

Online Appendix:

Reconciling the Empirical Implementation and Methodological Description in Labandeira, Labeaga and Teixidó (2022).

OA 1.- Introduction

This appendix provides a detailed comparison between the econometric approach outlined in Labandeira, Labeaga and Teixidó (2022, LLT hereafter) and the specifications implemented in their replication files. We identify several areas where the computational implementation differs from the textual description.

Here we focus on three issues. First, there is a discrepancy in the definition of the post-treatment dummy variable. Second, the econometric specification implemented in their STATA code is different from the one presented in the main text. Third, the specification of the placebo test does not follow the specification in the text.¹

To ensure this appendix is self-contained, we reproduce LLT's main equation below:²

$$\ln(q_{ht}) = \alpha + \beta \ln(P_{ht}) + \beta_y \ln y_{ht} + \gamma X_{ht} + \delta T_{ht} + \theta_h + \varphi_t + \epsilon_{ht}. \quad (\text{OA.1})$$

LLT's parameter of interest is δ , the coefficient of the post-treatment dummy variable T_{ht} .³

¹The original STATA code is presented in the final pages of this appendix.

²We follow the original paper's notation. Note that there is a typo in Equation (1) on p. 1527 as β parameter in the original equation multiplies both, income and price.

³The variables included are meticulously detailed in p 1527, which we reproduce here: $\ln(q_{ht})$ measures the natural log of kWh, $\ln(P_{ht})$ measures the natural log of the household kWh price $\ln(y_{it})$ measures income; X is a set of relevant socioeconomic controls: household size (number of household members), dwelling size (number of rooms and square meters), elderly people living in the household, education level of the head of the household, household economic situation regarding employment status of household members, housing tenure, building older than 25 years, dummies of municipality size, urban area dummy, province capital dummy and regional dummies; quarterly dummy to control for any potential seasonality effects; θ_h and φ_t are the household and the year fixed effects, respectively; T is our post-reform treatment variable.

OA 2.- Definition of the Post-Treatment Dummy Variable T_{ht} .

The post-treatment dummy variable, T_{ht} , in equation (OA.1), and defined in the text differs from the one used in their replication package.

In the text, T_{ht} is defined as taking the value $T_{ht} = 1$ starting in **September 2013** (one month after the reform) and $T_{ht} = 0$ before.⁴ LLT justify the September 2013 definition in their narrative. On p. 1528, they explain: *since households receive their electricity bills at the end of the billing period (one month) and do not usually have access to daily information about their consumption or prices, the actual response to the reform should be registered one month after it was introduced.*⁵

However, in the regressions implemented in their replication package, T_{ht} is defined as taking the value $T_{ht} = 1$ starting in **October 2013** (two month after the reform) and $T_{ht} = 0$ before.

LLT only use the post-treatment dummy variable textual definition (September 2013) in Table 1 (p. 1524; where the variable is labeled *TT (treatment dummy)*). As the replication package shows, in the regression specifications they use the October 2013 post-treatment dummy variable definition.

OA 3.- Differences in Regression Specification: Causal Effect not Identified.

The regression specification in the replication package differs from the one presented in the main text because it includes a *dynamic treatment effect* based on an additional post-treatment dummy variable defined for September 2013. Overall, the specification in their replication package, as we show below, undermines LLT's identification strategy, which relies exclusively on the parameter δ to measure the reform's impact.

The replication package specification of equation (OA.1) may be written for household h at year t and month m as

$$\ln(q_{h,t,m}^d) = \alpha + \beta \ln(P_{h,t,m}) + \delta \times T_{t,m}^1 + \lambda \times (m - m_r) \times T_{t,m}^2 + \gamma X_{h,t} + \theta_h + \varphi_t + \epsilon_{h,t,m} \quad (\text{STATA})$$

where $T_{t,m}^1$ is the post-treatment dummy variable of δ (their parameter of interest) and $T_{t,m}^2$ is the

⁴See p. 1526 of LLT: the post-treatment dummy variable is defined using monthly data: i_1 is the first interview date, i_2 is the second interview date, and R is the date of the reform (i.e., 1 August 2013). Then T is a post-reform dummy defined as $T = 1$ if $i_2 > R$, and 0 otherwise.

⁵The reform came into force on August 3, 2013 (IET/1491/2013, pp. 56730 and 56735). Contracts with electricity suppliers stipulate that government-regulated price changes are passed on to consumers immediately.

post-treatment dummy variable of the dynamic treatment effect, specified as a linear trend, $(m - m_r)$, $m_r = 8$, the August reform; household income is included in X_{ht} , and θ_h, φ_t denote individual and time aggregate shocks.

As observed, in the replication package regression specification there are two post-treatment dummy variables:

- 1.- $T_{t,m}^1$ is the post-treatment dummy variable multiplying δ (their parameter of interest)
 - 1.1.- $T_{t,m}^1$ is the same as T_{hm} in equation (OA.1).
 - 1.1.- $T_{t,m}^1$ takes value $T_{t,m}^1 = 1$ starting in **October 2013** and 0 before, in the replicaton package.
- 2.- $T_{t,m}^2$ is the post-treatment dummy variable of λ (the dynamic treatment effect, $(m - m_r)$)
 - 2.1.- $T_{t,m}^2$ takes value $T_{t,m}^2 = 1$ starting in **September 2013** and 0 before.
 - 2.2.- This post-treatment dummy variable, $T_{t,m}^2$, and the dynamic treatment effect, $(m - m_r)$, are **absent from the equation in the text**, equation (OA.1) (see p. 1527).

Overall, this implies that the impact of the August 2013 price reform on consumption is not identified by the parameter δ alone, as claim by LLT in their text, but must include $\delta \times T_{t,m}^1 + \lambda \times (m - m_r) \times T_{t,m}^2$, which depends on the month being considered. In other words, in the replication package specification the estimated treatment effect varies by month and cannot be summarized by a single parameter.⁶

Finally, there is an additional issue that undermines the identification of the price reform's effect through δ alone: the inclusion of the electricity price variable, $\ln(P_{ht})$, in equation (OA.1). Since the reform directly affected prices, the causal effect of the reform on consumption operates through the price response. Stated differently, conditional on the price of electricity, there is no exogenous variation left to identify the parameter related to the post-treatment dummy variable (see, for example, Heckman and Pinto, 2022). However, this issue goes beyond the scope of this appendix.⁷

⁶While LLT interpret their results exclusively in terms of δ (see Table 2 discussion on p. 1529), the dynamic treatment effect (*Month since reform*) appears in Table 2 without any discussion of its implications for measuring the reform's total impact.

⁷For example, considering treated and untreated households with both interviews conducted in the same months but

OA 4.- Placebo Test Specification

The placebo test is implemented by running an OLS regression on the cross-section for the year 2012, rather than using a TWFE specification in a two-period panel. Specifically, the placebo test equation in the replication package is:

$$\ln(q_{h,t,m}^d) = \alpha + \beta \ln(P_{h,t,m}) + \delta \times T_{t,m}^1 + \gamma X_{h,t} + \epsilon_{h,t,m} \quad (\text{Placebo})$$

where $T_{t,m}^1$ is a dummy variable that takes the value 1 starting in October 2012, conditional on year 2012.⁸

This specification raises three concerns. First, it does not include the same variables as the main equation. Second, it does not follow the TWFE model presented in the main text, which implies a difference-in-differences interpretation of the parameter of interest in a two-period approach. The placebo test should have been implemented using a TWFE specification to maintain consistency with the main empirical framework. Finally, their replication package before-after comparison on treated households implicitly assumes time invariance in the potential outcome in the absence of treatment—an assumption not discussed in the text. Only under this strong assumption would the implemented specification identify the treatment effect.

Below, we follow LLT’s empirical approach to assess the robustness of their placebo test results. Specifically, in Table O1, we conduct a series of placebo tests using the TWFE specification from their replication package. Our analysis focuses on the coefficient of the post-treatment reform dummy before and after the reform (see LLT Figure 3, page 1525), the impact of the price reform under LLT’s replication package specification is given by

$$\begin{aligned} \delta^{ATE}(m) = & \delta + \lambda \times (m - m_r) + \beta \left[E \left[\ln(P_{h,t,m}^T) - \ln(P_{h,t-1,m}^T) \right] - E \left[\ln(P_{h,t-1,m}^U) - \ln(P_{h,t-2,m}^U) \right] \right] \\ & + (\varphi_t - \varphi_{t-1}) - (\varphi_{t-1} - \varphi_{t-2}), \end{aligned}$$

where the superscript T and U refers to treated and untreated households. It is important to remark that LLT do not discuss the common trends assumption.

⁸The text states that the placebo test *involves the introduction of a placebo reform in the same period, but one year earlier, in August 2012* (p. [X]), with no mention of October 2012. The placebo regression for Table 8 is `reg lnc_e1e TT176 lnPRE . . . if year==2012`, where `lnc_e1e` is log consumption, `TT176` is a dummy variable equal to 1 starting in October 2012, and `lnPRE` is the log average electricity price. Other control variables are omitted for clarity. For the placebo tests in Table 9, the cross-section is 2013 in columns 1-2 and 2012 in columns 3-4.

variable, labeled *Reform* (T). We also report the estimated price coefficient, as the magnitude of the implied price elasticity may further inform the assessment of LLT's results.

Table O1 replicates the first four columns of Table 2 in LLT, where they present their main results. Column I uses an Ordinary Least Squares (OLS) specification; Column II employs an instrumental variable (IV) approach with the prices of potatoes, tap water, and car fuel as instruments; Column III includes household fixed effects; and Column IV combines instrumental variables with fixed effects (IV-FE). LLT's preferred estimates are those in Column IV, obtained using the IV-FE approach.

Panel A replicates LLT's original results using their data and replication package specification. Panel B substitutes the August 2013 price reform with the April 2013 billing reform, which altered the frequency and content of electricity invoices without affecting prices. Panels C and D apply the same empirical approach to natural gas and potato consumption, respectively.

INSERT TABLE O1

The estimates above show that the placebo tests yield statistically significant coefficients, in contrast to LLT's findings. Notably, the April 2013 billing reform—which altered only the format and content of electricity bills without changing prices—appears to have significantly affected electricity consumption according to LLT's empirical specification. The estimates in Panels C and D indicate that the reform's impact on potato consumption is even larger than its impact on electricity consumption, while the effect on natural gas consumption closely mirrors that on electricity. These results challenge the robustness of LLT's placebo test. In particular, these findings suggest that the observed effects are not specific to electricity consumption but may instead reflect broader behavioral or measurement issues unrelated to the price reform itself.

Table O1: Placebo regressions: robustness analysis.

	(1)	(2)	(3)	(4)
Table 2 columns:	OLS	IV	FE	IV-FE
A: Replication of Table 2 page 1529				
Reform (T)	-0.178*** (0.027)	-0.123*** (0.026)	-0.154*** (0.028)	-0.124* (0.074)
ln(price kWh)	-1.044*** (0.024)	-0.940*** (0.037)	-1.026*** (0.025)	-0.695 (0.757)
Observations	20,872	20,872	20,872	20,872
B: April 2013 billing reform placebo test				
Reform (T)	-0.062*** (0.021)	-0.117*** (0.020)	-0.071*** (0.023)	-0.068** (0.028)
ln(price kWh)	-1.049*** (0.028)	-0.939*** (0.040)	-1.065*** (0.031)	-0.889 (1.023)
Observations	16,880	16,880	16,880	16,880
C: Impact electricity price reform on natural gas consumption				
Reform (T)	-0.097*** (0.031)	-0.202*** (0.073)	-0.116*** (0.030)	-0.099** (0.040)
ln(price gas)	-1.157*** (0.021)	-2.053*** (0.242)	-1.053*** (0.020)	-0.314 (0.623)
Observations	7,962	7,962	7,962	7,962
D: Impact electricity price reform on potato consumption				
Reform (T)	-0.316*** (0.101)	-0.199** (0.101)	-0.505*** (0.142)	-0.489** (0.198)
ln(price potato)	-1.824*** (0.031)	-1.174*** (0.300)	-1.728*** (0.046)	-1.526 (1.710)
Observations	14,474	14,474	14,474	14,474

Replication of first four columns Table 2 of LLT: Column (1), OLS; Column (2) IV: instrumental variables regression; Column (3) FE: fixed-effects regression; Column (4) IV-FE; instrumental variable with two way fixed-effects. Sample: data before September 2013.

Panel A: Replication of Table 2 of LLT

Panel B: Placebo regression on April 2013 billing reform.

Panel C: Placebo regression on natural gas consumption.

Panel D: Placebo regression on potato consumption.