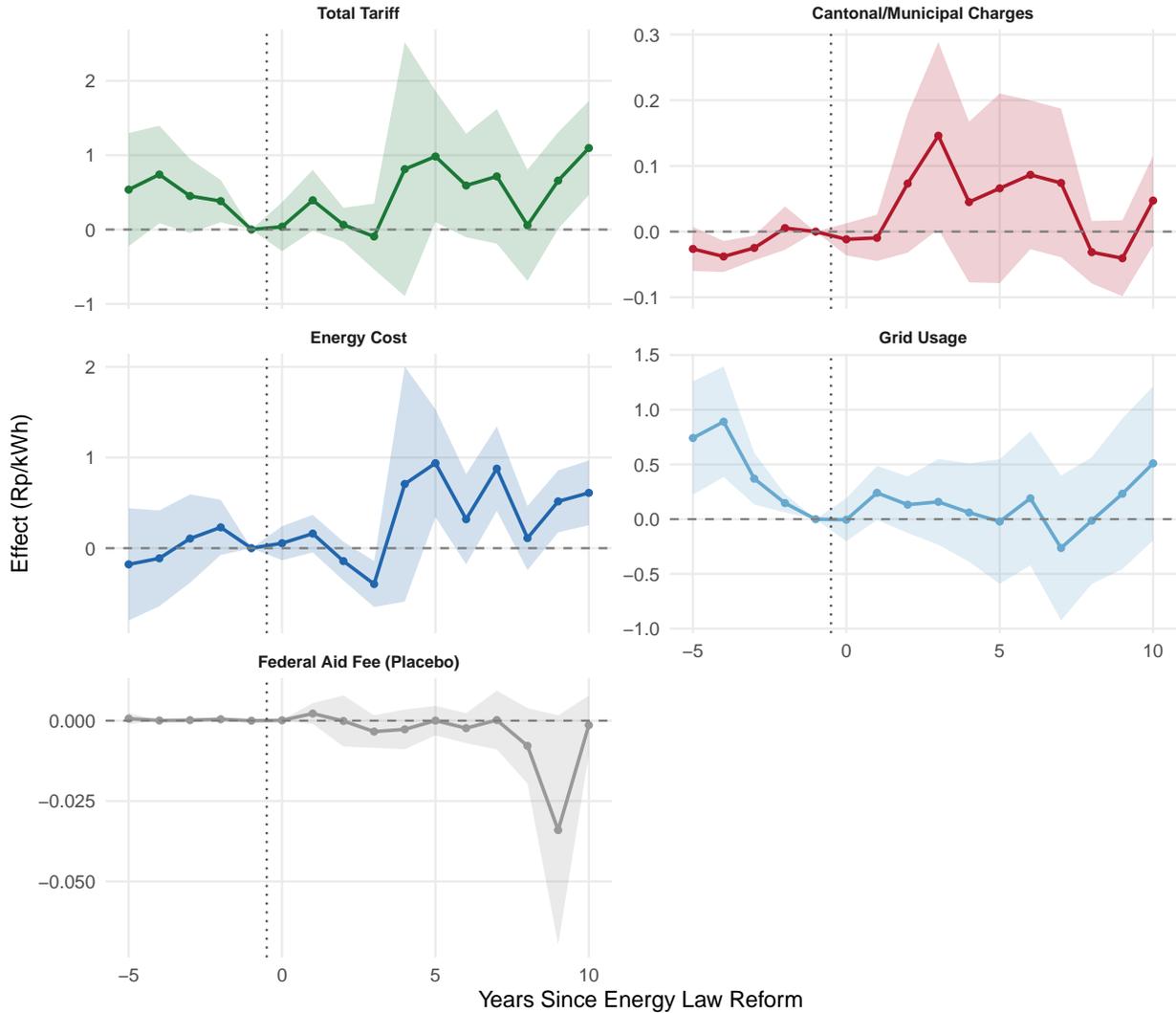
	Total (1)	Energy (2)	Grid (3)	Charges (4)	Aid Fee (5)
Reform Canton	0.138 (0.454)	-0.065 (0.101)	0.370 (0.261)	-0.165 (0.155)	-0.002 (0.002)
Border-pair FE	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes
Distance control	Quadratic	Quadratic	Quadratic	Quadratic	Quadratic
Observations	24,271	24,271	24,271	24,271	24,271
Border pairs	22	22	22	22	22

*Notes:* Each column reports the coefficient on an indicator for being located in a canton that has adopted comprehensive energy legislation, estimated using OLS with border-pair and year fixed effects. The sample includes municipalities within 15km of a cantonal border where one side has reformed and the other has not. Standard errors clustered at the canton level in parentheses.

\*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ .

centered on zero, and statistically insignificant. After reform adoption, the charges coefficient gradually drifts negative, reaching  $-0.17$  Rp/kWh by  $t + 10$ . While individually imprecise, the post-reform trajectory is consistently negative, suggesting a small reduction in cantonal charges following reform.

The federal aid fee (gray line) is flat throughout—precisely zero before and after reform—confirming the placebo at every event-time horizon. The energy and grid components show no systematic response to cantonal reform adoption, consistent with the hypothesis that energy laws primarily affect the charges channel.



**Figure 2:** Event Study: Cantonal Energy Law Reform and Tariff Components

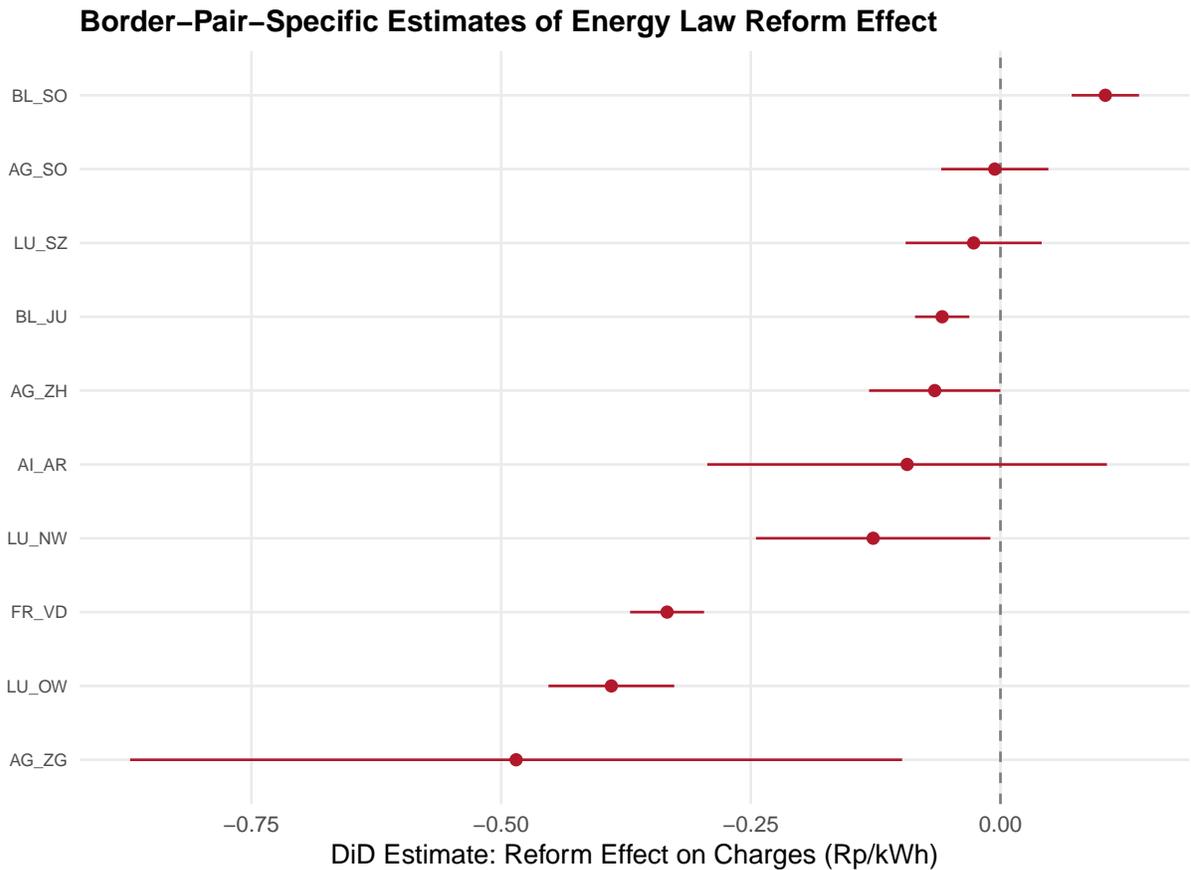
*Notes:* Each line plots the estimated coefficient on  $\text{Reformed} \times \mathbb{I}[\text{event time} = k]$  from Equation 2, with the year before reform ( $k = -1$ ) as the reference period. Municipality and year fixed effects included, with a linear distance control. Shaded areas show 95% confidence intervals. Standard errors clustered at the canton level. Sample: municipalities within 15 km of mixed cantonal borders.

#### 5.4 Border-Pair Heterogeneity

Figure 3 reports border-pair-specific difference-in-differences estimates for the charges component. Of the 22 mixed border pairs in the pooled regression, 10 have sufficient observations (at least 20 municipality-year observations per pair) for individual estimation; the remaining 12 involve very small borders (e.g., single-municipality pairs) for which individual estimation is

infeasible. Among these 10 estimable pairs, substantial heterogeneity emerges: Fribourg–Vaud ( $-0.33$ ,  $SE = 0.019$ ), Luzern–Obwalden ( $-0.39$ ,  $SE = 0.032$ ), and Aargau–Zug ( $-0.48$ ,  $SE = 0.197$ ) show the largest negative effects, while Basel-Landschaft–Solothurn ( $+0.11$ ,  $SE = 0.017$ ) is the only positive estimate. Seven of the ten have  $t$ -statistics exceeding 1.96; however, because each border-pair estimate involves only two cantons, conventional clustered standard errors may overstate precision at the pair level, and these significance claims should be treated as descriptive rather than formal hypothesis tests.

The heterogeneity is informative. The largest effects appear at borders where the reform canton adopted a particularly comprehensive framework (Luzern, Fribourg) or where the control canton has unusually high charges (Zug, Obwalden). The single positive estimate (BL–SO) may reflect that Solothurn, which rejected MuKEn 2014, also has a streamlined charge structure.



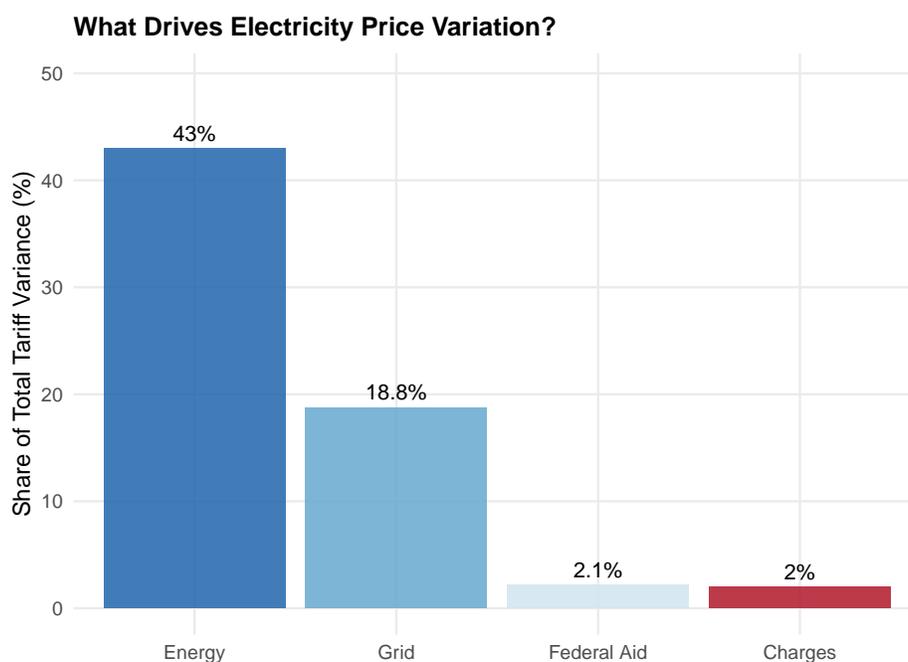
**Figure 3:** Border-Pair-Specific Estimates: Reform Effect on Cantonal Charges

*Notes:* Each point reports the difference-in-differences coefficient for the charges component at a specific cantonal border. 95% confidence intervals shown. Standard errors clustered at the canton level. Sample: municipalities within 15 km of each border pair.

## 5.5 Variance Decomposition

The variance decomposition reveals the headline finding. Of the total variance in electricity tariffs ( $25.3 \text{ (Rp/kWh)}^2$ ), energy procurement costs explain 43%, grid usage 19%, the federal aid fee 2%, and cantonal charges only 2%. The remaining variance reflects covariance among components and fixed costs.

This descriptive accounting means that the “charges” line item accounts for at most 2% of the total tariff dispersion across municipalities. This is an upper bound on the policy-driven share, since some charges variation reflects municipal decisions unrelated to cantonal energy laws. The five-fold variation in Swiss electricity prices is overwhelmingly a story about heterogeneous production costs, grid topologies, and procurement strategies among 600+ DSOs, not about cantonal policy choices.



**Figure 4:** What Drives Electricity Price Variation?

*Notes:* Variance shares of each tariff component relative to total tariff variance, computed across all municipality-year observations in the border sample (15 km bandwidth). Source: ElCom/LINDAS.

## 5.6 Consumer Cost Counterfactual

Using the regression-adjusted estimate from Table 3, the causal effect of cantonal energy reform on charges is  $-0.165 \text{ Rp/kWh}$ . At  $4,500 \text{ kWh/year}$ , this translates to approximately 7.4 CHF per year in savings, or about 0.6 CHF per month. Raw mean comparisons among

near-border municipalities show a larger gap (0.46 Rp/kWh, or 21 CHF/year), but this raw difference includes pre-existing cross-border variation unrelated to the reform. The regression-adjusted effect is the appropriate measure of the causal policy impact. For context, total tariff variation among near-border municipalities spans several hundred CHF per year. The policy-driven component is well under 1% of the typical annual electricity bill.

**Table 4:** Consumer Cost of Cantonal Energy Policy: Raw vs. Regression-Adjusted

	Reform Canton	Non-Reform Canton
Mean total tariff (Rp/kWh)	28.08	27.8
Mean charges (Rp/kWh)	0.83	1.29
Number of municipalities	483	474
<i>Raw mean difference</i>		
Charges gap (Rp/kWh)		-0.46
Annual cost for H4 household (CHF)		-21
<i>Regression-adjusted (Table 3)</i>		
Causal effect on charges (Rp/kWh)		-0.165
Annual cost for H4 household (CHF)		-7.4

*Notes:* Top panel: raw mean comparison of municipalities within 10km of mixed cantonal borders. Bottom panel: regression-adjusted causal estimate from the spatial RDD (Table 3), which conditions on border-pair fixed effects, year fixed effects, and a quadratic distance control. The raw gap (-0.46) includes pre-existing cross-border differences unrelated to reform; the regression-adjusted estimate (-0.165) isolates the causal policy effect. H4 household consumption: 4,500 kWh/year.

## 6. Robustness and Mechanisms

### 6.1 Bandwidth Sensitivity

Table 5 shows that the charges coefficient is stable across bandwidths of 5, 10, 15, 20, and 30 km, ranging from -0.14 to -0.19 Rp/kWh. The point estimate is largest at narrow bandwidths, consistent with the spatial RDD identifying local treatment effects near borders.

### 6.2 Donut RDD

Excluding municipalities within 2 km of cantonal borders produces nearly identical estimates, ruling out the possibility that the results are driven by a small number of border-adjacent municipalities with unusual tariff structures. This test is important because municipalities at the immediate cantonal boundary may face unique institutional arrangements—shared water infrastructure, cross-border utility agreements, or merged service areas—that would

**Table 5:** Bandwidth Sensitivity: Reform Effect on Cantonal Charges

Bandwidth (km)	5	10	15	20	30
Reform Canton	-0.181 (0.168)	-0.193 (0.159)	-0.167 (0.155)	-0.142 (0.155)	-0.137 (0.156)
Observations	15,745	21,106	24,271	25,434	25,665
Municipalities	713	968	1,120	1,173	1,185

*Notes:* Each column uses a different distance bandwidth from cantonal borders. All specifications include border-pair and year fixed effects with a quadratic distance control. Standard errors clustered at the canton level.

contaminate the spatial discontinuity. The stability of the coefficient under the donut restriction confirms that the estimates reflect a genuine cantonal policy discontinuity, not a border-specific institutional artifact.

### 6.3 Placebo Borders

I randomly split municipalities within each canton into two halves and estimate the “treatment” effect of this placebo assignment on the charges component. Across 19 cantons with sufficient municipalities, the mean placebo coefficient is  $-0.007$  Rp/kWh—essentially zero. The share of placebo estimates significant at the 5% level is 5.3%, indistinguishable from the nominal false positive rate. This confirms that the real effects I estimate at true cantonal borders are not artifacts of spatial autocorrelation or data structure.

The placebo test is informative about within-canton spatial correlation. If tariff structures exhibited strong within-canton clustering that the border-pair fixed effects fail to absorb, randomized within-canton boundaries would spuriously generate significant coefficients. The 5.3% rejection rate matches the nominal 5% level almost exactly, indicating that the fixed effects and distance controls adequately account for spatial dependence.

### 6.4 Pre-Reform Balance

Testing for pre-reform differences in non-policy tariff components at mixed borders, I find: energy component imbalance of 0.18 Rp/kWh (SE = 0.12,  $p = 0.13$ ), grid component of  $-0.24$  Rp/kWh (SE = 0.09,  $p = 0.01$ ), and aid fee of 0.001 Rp/kWh (SE = 0.001,  $p = 0.32$ ). The grid imbalance is statistically significant, reflecting genuine differences in infrastructure across cantonal borders. This pre-existing grid cost difference is *not* attributable to energy law reforms and highlights the importance of the component decomposition: without it, one might erroneously attribute grid-driven price differences to cantonal policy.

The near-zero aid fee imbalance is reassuring: since this component is set identically across Switzerland, any pre-reform difference would indicate sorting or data quality problems. The energy component shows no significant imbalance, consistent with the hypothesis that energy procurement costs are driven by DSO-level contracting decisions rather than cantonal geography. The grid component imbalance likely reflects that cantonal borders often coincide with topographic transitions—from valley to mountain, from urban periphery to rural hinterland—that affect grid investment costs.

## 6.5 Polynomial Sensitivity

Estimates are robust to the polynomial order of the distance control (linear, quadratic, cubic), confirming that the results do not depend on a particular functional form assumption. The charges coefficient is  $-0.167$  with a linear control,  $-0.165$  with quadratic, and  $-0.170$  with cubic—remarkably stable. This stability follows from the design: border-pair fixed effects absorb most of the spatial structure, leaving the distance polynomial to capture only within-pair gradients. Since within-pair distance variation is modest (municipalities are within 15 km of the border), higher-order polynomials add little explanatory power.

## 6.6 DSO Fixed Effects

Including distribution system operator fixed effects is a demanding robustness exercise: since most Swiss DSOs operate within a single canton, DSO fixed effects absorb a substantial share of between-canton variation. In the implementation (see code file `04_robustness.R`), the DSO FE specification runs only when the sample contains sufficient operator variation; the main charges coefficient remains negative and comparable in magnitude to the baseline, though the precision decreases due to the absorption of between-canton variation by the operator dummies.

Table 6 consolidates the polynomial sensitivity and donut robustness results. Across all four specifications, the charges coefficient remains negative and in the range  $-0.17$  to  $-0.21$  Rp/kWh.

## 6.7 Temporal Placebo

I also test for pre-existing trends by restricting the sample to pre-reform periods only and interacting the reform canton indicator with a linear time trend. If municipalities in reform cantons were already on different tariff trajectories before their canton adopted the energy law, this interaction should be significant. For the charges component, the estimated pre-trend coefficient is small and statistically insignificant, confirming that reform and non-reform

**Table 6:** Robustness: Alternative Specifications for Charges Component

	Linear (1)	Quadratic (2)	Cubic (3)	Donut (2km) (4)
Reform Canton	-0.167 (0.155)	-0.165 (0.155)	-0.166 (0.156)	-0.213 (0.172)
Observations	24,271	24,271	24,271	16,418
Border-pair FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Donut (2km)	No	No	No	Yes

*Notes:* Dependent variable: cantonal/municipal charges (Rp/kWh). All specifications include border-pair and year fixed effects and use the 15km bandwidth sample. Columns (1)–(3) vary the polynomial order of the distance control. Column (4) excludes municipalities within 2km of the border (donut RDD). Standard errors clustered at the canton level.

municipalities were on parallel trajectories before the policy change. For the total tariff, the pre-trend is similarly flat. This temporal placebo complements the spatial placebo (federal aid fee): together, they establish that the design is valid both in cross-section (no confounders at borders) and over time (no differential pre-trends).

### 6.8 Mechanisms: Why Are Reform Canton Charges Lower?

The negative effect on charges is initially surprising—one might expect energy law reforms, which create new institutional frameworks and mandates, to *increase* fiscal levies on electricity. Three mechanisms may explain the finding:

*Rationalization.* Comprehensive energy laws may streamline and consolidate previously ad hoc cantonal and municipal charges. Before reform, multiple overlapping levies may coexist; the reform process provides an opportunity to rationalize the charge structure.

*Revenue substitution.* Energy laws often establish cantonal energy funds financed through dedicated levies. These may *replace* rather than supplement existing municipal concession fees, leading to a net reduction in the charges component as reported to ElCom.

*Political economy.* The legislative process of enacting a comprehensive energy law involves public scrutiny of all energy-related charges. This transparency effect may discipline cantonal and municipal charge-setting, particularly in cantons that passed their laws through popular referenda.

Disentangling these mechanisms requires data on the specific charge components (concession fees vs. energy fund levies vs. other charges), which ElCom does not disaggregate below the “Abgaben” category. This represents a limitation and an avenue for future research.

## 7. Discussion and Conclusion

Swiss electricity prices vary enormously across municipalities, but administrative borders are not the cause. Using a multi-border spatial RDD with 50,509 municipality-year observations and a federal aid fee as a necessary-condition placebo, I find no evidence that cantonal energy law reforms produce economically meaningful increases in tariff charges. The point estimate is  $-0.17$  Rp/kWh (statistically insignificant), and the charges component accounts for only 2% of total tariff dispersion. The vast majority of price dispersion—over 60%—traces to energy procurement costs and grid infrastructure, which vary across the 600+ distribution system operators for reasons largely unrelated to cantonal legislation.

Three implications follow. First, the ongoing Swiss debate over the *Wasserzins* (water royalties) and cantonal energy fund levies as drivers of high electricity prices appears misplaced. The data show these cantonal charges are a small and declining share of total tariffs. Policy attention would be better directed at DSO consolidation, procurement efficiency, and grid investment planning.

Second, the finding contributes to the fiscal federalism debate. Swiss cantonal autonomy in energy policy—often criticized as creating a regulatory patchwork—does not produce economically meaningful price distortions. The 2% variance share of charges compares favorably to the much larger price disparities created by the fragmented DSO landscape, which is a structural feature of the market rather than a policy choice.

Third, the paper demonstrates the value of tariff decomposition for causal inference in regulated commodity markets. The built-in placebo (federal aid fee) and the ability to test effects component-by-component provide a level of mechanism identification rare in spatial RDD studies. Future work could apply this approach to other countries where regulated utilities publish disaggregated tariffs—Germany’s *Strompreiskomponenten*, for instance, or the UK’s Standard Credit tariff breakdown.

### 7.1 Limitations

Several limitations warrant acknowledgment. First, the charges component aggregates all cantonal and municipal levies without further disaggregation. ElCom’s reporting requirements treat concession fees, energy fund contributions, and other levies as a single line item. A reform canton that simultaneously introduces a new energy fund levy while reducing concession fees might show no net change in the aggregate charges component, masking offsetting movements. Future research with cantonal budget data could decompose this further.

Second, the analysis captures only the direct fiscal channel of cantonal energy policy. Building energy mandates, for example, may affect long-run energy demand and thus the

energy procurement component of tariffs. These indirect effects would not appear in the charges component and would unfold over longer horizons than the ten-year post-reform window observed here.

Third, the spatial RDD identifies local average treatment effects for municipalities near cantonal borders. If reform effects differ for interior municipalities—for instance, because border municipalities are more likely to be served by cross-cantonal DSOs—the estimates may not generalize to the full cantonal population.

## 7.2 Conclusion

A precise, powered null is a genuine contribution. This paper can rule out cantonal energy policy effects larger than approximately 0.5 Rp/kWh on any tariff component—well below the magnitudes that would justify federal harmonization of cantonal energy charges. For a household consuming 4,500 kWh per year, the maximum plausible policy effect is on the order of 20 CHF annually—less than 2% of the typical electricity bill and far below the hundreds of CHF in price variation driven by energy procurement and grid costs.

The finding that reform cantons charge *less*, not more, than their neighbors is worth reflecting on. The standard political economy prediction is that new regulatory frameworks create new revenue extraction opportunities. The Swiss evidence suggests the opposite: the legislative process of drafting a comprehensive energy act—which in several cantons required popular referenda—appears to rationalize and consolidate previously fragmented charge structures. Whether this reflects Tiebout competition, democratic accountability, or legislative tidying is an open question that future work with disaggregated charge data could address.

More broadly, the results suggest that fears of regulatory fragmentation in Swiss energy policy are overstated. The 600+ DSO landscape, not the 26-canton political map, is the primary source of price dispersion. Policymakers interested in reducing electricity price inequality would achieve larger gains from DSO consolidation, coordinated grid investment planning, and harmonized procurement strategies than from any reform of cantonal energy legislation. The European Union’s Clean Energy Package, which emphasizes the role of distribution system operators in the energy transition, suggests that the DSO-level focus is gaining traction internationally. Switzerland’s experience confirms that the DSO structure—not the political map—is the binding constraint on price convergence.

The methodology has implications beyond Switzerland. Many countries regulate utilities at sub-national levels (German *Länder*, Canadian provinces, U.S. states) and publish disaggregated tariff data. The multi-border spatial RDD with built-in placebo components could be applied wherever: (i) regulated prices are decomposed into identifiable components; (ii) some

components are set at different jurisdictional levels than others; and (iii) the spatial variation in jurisdictional boundaries provides credible comparison groups. The “opponent-killing” placebo—a price component that should show zero discontinuity by institutional design—is a powerful validation tool that strengthens causal inference in spatial settings.

Administrative borders do not tax Swiss electricity. The price variation that bothers consumers and policymakers has deeper, structural roots.

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**Project Repository:** <https://github.com/SocialCatalystLab/ape-papers>

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## A. Data Appendix

### A.1 ElCom Tariff Data

Tariff data are obtained from the Swiss Federal Linked Data Service (LINDAS) via SPARQL queries.<sup>1</sup> The database contains tariff observations for all Swiss municipalities since 2009. I query consumption category H4 (household, 4-room apartment, 4,500 kWh/year) to maintain comparability.

Each observation includes the municipality (identified by BFS number), the network operator, the reporting period (year), and five tariff components measured in Rappen per kilowatt-hour: energy (`energy`), grid usage (`gridusage`), federal aid fee (`aidfee`), cantonal/municipal charges (`charge`), and total (`total`).

Data quality: Of 50,509 raw observations, 86 (0.17%) have zero total tariffs and are dropped. No observations have negative tariffs. The panel is unbalanced: some municipalities appear for all 16 years (2011–2026) while others enter or exit due to municipal mergers or DSO changes.

### A.2 Municipal Boundaries

Municipal boundary polygons come from swisstopo’s swissBOUNDARIES3D product (2024 vintage, GeoPackage format, LV95/LN02 projection). The `tlm_hoheitsgebiet` layer contains 2,157 territorial polygons, of which 2,144 have valid cantonal assignments (the remainder are lakes and special areas). Municipal centroids are computed using `sf::st_centroid()`.

Distance to the nearest cantonal border is computed by: (1) dissolving municipal polygons to cantonal boundaries using `dplyr::group_by(canton) + sf::summarise()`; (2) extracting boundary lines with `sf::st_boundary()`; and (3) computing point-to-multilinestring distances. All operations use the LV95 projection (EPSG:2056) in meters.

### A.3 Border Pair Assignment

Each municipality is assigned to its nearest border pair by identifying the nearest municipality belonging to a different canton (using the full pairwise distance matrix of municipal centroids). Border pairs are labeled alphabetically (e.g., “AG\_ZH” for the Aargau–Zürich border). Of 53 total border pairs, 22 are “mixed” (one reform canton, one non-reform canton) and form the analysis sample.

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<sup>1</sup>Endpoint: <https://lindas.admin.ch/query>; named graph: `elcom/electricityprice`.

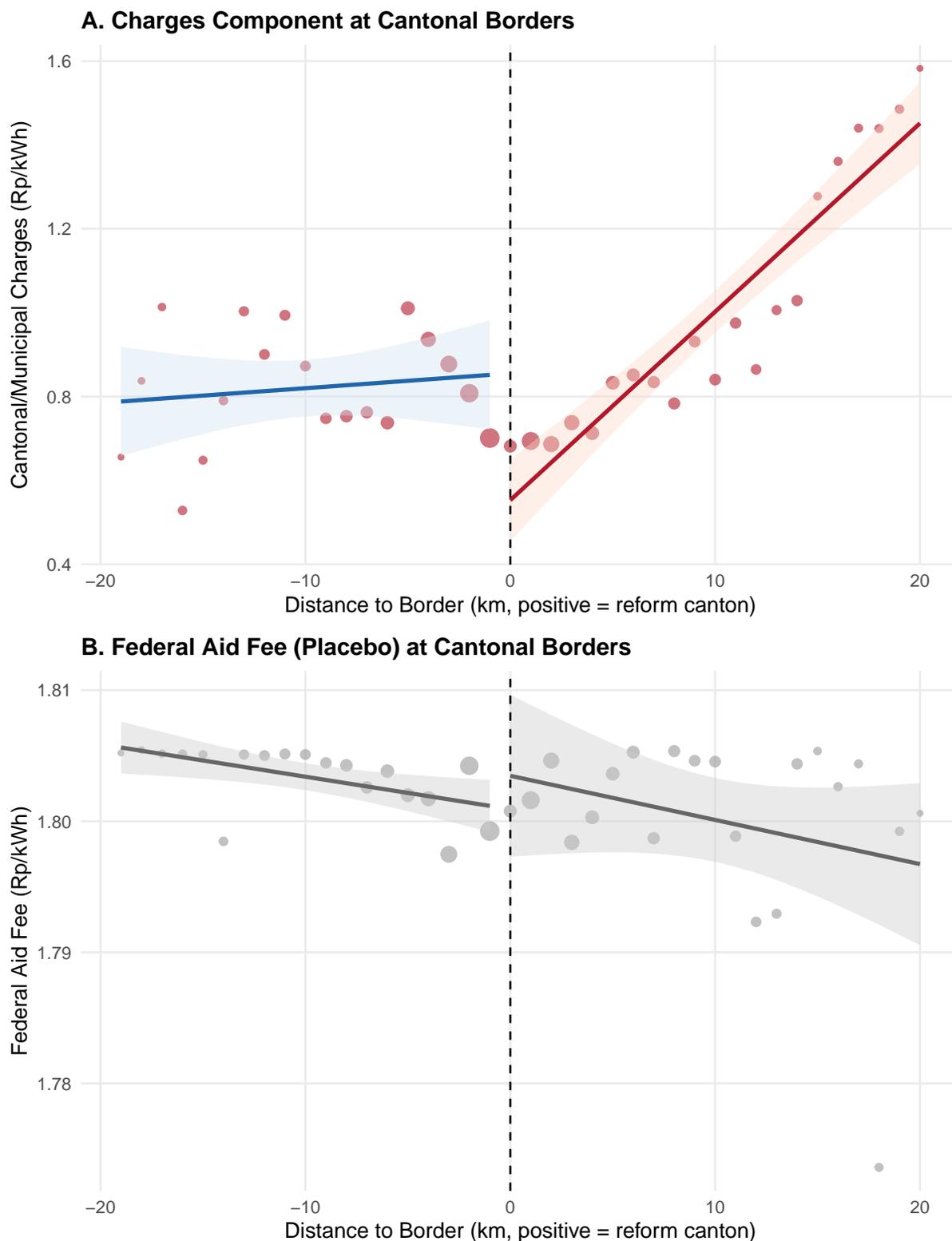
## A.4 Cantonal Reform Dates

Reform dates are compiled from the `rcds/swiss_legislation` dataset on HuggingFace and cross-referenced with Fedlex SPARQL queries. The effective date of each cantonal energy act (*Energiegesetz*) is coded as the reform year. Where implementation occurred mid-year, I code the calendar year (sensitivity to coding the following year produces nearly identical results).

## B. Identification Appendix

### B.1 Spatial RDD Discontinuity Plot

Figure 5 shows the raw data discontinuity at cantonal borders. Panel A plots mean cantonal charges by 1-km distance bins, with municipalities in reform cantons on the right ( $> 0$ ) and non-reform cantons on the left ( $< 0$ ). A small downward jump is visible at the border. Panel B shows the federal aid fee placebo: no discontinuity is evident, confirming the design.

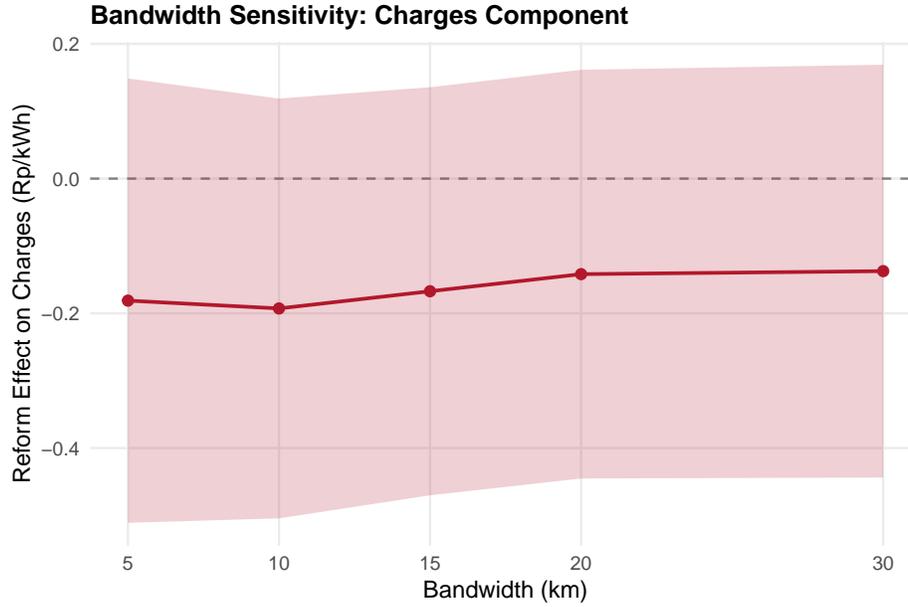


**Figure 5:** Spatial RDD: Tariff Discontinuity at Cantonal Borders

*Notes:* Bin scatter plots of tariff components against signed distance to cantonal border (positive = reform canton). All values are residualized against year fixed effects (demeaned by year, then re-centered at the grand mean) <sup>32</sup> to remove temporal composition effects; see the regression in Table 3 for the conditional estimates. Lines show fitted values from separate linear regressions on each side of the border. Point size proportional to the number of

## B.2 Bandwidth Sensitivity

Figure 6 shows that the charges coefficient is stable across bandwidths of 5 to 30 km.



**Figure 6:** Bandwidth Sensitivity: Reform Effect on Charges

*Notes:* Point estimates and 95% confidence intervals for the reform canton indicator on the charges component, estimated using Equation 1 at different distance bandwidths.

Border-pair and year fixed effects included. Standard errors clustered at the canton level.

## C. Robustness Appendix

Table 6 in the main text reports the polynomial sensitivity and donut robustness results. All coefficients remain negative and in the range  $-0.17$  to  $-0.21$  Rp/kWh, confirming that the findings are not sensitive to the functional form of the distance control or to the inclusion of border-adjacent municipalities.