Unveiling the Energy Price Elasticity: Exploring the Impact of Price Shocks through Regression Discontinuity Design*

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Abstract

Understanding how electricity demand responds to price shocks is a key question for a number of actors along the electricity supply chain as well as policy makers, albeit its estimation present several challenges. In this paper, we exploit a natural experiment to estimate the short-run impact of a price shock on residential electricity consumption. In particular, in January of 2021 the utility company adopted a new tariff schedule whereby the fixed component of the tariff was organized in four tiers based on households' annual moving average consumption, which we exploit in a regression-discontinuity design. Despite the large average price increases at each fixed-cost cutoff, we find no significant effect of the tariff change on subsequent electricity consumption around the three thresholds. This lack of demand response to prices suggests that non-price instruments may be more effective at influencing residential electricity consumption.

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1 Introduction

Understanding how electricity demand responds to price shocks is a key question for a number of actors along the electricity supply chain, as it allows regulators and distribution companies to forecast generation and capacity requirements for the future, as well as demands on the grid infrastructure (Wang and Mogi, 2017; Labandeira, Labeaga, and López-Otero, 2017). The consumption responses to price shocks are also essential to understanding welfare changes from environmental and energy policy (Miller and Alberini, 2016; Burke and Abayasekara, 2018) as well as social transfers and subsidies. Despite its importance, estimating the price elasticity of electricity demand is extremely complex. Generally, price changes occur together with demand shocks or simultaneously for all users (Nataraj and Hanemann, 2011). Moreover, experimental evaluations are extremely complex because of regulatory restrictions.

In this paper, we estimate the short-run impact of a price shock on residential users' electricity consumption using a natural experiment in the province of Tucuman, Argentina. Our analysis exploits billing data for the full population of residential electricity users across multiple years of consumption history for over 550 thousand households. In January of 2021, the provincial utility company EDET SA adopted a new tariff schedule whereby the fixed component of the tariff was organized in four tiers based on households' annual moving average consumption, while the variable component was linear and the same across the four tiers. Despite households being exposed to the same tariff structure, recent empirical findings argue that households inform their pricing perceptions and choose their consumption based on their recent past billing experiences (Ito, 2014), rather than their marginal or expected marginal price (Borenstein, 2009).

The introduction of the new tariff in 2021 creates a discontinuity in both the fixed and average price for those users around the three thresholds generated by their moving average annual consumption. Since the non-linearities are based on annual average consumption, this introduces random price variation for consumers around the thresholds. The change in the fixed cost barely above and below the three thresholds ranges from 77% to 107%, while the corresponding change in total costs ranges from 26% to 36%. Thus, we estimate the short-run demand responses to these price changes in the period following the implementation of the policy using a regression discontinuity design for users just above and below the three thresholds. To assess the validity of the research design, we first provide evidence that treatment and control units in a close neighborhood around the cutoffs are comparable, ruling out jumps in covariates at the cutoff once we control for our running variable.

Despite the large average price increase at each threshold, we find no effect of the tariff change on customers' electricity consumption around any of the three thresholds following receipt of their electricity bills. The estimates are both small in size and are not statistically significant. These estimated effects are robust to alternative bandwidths and functional forms. While the tariff change occurred during the COVID-19 pandemic, which may limit the generalizability of our findings, the lack of demand response to prices suggests that non-price instruments may be more effective at influencing residential electricity consumption.

Our work contributes to a recent literature that uses experimental and quasi-experimental methods to estimate electricity and natural gas consumption responses to tariff changes. The closest to our paper is Bastos et al. (2015) which exploit a similar change in natural gas tariffs to estimate

the short-run impact of price shocks on residential gas utilization. In contrast to our findings, they find an elasticity of roughly -0.15, which is in line with other estimates in the natural gas market (Bernstein and Griffin, 2006), as well as in electricity markets (Reiss and White, 2008; Ito, 2014).

However, our paper includes some stark differences. First, we focus our analysis in the first period after households receive the bill under the new tariff schedule. This makes it much more likely that users cannot react strategically to be assigned to their preferred fixed-cost tier (Lee and Card, 2008). Second, we are able to estimate the consumption response for low, medium, and high consumption households, while Bastos et al. (2015) only estimate for one of eight thresholds. Third, we test for behavioral responses using subsequent periods after the first bill in order to improve sample sizes and test for differential effects on high-season consumption and we still find similar results. This is particularly surprising since, around a threshold, households can lower their future fixed costs by sufficiently reducing consumption in the current period to bring their average annual consumption below the threshold in future periods.

Our speculation regarding these robust results are related to the following facts. First, this is not a short-run price elasticity: the natural experiment creates a treatment that is a price shock to the average price received in the previous bill. Then, we do expect a lower response than that from a permanent intervention to prices. Note, however, that there are some tariff policies that only intervene prices for short periods. Second, our sample period includes a period in which Argentina energy prices were really low. Average monthly bill was less than USD 20, 3% of average total household income. We would expect a lower consumption response for low prices support. In this sense, we highlight that it is crucial to consider the support region for prices when estimating consumers' price responses. We expect to test this claim in future research exploiting the current energy price actualization reform in Argentina.

The remainder of the paper proceeds as follows. Section 2 introduces the institutional background and Section 3 describes the data. Section 4 details the identification strategy and Section 5 presents the main results. The last section concludes.

2 Institutional and Tariff Background

EDET SA is the only electric power service provider in the Province of Tucumán, Argentina, and the fifth largest electric utility in the country, with approximately 650 thousand users (more than 90% residential). The utility is private and regulated by a public agency (ERSEPT), through a hybrid regulatory framework originally designed as Price Cap (Cont, Navajas, and Porto, 2019; Sappington and Weisman, 2010).

In the year 2021, the regulatory body ERSEPT introduced modifications to the tariff framework. Prior to this, from 2018 to December 2020, consumers were segmented into five distinct categories. They were subject to a pricing system that encompassed both a fixed cost and a marginal cost component (wherein energy consumption beyond the limits of the previous category incurred additional charges). These calculations were based on their consumption during the last bimester. Notice, EDET has clients with monthly and bimonthly reading, but, as explained latter, in this research we will focus on bimonthly clients.

However, from January 2021, the tariff structure underwent a significant transformation, marked by the implementation of four noteworthy adjustments [1]

[1] Users were categorized into four distinct groups (designated as C1 to C4), each of which was assigned a Fixed Cost based on their twelve-month moving average consumption (referred to as MAC).

[2] Variable price ($/kWh) was the same for all seasons, with only one jump at 750 kWh per month, after which the price per kWh in excess of 750 kWh increases 56%. Notice that more than 80% of users consume less than 750 kWh per month.

[3] The share of the fixed component on the bill increased noticeably. Previously, for a hypothetical consumption of 460 kWh/bimester[2], the bill consisted of 9% fixed cost (FC) and 91% variable cost (VC). Starting from January 2021, for the same consumption level, fixed costs represent nearly 40%.

[4] Additionally, a social tariff was implemented for low-income users, which represents a discount on the fixed cost of approximately 55%.

As a consequence, starting from January 2021, total bill (B_{it}), net of taxes[3], is made up of a tier-specific fixed cost (FC_{it}) determined as a function of the twelve-month moving average consumption (MAC_{it}), and a variable cost determined by the contemporaneous bimonthly consumption (C_{it}).

The tier-specific fixed cost per month, FC_{it}, is increasing in the twelve-month moving average consumption and defined by 4 categories:

$$FC_{it}(MAC_{it}) = \begin{cases} FC_1/month & \text{if } MAC_{it} \leq 150 \text{ kWh/month} \\ FC_2/month & \text{if } 151 \text{ kWh/month} \leq MAC_{it} \leq 250 \text{ kWh/month} \\ FC_3/month & \text{if } 251 \text{ kWh/month} \leq MAC_{it} \leq 550 \text{ kWh/month} \\ FC_4/month & \text{if } MAC_{it} > 550 \text{ kWh/month}, \end{cases} \tag{1}$$

where the annual moving average consumption MAC_{it} of the last 6 bimontlhy is defined by:

$$MAC_{it} = \frac{1}{12} \times \sum_{s=0}^{5} (C_{i,t-s}) \tag{2}$$

The variable cost per kWh is increasing in contemporaneous bimonthly consumption C_{it} and charged on excess consumption from the previous category. It is defined as follows:

$$vc_{it}(C_{it}) = \begin{cases} vc_1 & \text{if } C_{it}/2 \leq 750 \text{ kWh/month} \\ vc_2 & \text{if } C_{it}/2 > 750 \text{ kWh/month}. \end{cases} \tag{3}$$

[1] Resolution ERSEPT 645/20.
[2] Average monthly residential consumption.
[3] Taxes and other charges represent a 38% mark-up in the bill.

Finally, total bill for a bimonthly client t is defined by:

$$B_{it}(MAC_{it}, C_{it}) = \underbrace{\left[2 \times FC_{it}(MAC_{it})\right]}_{\text{fixed component}} + \underbrace{\left[vc_1 \times C_{it} + \mathbb{1}[C_{it}/2 > 750] \times vc_2 \times 2 \times (C_{it}/2 - 750)\right]}_{\text{variable component}} \quad (4)$$

Table 1 presents the tariff schedule valid from January 2021 for users with and without social tariff.

Table 1: Tariff Schedule from January 2021

Fixed Cost	**Unit**	**Fixed fee**	**Fixed fee under social tariff**	**Discount under social tariff**
C1: MAC <= 150 kWh/month	$/month	183	113	45%
C2: 151 <= MAC <= 250 kWh/month	$/month	365	178	51%
C3: 251 <= MAC <= 550 kWh/month	$/month	755	352	53%
C4: MAC >550 kWh/month	$/month	1,469	676	54%
Variable costs	**Unit**	**Variable fee**	**Variable fee under social tariff**	**Discount under social tariff**
Energy Cost	$/kWh	2.93	2.93	0%
Overage charge (>750 kWh/month)	$/kWh	1.64	0	100%

Then, the new tariff schedule generates a discontinuity on the fixed and total cost according to the annual moving average consumption. The fixed cost increases from 57% to 107% (from C2 to C3), while the total bill increases from 13% to 36%, depending on the threshold and whether the user receives social tariff (Table 2 and 3). Since this variation depends on the threshold, we will estimate different models for each one of them.

Table 2: Change in fixed and total cost around each threshold for bimonthly users without Social Tariff

		$MAC_{it} = C_{it}/2$	FC	VC	TC	Change in FC	Change in TC
C1 vs. C2	C1	149	413	874	1287		
	C2	151	729	886	1615	77%	26%
C2 vs. C3	C2	249	729	1461	2190		
	C3	251	1510	1473	2983	107%	36%
C3 vs. C4	C3	549	1510	3222	4732		
	C4	551	2938	3234	6171	95%	30%

Notes: For simplicity, we assume that the monthly consumption of the user (third column) is equal to the MAC_{it} on that period. Since we focus on bimonthly consumption, the fixed and total costs are calculated assuming that the period consumption was two times that monthly amount. For example, in the first case, since $MAC_{it} = 149kWh/month$, then the bimonthly consumption is $C_{it} = 298kWh$ (2 times 149 kWh).

Table 3: Change in fixed and total cost around each threshold for Social Tariff bimonthly Users

		$MAC_{it} = C_{it}/2$	FC	VC	TC	Change in FC	Change in TC
C1 vs. C2	C1	149	227	874	1101		
	C2	151	357	886	1243	57%	13%
C2 vs. C3	C2	249	357	1461	1818		
	C3	251	705	1473	2178	97%	20%
C3 vs. C4	C3	549	705	3222	3926		
	C4	551	1353	3234	4586	92%	17%

Notes: For simplicity, we assume that the monthly consumption of the user (third column) is equal to the MAC_{it} on that period. Since we focus on bimonthly consumption, the fixed and total costs are calculated assuming that the period consumption was two times that monthly amount. For example, in the first case, since $MAC_{it} = 149kWh/month$, then the bimonthly consumption is $C_{it} = 298kWh$ (2 times 149 kWh).

3 Data

At the heart of this paper is an unique longitudinal database with administrative records of residential users of electricity from the electric power service provider EDET SA. This database contains information about the users' service ID, their period consumption in kWh, annual moving average consumption, total bill in Argentine pesos, measurement dates for consumption, issue dates for the bills, and the period to which the measurement of consumption correspond to (which could be a month or two months). Our data cover the period from January 2020 to March 2022 with a total of 9,371,112 observations from 559,188 users.

We make several restrictions to create our estimation sample. Firstly, we drop monthly users and concentrate on bimonthly users only. This is because it takes about 10 days from the measurement date to receive the bill and, therefore, monthly users only have around 20 days to react to the new energy price seen in the bill compared to 50 days for their bimonthly counterpart. Hence, all else equal, we expect to find a higher effect on bimonthly users compared to monthly users. Following this line of reasoning, we intend to provide an upper bound for the behavioral response to the price shock.

Secondly, we will evaluate the effect of price shock on consumptions for the users with the bill issued in May 2021. Since the new tariff schedule was implemented in January 2021, the bill issued in March 2021 was the first bill received under the new tariff schedule. Therefore, the users' category by March 2021 was determined by computing the twelve-month moving average consumption, i.e., from the March-April 2020 bimester to the January-February 2021 bimester, included. As a consequence, the users' response to the new tariff schedule could be quantified for the first time with the bill issued in May 2021, reflecting the consumption measurement for the March-April 2021 bimester. Following this line of reasoning, this investigation focuses on the bill issued in May 2021, since it reflects the behavioral response for the users who received the "full" price shock in the March 2021 bill and acted upon it. Notice this is a difference with Bastos et al. (2015) and we will argue it may improve the identification strategy.

Third, we restrict the sample to users who have been active for at least five bimesters before the

implementation of the new tariff in January 2021, and who are also active at least two bimesters after. This is in order to avoid possible errors that will affect the sharp design of our experiment.

After these sample restrictions, our final sample consists of 171,587 users divided into four categories as of March 2021, as shown in Table 4 below. Category C1 presents the highest proportion of users, followed by category C3, C2, and ultimately, C4, with only 5% of the users.

Table 4: Descriptive Statistics By Price Category in Period 0 (March 2021 bill)

	Category C1	Category C2	Category C3	Category C4	Total
Number of Users	59,964	47,316	55,207	9,100	171,587
Share (%)	34.95	27.58	32.17	5.30	100.00
Consumption (kWh/bim)	185.076	421.289	762.978	1,627.751	512.660
	(127.641)	(152.026)	(291.332)	(829.478)	(449.187)
MAC (kWh/month)	84.223	197.468	354.763	757.335	238.193
	(43.923)	(28.610)	(78.800)	(306.898)	(187.883)
Total Bill ($/bim)	1,627.197	3,169.598	5,963.737	13,035.200	4,055.389
	(3,394.856)	(1,337.221)	(2,472.557)	(7,307.769)	(4,122.056)

Notes: Standard deviation between brackets.

4 Identification Strategy

Regression discontinuity (RD) has become one of the most credible non-experimental method for causal inference and impact evaluation (Cattaneo and Titiunik, 2022). The reason RD is so appealing to many is because of its ability to convincingly eliminate selection bias (Cunningham, 2021).

RD research designs exploit precise knowledge of the rules that determine treatment (Angrist and Pischke, 2009). In particular, RD design is defined by three components: a score (the "running variable"), a cutoff, and a discontinuous treatment assignment rule. The methodology is applicable in situations where the score is observable and the cutoff is known. In this paper, we exploit a sharp RD design[4] where the score variable is the annual moving average consumption of each user and there are 3 cutoffs which imply a jump in the fixed (and average) cost of the bill.

Despite households being exposed to the same tariff structure, recent empirical findings lend support to the proposition that households derive their pricing perceptions from their recent past billing experiences. In particular, Ito (2014) finds that residential consumers in electricity market respond to lagged average price, rather than marginal or expected marginal price. The authors exploit price variation at spatial discontinuities in electricity service areas and find strong evidence that households respond to lagged average price rather than contemporaneous price. Ito's argument

[4]where the treatment assigned and the treatment received coincide for all units.

rests on the assertion that discerning the marginal cost of electricity entails a significant information expenditure. This is primarily attributed to the intricate nature of monthly utility bills, which can obscure the nonlinear pricing structure, rendering comprehension arduous for consumers. Additionally, the practicality of tracking cumulative electricity consumption throughout a billing cycle is limited, unless aided by an in-home display furnishing consumption information. Remarkably, both these aspects align favorably with the tenets of our study. Our investigation focuses on the initial consumption period, wherein responses to new billing information could manifest, and underscores the challenges associated with monitoring annual cumulative electricity consumption in the absence of an in-home display.

Moreover, Bastos et al. (2015), who uses a similar strategy for identifying price shock on gas consumption, administers a telephone survey to more than 350 gas customers from Buenos Aires (Argentina) with a very similar tariff structure (cost depends on annual moving average consumption). The authors find that customers' knowledge regarding bill determination is "almost non existent", although they tend to know about how much they paid last month. As mentioned before, we have an advantage relative to Bastos et al. (2015), we are able to quantify the response to the new tariff schedule in the first bimester where consumption can react to the first bill received with the new tariff schedule.

Then, the introduction of a threshold, defined by observed annual moving average consumption, approximates a random experiment for users around the threshold, where users just below the cutoff receive a low price and users just above it receive a high price. Formally, our econometric model is defined by the following equations. The treatment variable, $Treatment_{it}$, corresponds to a binary indicator of whether the user has received low or high price (fixed and total bill) in $t-1$ bill:

$$Treatment_{it} = \begin{cases} 0 & \text{if } MAC_{i,t-1} < \text{threshold category} \\ 1 & \text{if } MAC_{i,t-1} > \text{threshold category} \end{cases} \tag{5}$$

This treatment assignment implies the sharp design, where the probability for treatment as a function of the annual moving average consumption changes discontinuously at the cutoff from zero to one. Thus, the sharp RD treatment effect is formally defined as:

$$\beta_{RD} \equiv \mathbb{E}\left[Y_i(1) - Y_i(0) | MAC_i = c\right] \tag{6}$$

The central goal of empirical RD analysis is to adequately perform (local) extrapolation in order to compare control and treatment units. The assumption of comparability between units with very similar values of the running variable around the threshold is formalized using continuity assumptions and is the fundamental concept on which all RD designs are implemented (Hahn, Todd, and Van der Klaauw, 2001). In particular, if the average potential outcomes are continuous functions of the score at c, the difference between the limits of the treated and control average observed outcomes as the score converges to the cutoff is equal to the average treatment effect at the cutoff.

$$\mathbb{E}\left[Y_i(1) - Y_i(0) | MAC_i = c\right] = \lim_{MAC \downarrow c} \mathbb{E}\left[Y_i(1) | MAC_i = c\right] - \lim_{MAC \uparrow c} \mathbb{E}\left[Y_i(1) | MAC_i = c\right] \tag{7}$$

Then, to implement the RD design, we use the following empirical specification, similar to Bastos et al. (2015):

$$C_{it} = \beta_0 + \beta_1 \times Treatment_{it} + f(MAC_{i,t-1}) + \epsilon_{it} \tag{8}$$

where C_{it} is bimonthly consumption on bimester t, $f(MAC_{i,t-1})$ is a flexible function of the annual moving average consumption, and $Treatment_{it}$ corresponds to low or high fixed cost.

4.1 Testing the Validity of the Research Design

The average treatment effect is identified if the treatment and control units in a close neighborhood around the cutoff are comparable. Tables 5, 7, and 6 below provide evidence in this regard defining treatment groups composed of users whose normalized twelve-month moving average consumption by March 2021 is within 5% of each of the cutoffs and we test for the existence of jumps in covariates at the cutoff once we control for differences in normalized moving average consumption.

Table 5 presents results for key dates and period lengths for users whose MAC is within 5% of 150 kWh/month by March 2021. Panel A shows the timing of events for the treatment and control users. We normalize the dates relative to March 1st, 2021, such that, for example, Day = 9 corresponds to March 9th, 2021. We focus our attention on three key dates: (a) the date of measurement for period 0 consumption, (b) the date the bill for period 0 was issued, and (c) the date of measurement for period 1 consumption. We can see that electricity bills are issued approximately four days after the final measurement for the period. Panel B shows that treatment and control users have almost identical number of days to respond to the price shock after receiving the period 0 bill (i.e., days between the issue date for period 0 bill and the final measurement for period 1 bill).[5] Finally, Panel C shows that the number of days between the final measurement for period 0 and period 1 is also almost identical for treatment and control users, ensuring that differences in period 1 consumption do not come from differences in period length. Note that these tables present raw differences as well as adjusted differences. The latter are the results from regressing the key dates and period lengths on the treatment dummy while controlling linearly for the normalized monthly moving average consumption in period 0. Tables 11 and 12 in the Appendix present the results for the 250 kWh and 550 kWh thresholds, respectively.

Table 6 presents bill amount for treatment and control group for different periods. Interestingly, once controlled by the running variable, there are no significant differences between the control and treatment groups for periods previous to the cutoff. However, as necessary and expected since it is the mechanism by which we expect an impact on consumption, treatment and control

[5]This is an upper bound for the number of days for consumers to react to the period 0 bill, as the issue date does not necessarily coincide with the date the users receive the bill.

Table 5: Dates and Periods by Treatment status (threshold = 150 kWh)
(Days Normalized: March 1st, 2021 = Day 1)

	Treatment	Control	Raw Difference	Adjusted Difference
Panel A: Dates				
Final Measurement Period 0	9.558	9.380	-0.178	0.313
	(0.097)	(0.093)	(0.135)	(0.271)
Bill Period 0 (Treatment Date)	13.622	13.460	-0.162	0.144
	(0.107)	(0.101)	(0.147)	(0.295)
Final Measurement Period 1	70.908	70.750	-0.158	0.275
	(0.085)	(0.082)	(0.118)	(0.238)
Panel B: Days Between Bill Period 0 and Final Measurement Period 1				
Days	57.252	57.247	-0.006	0.159
	(0.053)	(0.051)	(0.074)	(0.148)
Panel C: Days Between Final Measurement in Period 0 and Period 1				
Days	61.346	61.367	0.021	-0.089
	(0.022)	(0.021)	(0.031)	(0.060)

Notes: Means and standard errors in parentheses. Sample includes all customers with monthly moving average consumption within 5% of the threshold by March, 2021. Period 0 corresponds to the bimester whose bill was issued in March, 2021. Dates in the table are normalized so that March 1st, 2021 corresponds to day 1. Robust Standard Errors. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

have a significant difference in, average, bill amount. Once controlled by annual moving average consumption, the treatment group has a 14% higher bill amount than the control group. Notice, in tables 15 and 16 in the Appendix, similar results are observed for thresholds 250 and 550. Although the treatment (bill amount differences) varies to 23% (threshold 250) and 18% (threshold 550).

Table 6: Average Bill Amount By Treatment Status (threshold = 150 kWh)

	Treatment	Control	Raw Difference	Adjusted Difference
Period -5	2204.230	2133.545	-70.684**	1.729
	(22.387)	(21.859)	(31.291)	(61.874)
Period -4	1893.332	1804.307	-89.025***	7.863
	(17.989)	(17.917)	(25.405)	(48.925)
Period -3	1861.812	1796.264	-65.548***	13.742
	(17.988)	(16.808)	(24.591)	(47.881)
Period -2	1860.141	1774.421	-85.720***	72.454*
	(14.398)	(14.117)	(20.169)	(38.647)
Period -1	2640.312	2484.686	-155.626***	48.919
	(18.373)	(15.868)	(24.198)	(47.205)
Period 0	2688.294	2162.389	-525.904***	389.386***
	(16.931)	(15.833)	(23.156)	(48.731)

Table 7, Panel A, tests if there are significant differences between our control and treatment groups for our outcome variable, consumption, in the periods previous to our treatment. By con-

struction, as we would expect, we find that bimonthly average consumption is higher for treatment than control group. However, RD design points out that controlling by the running variable is essential. Notice that once we control for the running variable, like in our econometric model, we fail to observe statistically significant differences between treatment and control groups. Panel B, presents the ratio of the bimonthly consumption to annual accumulated consumption and highlights two interesting results. First, the treatment and control groups have similar consumption seasonality. Second, bimonthly consumption weighs less than 25% in annual moving average consumption. Then, strategically changing its score results is more difficult. Tables 13 and 14 in the Appendix present the results for the 250 kWh and 550 kWh thresholds, respectively.

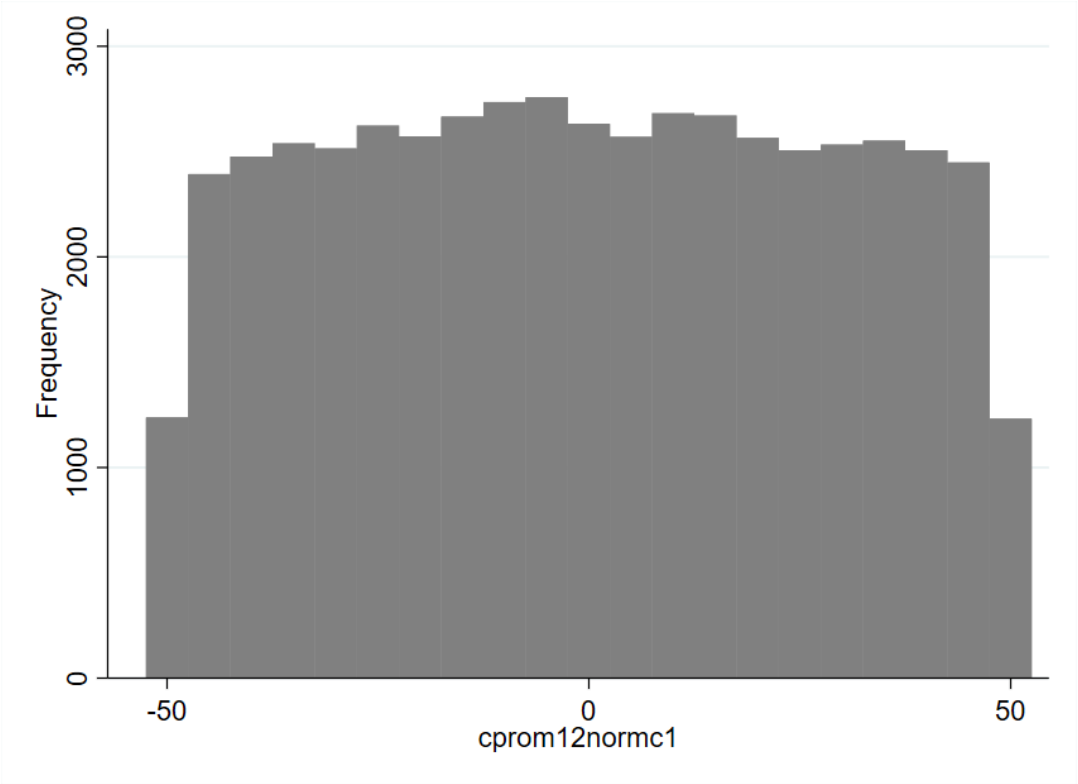
Table 7: Consumption Levels and Ratios To Accumulated Consumption by Treatment Status (threshold = 150 kWh)

	Treatment	Control	Raw Difference	Adjusted Difference
Panel A: Consumption Levels (kWh/bimester)				
Period -5	293.196	280.396	-12.800***	-5.241
	(1.626)	(1.516)	(2.221)	(4.495)
Period -4	263.860	248.876	-14.984***	1.019
	(1.703)	(1.533)	(2.287)	(4.660)
Period -3	265.673	253.216	-12.456***	0.075
	(1.680)	(1.516)	(2.258)	(4.584)
Period -2	281.117	266.162	-14.955***	8.88**
	(1.292)	(1.172)	(1.741)	(3.563)
Period -1	389.585	369.185	-20.400***	2.977
	(1.877)	(1.710)	(2.535)	(5.191)
Period 0	325.916	312.001	-13.915***	-7.446
	(1.820)	(1.723)	(2.505)	(5.057)
Panel B: Ratio of Consumption in a Period and Annual Accumulated Consumption by Period 0				
Period -5	0.159	0.160	0.001	-0.003
	(0.001)	(0.001)	(0.001)	(0.002)
Period -4	0.143	0.142	-0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.003)
Period -3	0.144	0.144	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.003)
Period -2	0.152	0.152	-0.001	0.005**
	(0.001)	(0.001)	(0.001)	(0.002)
Period -1	0.211	0.210	-0.001	0.002
	(0.001)	(0.001)	(0.001)	(0.003)
Period 0	0.177	0.178	0.001	-0.004
	(0.001)	(0.001)	(0.001)	(0.003)

Finally, one of the most important threats to our identification assumption is that households may strategically change their score (consumption) to be assigned to their preferred group (Lee and Card, 2008), which may be related to unobservable characteristics related to the outcome variable or a discontinuous change in the observable and affected the consistency of the estimator. Figure 1 show that the histogram of Annual Moving Average Consumption, for threshold 150, presents

no bunching around the kink points (in annex Figures 2 and 3 presents a similar results for the other two cutoff). Moreover, our natural experiment is particularly suitable to avoid this threat. In addition to being the first month of its application, controlling strategically the annual moving average consumption looks really difficult for users without smart meters.

Figure 1: Histogram Annual Moving Average Consumption (Threshold = 150 kWh/month)



4.2 Discussion regarding the identified parameter

It is pertinent at this juncture to delve into two distinct characteristics of the parameters we have identified. Firstly, the parameter we are isolating pertains to the alteration in the average bimonthly consumption prompted by a price shock (amounting to approximately 20%, contingent on the threshold). It is crucial to note that this is neither a long-term elasticity, nor even a short-term one, given that the subsequent period's average price is not contingent on surpassing or falling below the said threshold. Rather, our inquiry addresses the effect on consumption resulting from a transient fluctuation in the average price, diverging from the conventional notion of elasticity.

Secondly, the Regression Discontinuity (RD) design encapsulates a localized impact, delineating the mean shift in outcomes for consumers whose annual moving average consumption hovers around the threshold. However, our study extends beyond this basic premise. We meticulously estimate the impact of this price shock effect for three distinct thresholds. Drawing inspiration from Bastos and Timmins (2015), our analysis delves into the universe of users characterized by low, moderate, and high consumption levels, augmenting the intricacy of our understanding.

5 Results

We now turn to the primary focus of the paper: the effect of the price shock in bill 0 (issued in March 2021) on electricity consumption in period 1 (bill issued in May 2021). Table 8 presents the main results. Columns (1)-(2) show the estimates for users whose annual moving average consumption by March 2021 is around 150 kWh/month (first threshold). Columns (3)-(4) show the corresponding estimates for users whose annual moving average consumption by March 2021 is around 250 kWh/month (second threshold). Finally, columns (5)-(6) are for users whose annual moving average consumption by March 2021 is around 550 kWh/month (third threshold). For each threshold, we explore two functional forms: in the odd columns we control for the normalized running variable linearly, while in the even columns we add an interaction between the normalized running variable and the treatment dummy. This latter specification allows for different slopes around the discontinuity. Tables 17 to 28 in the Appendix present the results under alternative functional forms with higher order polynomials and different bandwidths.

Table 8: Impacts of Price Shock in Bill 0 on Consumption in Period 1 (bandwidth 5%)
Measurement on Month 5, 2021

	Threshold = 150 kWh		Threshold = 250 kWh		Threshold = 550 kWh	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-5.237	-5.355	3.632	3.652	-1.004	-1.718
	(3.953)	(3.955)	(4.704)	(4.712)	(17.111)	(17.246)
MAC	2.036***	1.470*	0.999**	1.033*	1.752***	1.483*
	(0.452)	(0.626)	(0.324)	(0.439)	(0.526)	(0.674)
MAC * Treatment		1.167		-0.073		0.612
		(0.905)		(0.650)		(1.071)
Constant	261.766***	259.632***	409.382***	409.600***	885.859***	882.012***
	(2.190)	(2.748)	(2.625)	(3.231)	(9.304)	(11.200)
Users	7925	7925	9809	9809	3220	3220
Adjusted R^2	0.0058	0.0059	0.0054	0.0053	0.0128	0.0126
Avg. Dep. Variable	258.98	258.98	410.96	410.96	881.54	881.54

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

The results reveal that users do not show an statistically significant response to the price shock in the subsequent two-month period. This lack of statistically significant response is consistent both across thresholds and alternative functional forms. There is a clear positive relationship between consumption in period 1 and normalized annual moving average consumption by period 0. This is not surprising since electricity consumption exhibits strong positive serial correlation, such that users with high consumption in the past also tend to consume more in the future. Table 8 also includes the average of the dependent variable at the bottom. It is interesting to note that even though the average consumption in period 0 for users around the discontinuity approximately coincides with the thresholds, average consumption in period 1 for both treatment and control users is at least 15% lower. This highlights the high seasonal component of electricity consumption: January and February are characterized by higher consumption compared to March and April. In

particular, bill 0 corresponds to consumption during January and February, two summer months with the highest temperatures in this region of the country, triggering intensive and prolonged usage of the A/C.

In order to increase the sample size, we pool together users with bill issued in May and June 2021. As we have just noted, electricity consumption exhibits high seasonality, so we included a dummy for the month of June to capture that users billed in June will mechanically have lower bimonthly consumption compared to the users billed in May. Table 9 presents these results.

Table 9: Impacts of Price Shock in Bill 0 on Consumption in Period 1 (bandwidth 5%)
Measurement on Months 5 and 6, 2021

	Threshold = 150 kWh		Threshold = 250 kWh		Threshold = 550 kWh	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	-5.243^{+}	-5.336^{+}	0.283	0.194	-6.309	-6.750
	(2.762)	(2.763)	(3.368)	(3.372)	(12.542)	(12.614)
MAC	1.870***	1.287**	1.213***	1.065***	1.723***	1.540**
	(0.317)	(0.436)	(0.234)	(0.321)	(0.385)	(0.503)
MAC * Treatment		1.194^{+}		0.311		0.410
		(0.634)		(0.469)		(0.780)
Constant	261.706***	259.508***	411.132***	410.205***	887.888***	885.286***
	(1.677)	(2.036)	(2.055)	(2.481)	(7.381)	(8.763)
Month 6	-25.753***	-25.764***	-30.612***	-30.606***	-54.295***	-54.280***
	(1.348)	(1.348)	(1.694)	(1.695)	(6.188)	(6.188)
Users	15890	15890	19501	19501	6136	6136
Adjusted R^2	0.0270	0.0272	0.0218	0.0218	0.0217	0.0216
Avg. Dep. Variable	246.03	246.03	395.77	395.77	855.91	855.91

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

As noted above, table 8 presents the estimates to the response immediately after the price shock, where users have approximately 50 days to make adjustments to their electricity consumption behavior. During this short time span, it is very unlikely that consumers make capital investments either via purchasing more efficient appliances or improving their home insulation. Specially so within the time frame of our study which overlaps with the COVID-19 pandemic. To make our results more comparable to Bastos et al. (2015), we mimic their timing selection and estimate the consumption response during the bimester with the highest consumption after the introduction of the new tariff schedule: January and February 2022. In particular, we focus on the bill issued in either March or April, and define treatment and control groups using the previous bill. Table 10 presents these results. The results are similar.

Table 10: Impacts of Price Shock in Bill 0 on Consumption in Period 1 (bandwidth 5%)
Measurement on Months 3 and 4, 2022

	Threshold = 150 kWh		Threshold = 250 kWh		Threshold = 550 kWh	
	(1)	(2)	(3)	(4)	(5)	(6)
Treatment	7.320*	7.596*	0.638	0.137	-7.674	-8.494
	(3.575)	(3.695)	(4.501)	(4.548)	(14.854)	(14.960)
MAC	1.083**	1.189*	1.699***	1.525***	1.691***	1.489*
	(0.410)	(0.525)	(0.312)	(0.410)	(0.468)	(0.617)
MAC * Treatment		-0.266		0.414		0.472
		(0.842)		(0.631)		(0.946)
Constant	353.474***	353.847***	587.928***	586.883***	1236.866***	1234.088***
	(2.170)	(2.468)	(2.864)	(3.293)	(9.465)	(10.974)
Month 4	-69.304***	-69.313***	-118.868***	-118.875***	-223.240***	-223.251***
	(1.773)	(1.773)	(2.252)	(2.252)	(7.333)	(7.333)
Users	15892	15892	19572	19572	6501	6501
Adjusted R^2	0.0915	0.0915	0.1288	0.1288	0.1299	0.1298
Avg. Dep. Variable	322.39	322.39	528.11	528.11	1118.29	1118.29

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

6 Concluding remarks

The main aim of this paper is to estimate the immediate effects of a price shock on the electricity consumption of residential users, leveraging a natural experiment within the province of Tucuman, Argentina. Our study capitalizes on recent empirical evidence supporting that households' consumption decisions are influenced by the average price from their recent bills, as opposed to the marginal or expected end-of-period price. In order to do this, we exploit the introduction of a novel tariff structure that gives rise to a discernible discontinuity in the average costs —ranging from 26% to 36%— incurred by customers situated in the vicinity of the three distinct moving average annual consumption thresholds.

Despite the large average price increases at each threshold, we do not find a significant effect of the tariff change on customers' electricity consumption around any of the three thresholds —characterized by low, moderate, and high consumption levels-. These findings are robust to alternative bandwidths, functional specifications, and time periods. Our findings are in contrast to the recent literature that find non negative, but certainly low, price elasticities in the natural gas market (Bernstein and Griffin, 2006; Bastos et al., 2015), as well as in electricity markets (Reiss and White, 2008; Ito, 2014).

Our conjecture concerning the absence of a consumption response stems from viewing this natural experiment akin to a transient price surge, which generates a divergence in billing dynamics for households within the treatment and control users across a single billing cycle. Moreover, it is noteworthy that the energy pricing landscape in Argentina exhibited marked moderation during our

analysis period. We underscore the importance of these considerations for both academic and policy audiences since numerous policy interventions are formulated as transient price augmentations. Furthermore, at times, discussions fail to account for non-linearities in price elasticities and elements of external validity, making our insights particularly pertinent.

Our research endeavors are poised to advance along diverse trajectories. Initially, we envisage the opportunity to assess varied treatments and treatment response by harnessing data pertaining to recipients of social tariffs. Subsequently, as Argentina undertakes the recalibration of tariffs for specific user segments, our analytical framework will enable us to scrutinize the existence of non-linearities in the nexus between price alterations and consumption reactions.

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A Figures

Figure 2: Histogram Annual Moving Average Consumption (Threshold = 250 kWh/month)

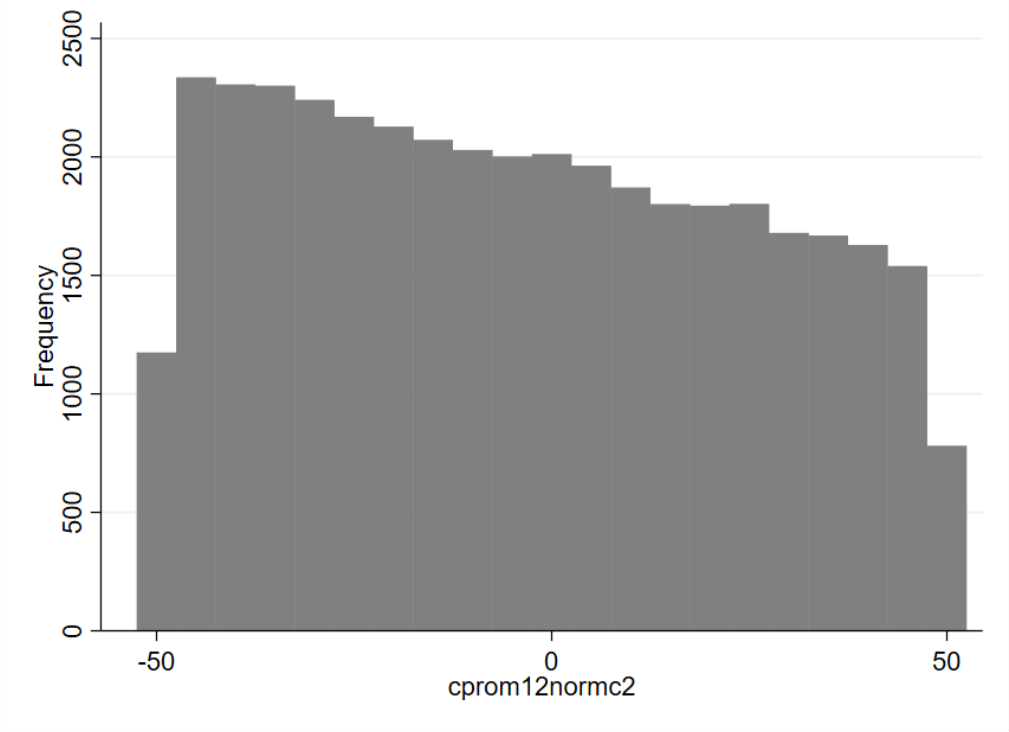
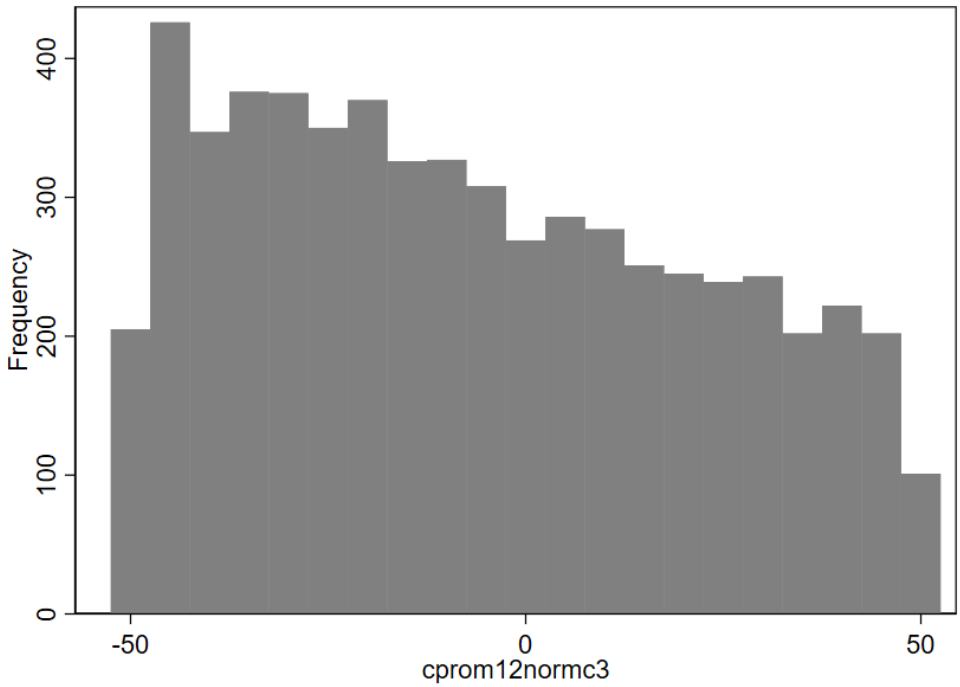


Figure 3: Histogram Annual Moving Average Consumption (Threshold = 550 kWh/month)



B More on the validity of the RD design

Table 11: Dates and Periods by Treatment status
(Days Normalized: March 1st, 2021 = Day 1; Threshold = 250 kWh/month)

	Treatment	Control	Raw Difference	Adjusted Difference
Panel A: Dates				
Final Measurement Period 0	9.495	9.486	-0.009	0.269
	(0.082)	(0.079)	(0.114)	(0.227)
Bill Period 0 (Treatment Date)	13.572	13.540	-0.032	0.306
	(0.091)	(0.088)	(0.126)	(0.252)
Final Measurement Period 1	70.917	70.869	-0,478	0.228
	(0.073)	(0.707)	(0.101)	(0.201)
Panel B: Days Between Bill Period 0 and Final Measurement Period 1				
Days	57.349	57.294	-0.055	-0.088
	(0.046)	(0.045)	(0.065)	(0.128)
Panel C: Days Between Final Measurement in Period 0 and Period 1				
Days	61.426	61.385	-0.041	0.009
	(0.018)	(0.018)	(0.026)	(0.052)

Notes: Means and standard errors in parentheses. Sample includes all users with monthly moving average consumption within 5% of the threshold by March 2021. Period 0 corresponds to the bimester whose bill was issued in March 2021. Dates in the table are normalized so that March 1st, 2021 corresponds to day 1. Robust Standard Errors. $^{*}\, p < 0.05$, $^{**}\, p < 0.01$, $^{***}\, p < 0.001$

Table 12: Dates and Periods by Treatment status
(Days Normalized: March 1st, 2021 = Day 1. Threshold = 550 kWh/month)

	Treatment	Control	Raw Difference	Adjusted Difference
Panel A: Dates				
Final Measurement Period 0	9.575	9.906	0.331*	-0.136
	(0.146)	(0.132)	(0.198)	(0.012)
Bill Period 0 (Treatment Date)	13.737	14.069	0.332	-0.546
	(0.166)	(0.148)	(0.223)	(0.449)
Final Measurement Period 1	70.991	71.271	0.280	-0.1952
	(0.128)	(0.118)	(0.175)	(0.352)
Panel B: Dyas Between Bill Period 0 and Final Measurement Period 1				
Days	70.991	71.271	0.280	-0.195
	(0.128)	(0.118)	(0.175)	(0.352)
Panel C: Dyas Between Final Measurement in Period 0 and Period 1				
Days	61.364	61.378	0.014	-0.034
	(0.036)	(0.032)	(0.048)	(0.094)

Notes: Means and standard errors in parentheses. Sample includes all users with monthly moving average consumption within 5% of the threshold by March 2021. Period 0 corresponds to the bimester whose bill was issued in March 2021. Dates in the table are normalized so that March 1st, 2021 corresponds to day 1. Robust Standard Errors. $^{*}\ p < 0.05$, $^{**}\ p < 0.01$, $^{***}\ p < 0.001$

Table 13: Consumption Levels and Ratios To Accumulated Consumption by Treatment Status (Threshold = 250 kWh/month)

	Treatment	Control	Raw Difference	Adjusted Difference
Panel A: Consumption Levels (kWh/bimester)				
Period -5	480.689	455.837	-24.852	-2.544
	(1.978)	(1.817)	(2.682)	(5.402)
Period -4	449.927	423.125	-26.802***	-1.166
	(2.347)	(2.153)	(3.180)	(6.457)
Period -3	449.545	427.272	-22.272***	-1.127
	(2.316)	(2.174)	(3.174)	(6.368)
Period -2	461.744	442.272	-19.469***	3.260
	(1.667)	(1.573)	(2.291)	(4.571)
Period -1	660.848	630.144	-30.704***	-4.005
	(2.551)	(2.345)	(3.460)	(6.817)
Period 0	550.134	521.832	-28.302***	14.588
	(2.576)	(2.182)	(3.363)	(6.744)
Panel B: Ratio of Consumption in a Period and Annual Accumulated Consumption by Period 0				
Period -5	0.156	0.156	-0.000	-0.008
	(0.001)	(0.001)	(0.001)	(0.002)
Period -4	0.146	0.145	-0.002	-0.0004
	(0.001)	(0.001)	(0.001)	(0.002)
Period -3	0.146	0.146	-0.0001	-0.001
	(0.001)	(0.001)	(0.001)	(0.002)
Period -2	0.151	0.150	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.002)
Period -1	0.215	0.215	0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.002)
Period 0	0.179	0.178	-0.0005	0.005*
	(0.001)	(0.001)	(0.001)	(0.002)

Notes: Means and standard errors in parentheses. Sample includes all users with monthly moving average consumption within 5% of the threshold by March 2021. Period 0 corresponds to the bimester whose bill was issued in March 2021. The Raw Difference column reports the mean difference between the Treatment and Control groups. The Adjusted Difference column presents the coefficient of regressing the respective variable on a dummy for treatment and a linear term for annual accumulated consumption by Period 0. Robust Standard errors. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

Table 14: Consumption Levels and Ratios To Accumulated Consumption by Treatment Status (Threshold = 550 kWh/month)

	Treatment	Control	Raw Difference	Adjusted Difference
Panel A: Consumption Levels (kWh/bimester)				
Period -5	1023.439	976.480	-46.959 ***	32.782*
	(7.933)	(5.673)	(9.507)	(19.247)
Period -4	989.666	949.805	-39.862	44.217*
	(9.271)	(7.256)	(11.599)	(23.422)
Period -3	992.290	952.786	-39.5049**	5.915
	(8.778)	(7.447)	(11.452)	(21.539)
Period -2	1015.771	976.665	-39.106***	-34.169**
	(6.214)	(4.924)	(7.823)	(16.135)
Period -1	1461.499	1375.181	-86.318***	-39.688
	(10.230)	(7.633)	(12.505)	(25.964)
Period 0	1208.790	115.666	-52.123***	-48.166**
	(9.188)	(7.866)	(12.044)	(23.216)
Panel B: Ratio of Consumption in a Period and Annual Accumulated Consumption by Period 0				
Period -5	1.817	1.823	0.005	0.0589*
	(0.014)	(0.011)	(0.017)	(0.035)
Period -4	1.757	1.774	0.016	0.082
	(0.016)	(0.014)	(0.021)	(0.043)
Period -3	1.761	1.779	0.018	0.012
	(0.016)	(0.014)	(0.021)	(0.039)
Period -2	1.803	1.823	0.020	-0.063**
	(0.011)	(0.009)	(0.014)	(0.029)
Period -1	2.594	2.568	-0.027	-0.072
	(0.018)	(0.014)	(0.023)	(0.047)
Period 0	2.145	2.159	0.137	-0.088*
	(0.016)	(0.015)	(0.022)	(0.042)

Notes: Means and standard errors in parentheses. Sample includes all users with monthly moving average consumption within 5% of the threshold by March 2021. Period 0 corresponds to the bimester whose bill was issued in March 2021. The Raw Difference column reports the mean difference between the Treatment and Control groups. The Adjusted Difference column presents the coefficient of regressing the respective variable on a dummy for treatment and a linear term for annual accumulated consumption by Period 0. Robust Standard errors. $^{*}\, p < 0.05$, $^{**}\, p < 0.01$, $^{***}\, p < 0.001$

Table 15: Average Bill Amount By Treatment Status
(Threshold 250 kWh/month)

	Treatment	Control	Raw Difference	Adjusted Difference
Period -5	3592.020	3362.007	-230.012***	-18.628
	(29.920)	(26.727)	(40.026)	(78.982)
Period -4	3108.500	2900.555	-207.946***	-36.918
	(22.441)	(20.382)	(30.260)	(61.136)
Period -3	3101.963	2892.056	-209.907***	-20.501
	(27.236)	(20.390)	(33.778)	(59.843)
Period -2	2984.245	2840.666	-143.579***	30.034
	(18.494)	(16.338)	(24.605)	(51.076)
Period -1	4429.053	4197.591	-231.462***	72.975
	(22.997)	(21.512)	(31.456)	(61.977)
Period 0	4859.520	3647.369	-1212.146***	1129.181***
	(24.364)	(20.566)	(31.762)	(62.771)

Notes: Means and standard errors in parentheses. Sample includes all users with monthly moving average consumption within 5% of the threshold by March 2021. Period 0 corresponds to the bimester whose bill was issued in March 2021. Bill amounts are in Argentine Pesos. The Raw Difference column reports the mean difference between the Treatment and Control groups. The Adjusted Difference column presents the coefficient of regressing the respective variable on a dummy for treatment and a linear term for annual accumulated consumption by Period 0. Robust Standard errors. $^{*}\, p < 0.05$, $^{**}\, p < 0.01$, $^{***}\, p < 0.001$

Table 16: Average Bill Amount By Treatment Status
(Threshold 550 kWh/month)

	Treatment	Control	Raw Difference	Adjusted Difference
Period -5	8033.329	7408.193	-625.136***	389.913
	(117.999)	(89.775)	(145.590)	(303.452)
Period -4	7093.004	6702.714	-390.290***	509.603**
	(88.161)	(68.785)	(110.130)	(222.800)
Period -3	7099.921	6815.166	-284.755**	220.446
	(85.854)	(77.352)	(115.861)	(232.912)
Period -2	891.359	6400.109	-491.249***	213.245
	(75.572)	(53.093)	(85.874)	(188.366)
Period -1	10290.000	9454.680	-835.677***	137.582
	(99.995)	(74.072)	(121.806)	(256.723)
Period 0	10351.550	8057.703	-2293.845***	1886.800 ***
	(97.615)	(82.156)	(126.825)	(257.959)

Notes: Means and standard errors in parentheses. Sample includes all users with monthly moving average consumption within 5% of the threshold by March 2021. Period 0 corresponds to the bimester whose bill was issued in March 2021. Bill amounts are in Argentine Pesos. The Raw Difference column reports the mean difference between the Treatment and Control groups. The Adjusted Difference column presents the coefficient of regressing the respective variable on a dummy for treatment and a linear term for annual accumulated consumption by Period 0. Robust Standard errors. $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$

C Results: alternative specifications and bandwidths

C.1 Immediate price response: consumption in March and April of 2021

Table 17: Regression C1 (150) Alternative Function Forms (bandwith 5%) - Measurement on Month 5, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-5.237	-5.355	-5.317	-8.148	-8.407	2.319	-8.623	2.183
	(3.953)	(3.955)	(3.954)	(5.886)	(5.250)	(7.743)	(5.255)	(9.721)
MAC	2.036***	1.470*	2.048***	1.610	2.958**	-1.655	3.022**	-7.911
	(0.452)	(0.626)	(0.453)	(2.409)	(1.098)	(6.060)	(1.100)	(11.905)
MAC $*$ Treatment		1.167		3.059		-6.554		5.649
		(0.905)		(3.511)		(8.839)		(18.034)
MAC^2			0.065	0.019	0.065	-1.072	0.320	-4.843
			(0.058)	(0.311)	(0.058)	(1.871)	(0.198)	(6.441)
$MAC^2 *$ Treatment				-0.286		5.037$^+$		5.324
				(0.450)		(2.725)		(9.685)
MAC^3					-0.018	-0.097	-0.019	-0.878
					(0.020)	(0.163)	(0.020)	(1.285)
$MAC^3 *$ Treatment						-0.276		1.217
						(0.237)		(1.919)
MAC^4							-0.005	-0.052
							(0.004)	(0.085)
$MAC^4 *$ Treatment								0.005
								(0.126)
Constant	261.766***	259.632***	260.585***	259.809***	262.132***	257.804***	260.780***	255.555***
	(2.190)	(2.748)	(2.433)	(4.014)	(2.973)	(5.242)	(3.145)	(6.385)
Users	7925	7925	7925	7925	7925	7925	7925	7925
Adjusted R^2	0.0058	0.0059	0.0058	0.0057	0.0058	0.0061	0.0059	0.0059
Avg. Dep. Variable (KWh/bim)	258.98	258.98	258.98	258.98	258.98	258.98	258.98	258.98

Standard errors in parentheses

Outliers out-99-

$^+$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 18: Regression C1 (150) Alternative Function Forms (bandwith 5%) - Measurement on Months 5 and 6, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-5.243^{+}	-5.336^{+}	-5.309^{+}	-3.791	-5.195	7.523	-5.308	9.621
	(2.762)	(2.763)	(2.762)	(4.202)	(3.721)	(5.629)	(3.723)	(7.064)
MAC	1.870***	1.287**	1.880***	-0.273	1.846*	-7.351^{+}	1.882*	-17.992*
	(0.317)	(0.436)	(0.317)	(1.721)	(0.779)	(4.316)	(0.780)	(8.519)
MAC $*$ Treatment		1.194^{+}		3.092		-0.375		14.723
		(0.634)		(2.499)		(6.275)		(12.686)
MAC^2			0.066	-0.207	0.066	-2.562^{+}	0.253^{+}	-8.956*
			(0.040)	(0.219)	(0.040)	(1.313)	(0.138)	(4.557)
MAC^2 $*$ Treatment				0.162		5.974**		9.759
				(0.317)		(1.906)		(6.758)
MAC^3					0.001	-0.209^{+}	0.000	-1.531^{+}
					(0.014)	(0.113)	(0.014)	(0.904)
MAC^3 $*$ Treatment						-0.095		1.760
						(0.165)		(1.335)
MAC^4							-0.004	-0.088
							(0.003)	(0.059)
MAC^4 $*$ Treatment								0.053
								(0.087)
Constant	261.706***	259.508***	260.504***	257.526***	260.447***	253.139***	259.419***	249.255***
	(1.677)	(2.036)	(1.826)	(2.968)	(2.212)	(3.882)	(2.333)	(4.760)
Month 6	-25.753***	-25.764***	-25.768***	-25.756***	-25.769***	-25.776***	-25.746***	-25.780***
	(1.348)	(1.348)	(1.348)	(1.347)	(1.348)	(1.348)	(1.348)	(1.348)
Users	15890	15890	15890	15890	15890	15890	15890	15890
Adjusted R^2	0.0270	0.0272	0.0271	0.0271	0.0271	0.0276	0.0271	0.0276
Avg. Dep. Variable (KWh/bim)	246.03	246.03	246.03	246.03	246.03	246.03	246.03	246.03

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 19: Regression C1 (150) Alternative Function Forms (bandwith 10%) - Measurement on Month 5, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-2.103	-2.064	-2.058	-6.750	-5.542	-7.915	-5.548	-2.937
	(2.733)	(2.735)	(2.734)	(4.170)	(3.692)	(5.570)	(3.692)	(6.871)
MAC	1.632***	1.769***	1.630***	1.919*	2.149***	0.490	2.150***	0.234
	(0.155)	(0.214)	(0.155)	(0.868)	(0.392)	(2.124)	(0.392)	(4.258)
MAC $*$ Treatment		-0.278		1.279		5.010		-0.824
		(0.310)		(1.258)		(3.118)		(6.193)
MAC^2			-0.012	0.010	-0.012	-0.228	-0.005	-0.305
			(0.010)	(0.055)	(0.010)	(0.325)	(0.035)	(1.156)
$MAC^2 *$ Treatment				-0.123		-0.263		1.613
				(0.080)		(0.476)		(1.672)
MAC^3					-0.003	-0.011	-0.003	-0.019
					(0.002)	(0.014)	(0.002)	(0.116)
$MAC^3 *$ Treatment						0.027		-0.150
						(0.021)		(0.167)
MAC^4							-0.000	-0.000
							(0.000)	(0.004)
$MAC^4 *$ Treatment								0.006
								(0.006)
Constant	259.251***	260.282***	260.121***	260.658***	261.861***	258.861***	261.723***	258.672***
	(1.512)	(1.899)	(1.677)	(2.890)	(2.094)	(3.804)	(2.219)	(4.667)
Users	15949	15949	15949	15949	15949	15949	15949	15949
Adjusted R^2	0.0244	0.0244	0.0245	0.0245	0.0245	0.0245	0.0245	0.0246
Avg. Dep. Variable (KWh/bim)	258.03	258.03	258.03	258.03	258.03	258.03	258.03	258.03

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 20: Regression C1 (150) Alternative Function Forms (bandwith 10%) - Measurement on Months 5 and 6, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-2.624	-2.667	-2.653	-5.482^{+}	-4.869^{+}	-4.962	-4.884^{+}	1.304
	(1.919)	(1.920)	(1.920)	(2.933)	(2.590)	(3.974)	(2.590)	(4.981)
MAC	1.512***	1.380***	1.513***	1.326*	1.845***	-0.344	1.846***	-2.167
	(0.110)	(0.152)	(0.110)	(0.617)	(0.277)	(1.540)	(0.277)	(3.079)
MAC $*$ Treatment		0.268		1.497^{+}		4.407*		-0.050
		(0.220)		(0.891)		(2.240)		(4.464)
MAC^2			0.006	-0.004	0.006	-0.281	0.022	-0.829
			(0.007)	(0.039)	(0.007)	(0.236)	(0.025)	(0.828)
MAC^2 $*$ Treatment				-0.075		-0.001		2.405*
				(0.057)		(0.342)		(1.197)
MAC^3					-0.002	-0.012	-0.002	-0.069
					(0.001)	(0.010)	(0.001)	(0.083)
MAC^3 $*$ Treatment						0.021		-0.113
						(0.015)		(0.119)
MAC^4							-0.000	-0.002
							(0.000)	(0.003)
MAC^4 $*$ Treatment								0.008*
								(0.004)
Constant	259.514***	258.523***	259.083***	258.392***	260.199***	256.290***	259.836***	254.929***
	(1.162)	(1.417)	(1.269)	(2.097)	(1.546)	(2.769)	(1.634)	(3.440)
Month 6	-23.332***	-23.324***	-23.326***	-23.334***	-23.337***	-23.337***	-23.336***	-23.342***
	(0.946)	(0.946)	(0.946)	(0.946)	(0.946)	(0.946)	(0.946)	(0.946)
Users	31724	31724	31724	31724	31724	31724	31724	31724
Adjusted R^2	0.0379	0.0379	0.0379	0.0380	0.0379	0.0380	0.0379	0.0381
Avg. Dep. Variable (KWh/bim)	246.45	246.45	246.45	246.45	246.45	246.45	246.45	246.45

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 21: Regression C2 (250) Alternative Function Forms (bandwith 5%) - Measurement on Month 5, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	3.632	3.652	3.589	3.312	2.436	9.354	2.503	11.584
	(4.704)	(4.712)	(4.711)	(6.953)	(6.208)	(9.146)	(6.217)	(11.425)
MAC	0.999**	1.033*	1.002**	3.035^{+}	1.209	5.894	1.200	2.212
	(0.324)	(0.439)	(0.325)	(1.707)	(0.799)	(4.317)	(0.801)	(8.627)
MAC $*$ Treatment		-0.073		-3.867		-15.138*		-11.495
		(0.650)		(2.553)		(6.401)		(12.894)
MAC^2			0.007	0.159	0.007	0.734	-0.024	-0.605
			(0.025)	(0.131)	(0.025)	(0.807)	(0.087)	(2.815)
$MAC^2 *$ Treatment				-0.017		1.075		2.428
				(0.197)		(1.192)		(4.192)
MAC^3					-0.001	0.031	-0.001	-0.136
					(0.005)	(0.042)	(0.005)	(0.336)
$MAC^3 *$ Treatment						-0.119^{+}		0.047
						(0.062)		(0.501)
MAC^4							0.000	-0.007
							(0.001)	(0.013)
$MAC^4 *$ Treatment								0.007
								(0.020)
Constant	409.382***	409.600***	409.044***	413.741***	409.618***	416.640***	410.070***	414.436***
	(2.625)	(3.231)	(2.876)	(4.678)	(3.533)	(6.071)	(3.708)	(7.489)
Users	9809	9809	9809	9809	9809	9809	9809	9809
Adjusted R^2	0.0054	0.0053	0.0053	0.0054	0.0053	0.0056	0.0052	0.0054
Avg. Dep. Variable (KWh/bim)	410.96	410.96	410.96	410.96	410.96	410.96	410.96	410.96

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 22: Regression C2 (250) Alternative Function Forms (bandwith 5%) - Measurement on Months 5 and 6, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	0.283	0.194	0.191	-2.633	-2.348	0.866	3.576
	(3.368)	(3.372)	(3.372)	(5.050)	(4.484)	(6.744)	(8.447)
MAC	1.213***	1.065***	1.221***	2.092^{+}	1.676**	5.425^{+}	2.446
	(0.234)	(0.321)	(0.234)	(1.264)	(0.579)	(3.218)	(6.357)
MAC $*$ Treatment		0.311		-0.388		-10.215*	-8.644
		(0.469)		(1.857)		(4.663)	(9.323)
MAC^2			0.014	0.082	0.013	0.751	-0.329
			(0.018)	(0.097)	(0.018)	(0.598)	(2.051)
MAC^2 $*$ Treatment				-0.108		0.512	2.095
				(0.143)		(0.864)	(3.015)
MAC^3					-0.003	0.036	-0.099
					(0.004)	(0.031)	(0.245)
MAC^3 $*$ Treatment						-0.104*	-0.032
						(0.045)	(0.361)
MAC^4							-0.005
							(0.010)
MAC^4 $*$ Treatment							0.008
							(0.014)
Constant	411.132***	410.205***	410.470***	412.334***	411.740***	415.752***	413.946***
	(2.055)	(2.481)	(2.234)	(3.544)	(2.683)	(4.661)	(5.762)
Month 6	-30.612***	-30.606***	-30.602***	-30.596***	-30.600***	-30.624***	-30.622***
	(1.694)	(1.695)	(1.695)	(1.695)	(1.695)	(1.695)	(1.695)
Users	19501	19501	19501	19501	19501	19501	19501
Adjusted R^2	0.0218	0.0218	0.0218	0.0218	0.0218	0.0219	0.0219
Avg. Dep. Variable (KWh/bim)	395.77	395.77	395.77	395.77	395.77	395.77	395.77

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 23: Regression C2 (250) Alternative Function Forms (bandwith 10%) - Measurement on Month 5, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-1.934	-1.876	-1.883	1.164	-0.046	5.751	-0.075	8.223
	(3.331)	(3.338)	(3.339)	(4.967)	(4.422)	(6.562)	(4.429)	(8.097)
MAC	1.581***	1.628***	1.578***	1.355*	1.412***	1.407	1.415***	3.064
	(0.115)	(0.154)	(0.116)	(0.617)	(0.285)	(1.522)	(0.286)	(3.016)
MAC $*$ Treatment		-0.101		-0.287		-2.582		-7.805^{+}
		(0.232)		(0.913)		(2.279)		(4.529)
MAC^2			-0.002	-0.011	-0.002	-0.006	0.001	0.294
			(0.004)	(0.024)	(0.004)	(0.141)	(0.016)	(0.494)
$MAC^2 *$ Treatment				0.029		0.249		0.591
				(0.035)		(0.212)		(0.742)
MAC^3					0.000	0.000	0.000	0.019
					(0.000)	(0.004)	(0.000)	(0.030)
$MAC^3 *$ Treatment						-0.006		-0.065
						(0.006)		(0.045)
MAC^4							-0.000	0.000
							(0.000)	(0.001)
$MAC^4 *$ Treatment								0.000
								(0.001)
Constant	411.419***	412.021***	411.752***	410.882***	410.818***	410.989***	410.679***	413.019***
	(1.860)	(2.285)	(2.027)	(3.400)	(2.519)	(4.425)	(2.650)	(5.380)
Users	19470	19470	19470	19470	19470	19470	19470	19470
Adjusted R^2	0.0346	0.0346	0.0346	0.0345	0.0346	0.0346	0.0345	0.0345
Avg. Dep. Variable (KWh/bim)	409.09	409.09	409.09	409.09	409.09	409.09	409.09	409.09

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 24: Regression C2 (250) Alternative Function Forms (bandwith 10%) - Measurement on Months 5 and 6, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Treatment	-1.949	-1.960	-1.969	-2.623	-2.940	1.202	0.566
	(2.384)	(2.388)	(2.389)	(3.573)	(3.171)	(4.772)	(5.958)
MAC	1.482***	1.474***	1.483***	1.651***	1.571***	0.636	2.121
	(0.083)	(0.111)	(0.083)	(0.447)	(0.206)	(1.121)	(2.231)
MAC $*$ Treatment		0.018		-0.177		0.013	-2.420
		(0.167)		(0.662)		(1.659)	(3.306)
MAC^2			0.001	0.007	0.001	-0.094	0.174
			(0.003)	(0.017)	(0.003)	(0.103)	(0.362)
$MAC^2 *$ Treatment				-0.006		0.178	0.080
				(0.026)		(0.154)	(0.539)
MAC^3					-0.000	-0.003	0.014
					(0.000)	(0.003)	(0.022)
$MAC^3 *$ Treatment						0.000	-0.027
						(0.004)	(0.032)
MAC^4							0.000
							(0.000)
$MAC^4 *$ Treatment							-0.000
							(0.001)
Constant	411.546***	411.441***	411.433***	412.179***	411.929***	410.080***	411.910***
	(1.453)	(1.743)	(1.567)	(2.524)	(1.902)	(3.310)	(4.077)
Month 6	-30.481***	-30.481***	-30.480***	-30.480***	-30.480***	-30.488***	-30.486***
	(1.198)	(1.198)	(1.198)	(1.198)	(1.198)	(1.198)	(1.198)
Users	38708	38708	38708	38708	38708	38708	38708
Adjusted R^2	0.0451	0.0450	0.0450	0.0450	0.0450	0.0450	0.0450
Avg. Dep. Variable (KWh/bim)	394.05	394.05	394.05	394.05	394.05	394.05	394.05

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 25: Regression C3 (550) Alternative Function Forms (bandwith 5%) - Measurement on Month 5, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-1.004	-1.718	-1.585	-20.302	-15.911	-14.037	-16.225	-7.411
	(17.111)	(17.246)	(17.268)	(26.940)	(23.476)	(36.914)	(23.668)	(46.822)
MAC	1.752***	1.483*	1.781***	2.233	2.949*	-4.049	2.978*	-11.890
	(0.526)	(0.674)	(0.536)	(2.766)	(1.360)	(6.826)	(1.387)	(13.798)
MAC $*$ Treatment		0.612		3.202		13.342		24.552
		(1.071)		(4.463)		(11.168)		(22.464)
MAC^2			0.008	0.027	0.007	-0.531	0.018	-1.787
			(0.018)	(0.094)	(0.019)	(0.559)	(0.066)	(2.006)
$MAC^2 *$ Treatment				-0.149		0.054		0.758
				(0.154)		(0.922)		(3.262)
MAC^3					-0.002	-0.013	-0.002	-0.083
					(0.002)	(0.013)	(0.002)	(0.108)
$MAC^3 *$ Treatment						0.022		0.123
						(0.022)		(0.177)
MAC^4							-0.000	-0.001
							(0.000)	(0.002)
$MAC^4 *$ Treatment								0.001
								(0.003)
Constant	885.859***	882.012***	884.147***	885.548***	891.648***	870.534***	890.976***	859.255***
	(9.304)	(11.200)	(9.906)	(17.500)	(13.123)	(23.353)	(13.482)	(28.855)
Users	3220	3220	3220	3220	3220	3220	3220	3220
Adjusted R^2	0.0128	0.0126	0.0125	0.0124	0.0125	0.0121	0.0122	0.0116
Avg. Dep. Variable (KWh/bim)	881.54	881.54	881.54	881.54	881.54	881.54	881.54	881.54

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 26: Regression C3 (550) Alternative Function Forms (bandwith 5%) - Measurement on Months 5 and 6, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-6.309	-6.750	-6.675	-26.777	-21.589	-27.358	-22.196	-23.733
	(12.542)	(12.614)	(12.614)	(19.399)	(17.032)	(26.327)	(17.129)	(33.422)
MAC	1.723***	1.540**	1.741***	2.969	2.968**	2.152	3.023**	-8.424
	(0.385)	(0.503)	(0.390)	(2.079)	(0.994)	(5.174)	(1.006)	(10.357)
MAC $*$ Treatment		0.410		1.958		3.858		22.255
		(0.780)		(3.221)		(8.097)		(16.396)
MAC^2			0.006	0.052	0.005	-0.022	0.028	-1.744
			(0.013)	(0.072)	(0.013)	(0.428)	(0.049)	(1.518)
$MAC^2 *$ Treatment				-0.160		-0.186		0.257
				(0.111)		(0.674)		(2.388)
MAC^3					-0.002	-0.002	-0.002	-0.099
					(0.001)	(0.010)	(0.001)	(0.082)
$MAC^3 *$ Treatment						0.004		0.173
						(0.016)		(0.129)
MAC^4							-0.000	-0.002
							(0.000)	(0.001)
$MAC^4 *$ Treatment								0.000
								(0.002)
Constant	887.888***	885.286***	886.625***	891.881***	894.337***	889.988***	892.858***	875.444***
	(7.381)	(8.763)	(7.875)	(13.109)	(9.897)	(17.346)	(10.245)	(21.314)
Month 6	-54.295***	-54.280***	-54.293***	-54.245***	-54.285***	-54.241***	-54.250***	-54.199***
	(6.188)	(6.188)	(6.188)	(6.191)	(6.188)	(6.194)	(6.190)	(6.193)
Users	6136	6136	6136	6136	6136	6136	6136	6136
Adjusted R^2	0.0217	0.0216	0.0216	0.0216	0.0217	0.0213	0.0216	0.0213
Avg. Dep. Variable (KWh/bim)	855.91	855.91	855.91	855.91	855.91	855.91	855.91	855.91

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 27: Regression C3 (550) Alternative Function Forms (bandwith 10%) - Measurement on Month 5, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	1.688	2.260	3.035	5.323	9.248	-17.373	7.532	-14.050
	(11.799)	(12.055)	(12.104)	(18.330)	(16.008)	(25.048)	(16.232)	(32.190)
MAC	1.441***	1.499***	1.407***	0.227	1.153*	1.661	1.236*	3.879
	(0.186)	(0.227)	(0.196)	(0.952)	(0.468)	(2.384)	(0.483)	(4.769)
MAC $*$ Treatment		-0.145		2.186		4.342		-1.496
		(0.389)		(1.552)		(3.942)		(7.962)
MAC^2			-0.003	-0.023	-0.002	0.041	0.008	0.218
			(0.003)	(0.016)	(0.003)	(0.098)	(0.012)	(0.340)
$MAC^2 *$ Treatment				0.003		-0.228		-0.102
				(0.028)		(0.166)		(0.580)
MAC^3					0.000	0.001	0.000	0.006
					(0.000)	(0.001)	(0.000)	(0.009)
$MAC^3 *$ Treatment						0.001		-0.012
						(0.002)		(0.016)
MAC^4							-0.000	0.000
							(0.000)	(0.000)
$MAC^4 *$ Treatment								0.000
								(0.000)
Constant	882.512***	884.187***	884.421***	871.906***	881.021***	878.757***	878.721***	885.139***
	(6.441)	(7.463)	(6.652)	(11.768)	(8.840)	(16.032)	(9.011)	(20.254)
Users	6472	6472	6472	6472	6472	6472	6472	6472
Adjusted R^2	0.0363	0.0362	0.0362	0.0363	0.0361	0.0363	0.0361	0.0362
Avg. Dep. Variable (KWh/bim)	872.41	872.41	872.41	872.41	872.41	872.41	872.41	872.41

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 28: Regression C3 (550) Alternative Function Forms (bandwith 10%) - Measurement on Months 5 and 6, 2021

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-3.248	-2.994	-2.580	-4.187	-0.656	-21.919	-1.781	-24.979
	(8.738)	(8.881)	(8.909)	(13.430)	(11.780)	(18.157)	(11.927)	(23.063)
MAC	1.489***	1.516***	1.472***	0.933	1.393***	2.370	1.448***	4.616
	(0.135)	(0.168)	(0.142)	(0.697)	(0.341)	(1.760)	(0.352)	(3.571)
MAC $*$ Treatment		-0.066		1.296		2.347		-1.105
		(0.282)		(1.125)		(2.851)		(5.725)
MAC^2			-0.001	-0.010	-0.001	0.054	0.006	0.234
			(0.002)	(0.012)	(0.002)	(0.072)	(0.009)	(0.255)
$MAC^2 *$ Treatment				-0.004		-0.184		-0.263
				(0.020)		(0.120)		(0.418)
MAC^3					0.000	0.001	0.000	0.006
					(0.000)	(0.001)	(0.000)	(0.007)
$MAC^3 *$ Treatment						0.001		-0.007
						(0.001)		(0.011)
MAC^4							-0.000	0.000
							(0.000)	(0.000)
$MAC^4 *$ Treatment								-0.000
								(0.000)
Constant	884.478***	885.243***	885.464***	879.629***	884.412***	886.425***	882.916***	892.743***
	(5.144)	(5.901)	(5.328)	(8.910)	(6.819)	(11.910)	(6.968)	(14.980)
Month 6	-52.819***	-52.809***	-52.790***	-52.760***	-52.789***	-52.815***	-52.787***	-52.836***
	(4.257)	(4.259)	(4.259)	(4.259)	(4.259)	(4.261)	(4.259)	(4.262)
Users	12481	12481	12481	12481	12481	12481	12481	12481
Adjusted R^2	0.0461	0.0460	0.0461	0.0460	0.0460	0.0461	0.0460	0.0460
Avg. Dep. Variable (KWh/bim)	846.58	846.58	846.58	846.58	846.58	846.58	846.58	846.58

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

C.2 Late price response in high season period: consumption in January and February of 2022

Table 29: Regression C1 (150) Alternative Function Forms (bandwith 5%) - Measurement on Months 3 and 4, 2022

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	7.320*	7.596*	7.371*	14.538*	9.954*	2.476	12.243*	-25.136
	(3.575)	(3.695)	(3.630)	(6.099)	(4.818)	(10.593)	(4.935)	(21.485)
MAC	1.083**	1.189*	1.078**	1.176	0.298	-4.708	-0.120	-3.608
	(0.410)	(0.525)	(0.415)	(1.938)	(1.041)	(4.302)	(1.059)	(7.813)
MAC $*$ Treatment		-0.266		-4.838		17.255		59.586^{+}
		(0.842)		(3.616)		(11.114)		(32.304)
MAC^2			-0.005	-0.002	-0.012	-2.253	-0.432*	-1.436
			(0.054)	(0.266)	(0.055)	(1.482)	(0.199)	(5.077)
MAC^2 $*$ Treatment				0.572		-1.907		-23.624
				(0.458)		(3.244)		(15.383)
MAC^3					0.016	-0.215	0.021	-0.026
					(0.019)	(0.139)	(0.019)	(1.131)
MAC^3 $*$ Treatment						0.608*		4.286
						(0.275)		(2.872)
MAC^4							0.009*	0.014
							(0.004)	(0.080)
MAC^4 $*$ Treatment								-0.255
								(0.183)
Constant	353.474***	353.847***	353.543***	353.847***	352.465***	351.601***	353.784***	351.754***
	(2.170)	(2.468)	(2.299)	(3.088)	(2.652)	(3.449)	(2.720)	(3.576)
Month 4	-69.304***	-69.313***	-69.306***	-69.340***	-69.309***	-69.342***	-69.356***	-69.325***
	(1.773)	(1.773)	(1.773)	(1.773)	(1.773)	(1.773)	(1.773)	(1.773)
Users	15892	15892	15892	15892	15892	15892	15892	15892
Adjusted R^2	0.0915	0.0915	0.0915	0.0915	0.0914	0.0917	0.0917	0.0917
Avg. Dep. Variable (KWh/bim)	322.39	322.39	322.39	322.39	322.39	322.39	322.39	322.39

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 30: Regression C1 (150) Alternative Function Forms (bandwith 10%) - Measurement on Months 3 and 4, 2022

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	2.040	2.014	2.015	9.937*	7.912*	9.042+	8.006*	19.187*
	(2.482)	(2.507)	(2.495)	(3.879)	(3.330)	(5.486)	(3.357)	(7.699)
MAC	1.831***	1.820***	1.832***	0.734	0.976**	1.756	0.967**	-2.696
	(0.140)	(0.186)	(0.140)	(0.699)	(0.349)	(1.647)	(0.352)	(3.057)
MAC $*$ Treatment		0.024		-0.785		-1.914		-4.983
		(0.282)		(1.144)		(2.977)		(6.466)
MAC^2			0.001	-0.072	-0.000	0.103	-0.008	-1.332
			(0.009)	(0.045)	(0.009)	(0.261)	(0.031)	(0.865)
$MAC^2 *$ Treatment				0.191**		0.031		3.423*
				(0.071)		(0.441)		(1.642)
MAC^3					0.004**	0.008	0.004**	-0.144
					(0.001)	(0.011)	(0.001)	(0.088)
$MAC^3 *$ Treatment						-0.008		-0.043
						(0.019)		(0.157)
MAC^4							0.000	-0.005+
							(0.000)	(0.003)
$MAC^4 *$ Treatment								0.011*
								(0.005)
Constant	356.719***	356.639***	356.641***	354.127***	353.920***	355.188***	354.062***	352.820***
	(1.553)	(1.795)	(1.650)	(2.398)	(1.944)	(2.863)	(2.013)	(3.185)
Month 4	-70.883***	-70.883***	-70.883***	-70.902***	-70.892***	-70.905***	-70.896***	-70.902***
	(1.246)	(1.246)	(1.246)	(1.246)	(1.246)	(1.247)	(1.246)	(1.246)
Users	32861	32861	32861	32861	32861	32861	32861	32861
Adjusted R^2	0.1077	0.1077	0.1077	0.1078	0.1079	0.1078	0.1078	0.1079
Avg. Dep. Variable (KWh/bim)	322.31	322.31	322.31	322.31	322.31	322.31	322.31	322.31

Standard errors in parentheses

Outliers out-99-

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 31: Regression C2 (250) Alternative Function Forms (bandwith 5%) - Measurement on Months 3 and 4, 2022

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	0.638	0.137	0.154	-3.185	-2.816	-17.483^{+}	-1.578	-31.683*
	(4.501)	(4.548)	(4.524)	(7.138)	(6.060)	(10.519)	(6.122)	(15.607)
MAC	1.699***	1.525***	1.733***	3.441*	2.267**	2.902	2.111**	13.875*
	(0.312)	(0.410)	(0.314)	(1.559)	(0.788)	(3.643)	(0.797)	(6.679)
MAC $*$ Treatment		0.414		-1.594		10.327		10.454
		(0.631)		(2.608)		(7.022)		(15.688)
MAC^2			0.022	0.159	0.023	0.043	-0.088	4.508^{+}
			(0.024)	(0.124)	(0.024)	(0.715)	(0.088)	(2.366)
MAC^2 $*$ Treatment				-0.152		-2.147^{+}		-10.111*
				(0.200)		(1.280)		(4.832)
MAC^3					-0.004	-0.006	-0.003	0.584^{+}
					(0.005)	(0.039)	(0.005)	(0.299)
MAC^3 $*$ Treatment						0.115^{+}		-0.069
						(0.067)		(0.566)
MAC^4							0.001	0.025*
							(0.001)	(0.012)
MAC^4 $*$ Treatment								-0.040^{+}
								(0.022)
Constant	587.928***	586.883***	587.035***	590.421***	588.394***	589.943***	589.541***	594.363***
	(2.864)	(3.293)	(3.038)	(4.349)	(3.572)	(5.127)	(3.684)	(5.615)
Month 4	-118.868***	-118.875***	-118.880***	-118.872***	-118.870***	-118.794***	-118.873***	-118.798***
	(2.252)	(2.252)	(2.252)	(2.253)	(2.252)	(2.254)	(2.252)	(2.254)
Users	19572	19572	19572	19572	19572	19572	19572	19572
Adjusted R^2	0.1288	0.1288	0.1288	0.1287	0.1288	0.1288	0.1288	0.1290
Avg. Dep. Variable (KWh/bim)	528.11	528.11	528.11	528.11	528.11	528.11	528.11	528.11

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 32: Regression C2 (250) Alternative Function Forms (bandwith 10%) - Measurement on Months 3 and 4, 2022

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-4.533	-3.862	-3.884	1.565	1.263	-2.135	1.005	-4.497
	(3.153)	(3.177)	(3.173)	(4.816)	(4.209)	(6.602)	(4.236)	(8.688)
MAC	2.057***	2.239***	2.030***	1.019^{+}	1.575***	1.674	1.594***	4.422^{+}
	(0.107)	(0.140)	(0.109)	(0.553)	(0.268)	(1.332)	(0.272)	(2.550)
MAC $*$ Treatment		-0.417^{+}		0.695		1.081		-2.007
		(0.217)		(0.878)		(2.235)		(4.617)
MAC^2			-0.009*	-0.049*	-0.009*	0.018	-0.001	0.531
			(0.004)	(0.021)	(0.004)	(0.123)	(0.014)	(0.419)
MAC^2 $*$ Treatment				0.053		-0.113		-0.569
				(0.033)		(0.203)		(0.726)
MAC^3					0.001^{+}	0.002	0.001^{+}	0.034
					(0.000)	(0.003)	(0.000)	(0.025)
MAC^3 $*$ Treatment						0.001		-0.035
						(0.005)		(0.042)
MAC^4							-0.000	0.001
							(0.000)	(0.000)
MAC^4 $*$ Treatment								-0.001
								(0.001)
Constant	589.761***	592.078***	591.459***	587.124***	588.910***	588.364***	588.484***	591.247***
	(2.026)	(2.348)	(2.148)	(3.231)	(2.577)	(4.004)	(2.655)	(4.641)
Month 4	-120.215***	-120.236***	-120.244***	-120.218***	-120.209***	-120.216***	-120.214***	-120.219***
	(1.576)	(1.576)	(1.576)	(1.576)	(1.576)	(1.576)	(1.576)	(1.577)
Users	39659	39659	39659	39659	39659	39659	39659	39659
Adjusted R^2	0.1512	0.1513	0.1513	0.1513	0.1514	0.1513	0.1513	0.1513
Avg. Dep. Variable (KWh/bim)	525.63	525.63	525.63	525.63	525.63	525.63	525.63	525.63

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 33: Regression C3 (550) Alternative Function Forms (bandwith 5%) - Measurement on Months 3 and 4, 2022

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-7.674	-8.494	-8.448	-28.397	-26.372	-3.647	-25.838	11.773
	(14.854)	(14.960)	(14.950)	(22.134)	(19.612)	(29.489)	(19.694)	(37.915)
MAC	1.691***	1.489*	1.725***	3.439	3.213**	-4.362	3.170**	9.952
	(0.468)	(0.617)	(0.473)	(2.374)	(1.148)	(5.723)	(1.156)	(10.904)
MAC $*$ Treatment		0.472		0.968		5.383		-29.938
		(0.946)		(3.715)		(9.431)		(19.399)
MAC^2			0.008	0.072	0.007	-0.654	-0.008	1.788
			(0.017)	(0.085)	(0.017)	(0.499)	(0.058)	(1.673)
$MAC^2 *$ Treatment				-0.161		0.869		1.749
				(0.132)		(0.805)		(2.866)
MAC^3					-0.002	-0.018	-0.002	0.123
					(0.002)	(0.012)	(0.002)	(0.094)
$MAC^3 *$ Treatment						0.010		-0.316*
						(0.019)		(0.157)
MAC^4							0.000	0.003
							(0.000)	(0.002)
$MAC^4 *$ Treatment								0.001
								(0.003)
Constant	1236.866***	1234.088***	1235.187***	1242.691***	1244.201***	1226.037***	1245.076***	1243.024***
	(9.465)	(10.974)	(10.036)	(14.936)	(11.859)	(18.379)	(12.297)	(21.030)
Month 4	-223.240***	-223.251***	-223.236***	-223.014***	-222.942***	-222.941***	-222.913***	-222.715***
	(7.333)	(7.333)	(7.333)	(7.343)	(7.341)	(7.343)	(7.343)	(7.343)
Users	6501	6501	6501	6501	6501	6501	6501	6501
Adjusted R^2	0.1299	0.1298	0.1298	0.1297	0.1299	0.1298	0.1298	0.1301
Avg. Dep. Variable (KWh/bim)	1118.29	1118.29	1118.29	1118.29	1118.29	1118.29	1118.29	1118.29

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 34: Regression C3 (550) Alternative Function Forms (bandwith 10%) - Measurement on Months 3 and 4, 2022

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Treatment	-17.356^{+}	-18.483^{+}	-18.451^{+}	-7.187	-8.433	-20.360	-7.327	-22.871
	(10.342)	(10.527)	(10.554)	(15.863)	(13.915)	(20.976)	(14.138)	(26.014)
MAC	2.075***	1.979***	2.102***	1.385^{+}	1.687***	0.867	1.636***	5.249
	(0.163)	(0.202)	(0.172)	(0.828)	(0.410)	(2.028)	(0.425)	(3.938)
MAC $*$ Treatment		0.249		0.194		4.134		-3.491
		(0.342)		(1.344)		(3.308)		(6.600)
MAC^2			0.002	-0.011	0.002	-0.034	-0.003	0.324
			(0.003)	(0.014)	(0.003)	(0.084)	(0.010)	(0.290)
MAC^2 $*$ Treatment				0.023		-0.112		-0.204
				(0.024)		(0.141)		(0.493)
MAC^3					0.000	-0.000	0.000	0.010
					(0.000)	(0.001)	(0.000)	(0.008)
MAC^3 $*$ Treatment						0.002		-0.015
						(0.002)		(0.014)
MAC^4							0.000	0.000
							(0.000)	(0.000)
MAC^4 $*$ Treatment								-0.000
								(0.000)
Constant	1243.549***	1240.775***	1242.160***	1235.198***	1236.739***	1232.810***	1237.864***	1244.423***
	(6.695)	(7.507)	(6.887)	(10.801)	(8.551)	(13.813)	(8.700)	(16.381)
Month 4	-223.324***	-223.361***	-223.354***	-223.362***	-223.353***	-223.344***	-223.341***	-223.265***
	(5.230)	(5.231)	(5.231)	(5.231)	(5.231)	(5.232)	(5.231)	(5.232)
Users	12960	12960	12960	12960	12960	12960	12960	12960
Adjusted R^2	0.1531	0.1531	0.1531	0.1530	0.1531	0.1530	0.1531	0.1530
Avg. Dep. Variable (KWh/bim)	1108.72	1108.72	1108.72	1108.72	1108.72	1108.72	1108.72	1108.72

Standard errors in parentheses

Outliers out-99-

$^{+}$ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$