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It's Not Price; It's Quality. Satisfaction and Price Fairness Perception of Electricity Services in the Urban Dominican Republic

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"No Precio, Es Calidad: Satisfacción y Percepción de Justicia de Precio de Servicios de Electricidad en Áreas Urbanas de República Dominicana"

Resumen

La deficiente calidad de infraestructura altamente subvencionada se asocia típicamente con interferencia política. En este contexto, la efectiva implementación de tarifas que permitan recuperar costos de provisión de mejores servicios de infraestructura representa un desafío persistente en países en desarrollo. Este documento examina cómo los niveles de satisfacción del usuario final y su percepción de justicia del precio responden a diferentes escenarios de precio-calidad de servicios de electricidad en la República Dominicana urbana. El análisis se basa una base de datos representativa de usuarios informales y formales en un caso de estudio que ofrece heterogeneidad significativa sobre las características de servicio (ej. la confiabilidad de la provisión, calidad comercial del servicio). Adicionalmente, el análisis usa variabilidad temporal en la exposición a mejoras de servicios y subsidios de electricidad para evaluar si las actitudes de los consumidores cambian en el tiempo. Los resultados sugieren que el efecto positivo de mejoras de la calidad del servicio sobre la satisfacción es mayor que los efectos negativos combinados del aumento de precios y de la eliminación de subsidios. Este caso de estudio no encuentra evidencia de que las actitudes de los usuarios se adapten. Ello sugiere que las opiniones favorables de las mejoras del servicio tienen efectos duraderos. En general, los resultados sugieren que los ajustes de precios relacionados con mejoras en el servicio de electricidad aumentan la satisfacción del cliente en forma duradera.

Palabras clave: Satisfacción del consumidor, Justicia de Precio, Servicios de electricidad. Precios de la Electricidad, calidad de los servicios eléctricos, Subsidios.

“It’s Not Price; It’s Quality. Satisfaction and Price Fairness Perception of Electricity Services in the Urban Dominican Republic”

Abstract

Poor quality infrastructure that is highly subsidized is also typically associated with political interference. In such a context, implementing cost-recovery tariffs, necessary to improve infrastructure services, represents a persistent challenge in developing countries. This paper examines how levels of end-user satisfaction and price fairness perception respond to different price-quality mixes of electricity services in the urban Dominican Republic. The analysis exploits a rich dataset, representative of informal and formal users, in a case study that provides significant variability of service characteristics (e.g., service reliability, commercial quality). I further exploit temporal variation in exposure to service improvements and electricity subsidies to evaluate if consumer attitudes change over time. The results suggest that the positive effect of improvements in service quality on satisfaction is greater than the negative effects of increasing prices and eliminating subsidies combined. In this case study, I find no evidence of attitude adaptation, suggesting that favorable views of service improvements have lasting effects. Overall, the results seem to suggest that price adjustments related to electricity service improvements permanently increase customer satisfaction.

Keywords: Consumer Satisfaction, Price Fairness, Electricity Services, Electricity Prices, Quality of Electricity Services, Subsidies.

Códigos JEL: D60, L94, L98

It's Not Price; It's Quality. Satisfaction and Price Fairness Perception of Electricity Services in the Urban Dominican Republic

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This version: January 2018

Abstract

In developing countries, poor quality infrastructure that is highly subsidized is typically associated with populist political interference. In such a context, implementing cost-recovery tariffs, necessary to improve infrastructure services, is a political challenge. This paper examines how levels of end-user satisfaction and price fairness perception respond to different price-quality mixes of electricity services in the urban Dominican Republic. The analysis exploits a rich dataset that includes informal and formal users, as well as heterogeneity in a set of service characteristics (i.e., reliability and commercial quality). I further exploit temporal variation in exposure to service improvements and electricity subsidies to evaluate if consumer attitudes change over time. The results suggest that the marginal positive effect of improvements in service quality on satisfaction is greater than the marginal negative effects of increasing prices and eliminating subsidies combined. In this case study, I find no evidence of attitude adaptation, suggesting that favorable views of service improvements have lasting effects. Overall, the results seem to suggest that price adjustments related to electricity service improvements permanently increase customer satisfaction.

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1. Introduction

Consumer attitudes, such as satisfaction and price fairness perception, play an important role in both competitive markets and natural monopolies. In competitive markets, understanding consumer attitudes helps firms design strategies to retain clients and improve performance. For example, price perceptions may influence customers' overall quality perceptions, purchase intentions, complaints and, ultimately, firm profitability (Homburg et al. 2005; Orsingher et al. 2010; Suchanek et al. 2014). In the case of vertically integrated natural monopolies, where consumers usually cannot switch service providers, regulators have been paying increasing attention to measuring consumer attitudes to evaluate market performance with regard to consumer welfare. This focus on attitudes has translated into an increasing number of surveys being implemented to complement traditional regulatory approaches.[1]

From a public policy point of view, adopting a consumer-centric approach to evaluating welfare has advantages in a variety of contexts. For instance, in markets that have experienced reforms (i.e., privatization or liberalization), consumer satisfaction is a relevant indicator of success (Fiorio and Florio, 2011). Evaluating consumer perceptions can be even more important in markets where state-owned utilities predominate, and the degree of consumer satisfaction can influence public opinion and trust in governmental policies (Dudley et al. 2015).

In developing countries, low-quality infrastructure services such as electricity and water have persistently been provided at heavily subsidized tariffs, a situation that is associated with high levels of populistic political interference (e.g., McRae

[1] Assessments of consumer satisfaction through direct surveys have been applied in developing and developed markets. As reported by Clifton et al. (2014), data on satisfaction with utility services are available in a range of national surveys, such as in the US (ACSI 2013), Sweden, (Fornell 1992), Korea, New Zealand, Norway, Taiwan (Johnson et al. 2001) and the United Kingdom (UK) (NCSI-UK 2013). The European Union (EU) has also invested considerable resources to conduct in-depth evaluations of consumer satisfaction with utilities. The results of these surveys have been published in a series of surveys known as Eurobarometers (EC 2013). Among developing countries, Guatemala and Chile also implement similar annual surveys.

2015, Kojima et al., 2014). Such interference is to a great degree driven by the expectation of gaining political support assuming that free but poor-quality services constitute a good deal for the population. However, these subsidies and interference not only represent a substantial fiscal burden on taxpayers but also may fail to maximize consumer welfare. In this context, understanding user satisfaction and price fairness perceptions may contribute to improved policies aimed at overcoming political barriers or prior beliefs that have preserved such situations.

In this paper, I propose a unified framework to examine the drivers of satisfaction and price fairness perception, where those drivers are allowed to have direct and indirect effects on satisfaction through price perceptions. Further, I exploit temporal variation in the exposure to service improvements and electricity subsidies to evaluate if consumer attitudes change over time.

I designed an original survey and implemented it in around 2,500 households to assess end-user satisfaction with electricity services, and to capture their perceptions of electricity prices, hoping to improve the understanding of underlying consumer attitudes toward basic services (i.e., electricity and water). This cross-sectional dataset also contains detailed information on a range of individual demographic and economic characteristics in addition to customers' perceptions of the attributes of electricity services, such as voltage stability and attention to claims, making it possible to control for potential confounding factors. The survey also contains administrative information related to the implementation of programs aimed at upgrading these services and delivering electricity subsidies.

The analysis takes place in the urban Dominican Republic, a developing country with significant cross-sectional and temporal variation in the quality of electricity services and their costs (through subsidies). Indeed, over one-fifth of the population has less than 12 hours of electricity service per day and does not pay for the service. Over the last several years, the government has been reforming subsidies and implementing programs of service improvements to overcome this situation. In this sense, the country represents a politically meaningful and analytically interesting case of study.

This paper fits into the literature examining drivers of satisfaction and price fairness from the customers' perspective. This topic merges fields such as economics, psychology, and marketing, representing a fertile area of research with substantive theoretical and practical implications. In this literature, satisfaction is defined as the result of a post-consumption/post-usage evaluation, comparing expectations with perceived product or service performance. Price fairness perception, on the other hand, is defined as a judgment of whether a price or a process to reach a given outcome is reasonable, acceptable or fair (e.g., Bolton, Warlop, and Alba 2003). This evaluation includes both cognitive and affective elements. The cognitive aspect of this definition indicates a comparison with a pertinent reference, which can be explicit or implicit. In explicit comparisons, people compare one price to another or with a range of prices, while in implicit comparisons, judgments are made based on cost expectations (see for example Oliver 1997; Xia et al., 2004).

In electricity distribution markets, few studies have analyzed these dimensions, and these have not addressed satisfaction and price perception jointly. To the best of my knowledge, only the study by Rekettye and Pinter (2006) has investigated price acceptance and consumer satisfaction, with electricity services in Hungary. However, that study focuses on examining the correlation between the two variables, controls for a relatively small set of socioeconomic characteristics, and does not account for drivers related to service quality.

Regarding electricity prices, in one of the most extensive studies, Fiorio and Florio (2011) analyze 15 European countries, showing that price fairness perception responds to actual price variation, different market arrangements, and socioeconomic characteristics of the end-users. Clifton et al. (2014) focus on consumers' socio-economic characteristics—mostly those highly correlated with household economic conditions—also finding that these are important in explaining consumer price perception in 12 European countries.

Regarding satisfaction with overall electricity services, Konya et al. (2014) study Missouri residential customers, showing that electricity rates, service reliability, and consumer service–related attributes are important drivers of satisfaction. The authors also show that the relative importance of attributes changes across consumer groups at different levels of satisfaction, and that, albeit with significant variance, perceptions tend to reflect the actual service characteristics. Along these lines, Di Tella et al. (2012) show that, even in a context of unpopular foreign water companies, exposure to service improvements affects users' beliefs, and moreover, such beliefs are robust to anti-privatization propaganda. Further, in the case of the Dominican Republic, a country with some of the poorest quality public services, Jimenez et al. (2015) show that households identify price, service reliability and voltage stability as the most important characteristics of electricity services.

This paper is also related to the literature on happiness economics along two dimensions. First, some studies have focused on the correlation between variables in the energy sector and life satisfaction. Second, the literature of happiness economics provides an empirical reference for the study of satisfaction and how it may change over time. For example, Boyd-Swan and Herbst (2012) and Nugent and Switex (2013) study the effects of gasoline and oil prices on subjective well-being, showing that price increases have strong negative effects on life satisfaction. Boyd-Swan and Herbst (2012) also find evidence that well-being almost fully rebounds within one year and changes very little each year thereafter. This is in line with more general findings on the relationship between income and happiness, which indicate that subjective measures of well-being tend to adjust to new circumstances over time (Diener et al. 2006; Di Tella et al. 2010). However, whether this finding extends to consumer satisfaction with public services is a question that, to the best of my knowledge, has not yet been explored.

The results of this paper indicate that satisfaction is mainly explained by the quality of service attributes—reliability, voltage stability, and attention to claims—and by price fairness perception. Price fairness perceptions mainly respond to cost-related attributes such as average electricity price, subsidies and the tariff scheme. Price-related attributes seem to only affect overall quality perception through price perception, rather than directly. The estimates indicate that the marginal positive effect of improvements in service quality is greater than the combined marginal negative effects of increasing prices and eliminating subsidies. In the case under study, the estimations show no evidence of attitude adaptation, suggesting that the effect on satisfaction with service improvements lasts over time.

This paper contributes to the literature in the following ways: (i) It is the first study to jointly address satisfaction and price fairness perception in the electricity sector of a developing country. Given the increasing attention toward consumer satisfaction with utility services, as well as the need to adjust electricity prices to reflect the actual cost of providing services (Clements et al. 2013), the findings of this study are highly policy-relevant for countries with a detrimental mix of high subsidies and poor-quality basic services. Indeed, our results suggest that consumers would be more likely to accept price increases that are associated with improvements in service quality, producing a net gain in satisfaction. (ii) It provides evidence that satisfaction and price perceptions may not adapt over time, indicating differentiation between attitudes toward basic utilities and overall well-being.

The remainder of the paper is organized as follows. Section 2 provides background on the case study. Section 3 describes the data. Section 4 lays out a conceptual framework and presents the econometric specifications. Section 5 presents the empirical results, also providing robustness checks. Section 6 offers concluding remarks.

2. Institutional Context

The study focuses on residential users in the urban Dominican Republic. Electricity distribution services are mainly provided by state-owned utilities, presenting a complex mixture of highly subsidized electricity services, low-quality services, and substantial financial losses for the utilities. In 2015, formal users experienced an average of 35 interruptions per month, of an average length of 3.3 hours.[2] Over the last decade, utilities have reported sizeable financial losses, which have translated into a fiscal burden of between 1.8 and 0.6 percent of the Gross Domestic Product (GDP).[3] This situation makes the electricity distribution sector in the Dominican Republic one of the least functional in the Latin American and Caribbean region, see Figure 1.

This situation originates with a history of political interference in the electricity sector dating to the mid-20th century (Mercado, 2017; Gallina et al. 2017). In this period, the rapidly growing urban population was connected to the electricity grid under populistic mandate without compliance with formal technical standards and without being registered as clients in the commercial datasets of the utilities. I argue that this situation resulted in exogeneity in the type of services received by end-users (Section 4). Households were connected to the grid, but the quality of the services was subject to the overall quality of electricity infrastructure, and fiscal constraints.

As a result, there is significant variability in the quality of service provided. Utilities classify their customers according to the availability of services: (a) those receiving less than 12 hours of electricity service per day; (b) those receiving between 12 and 18 hours per day; and (c) those receiving over 18 hours. End-users

[2] Based on information from the Superintendencia de Electricidad, http://sie.gob.do/mercado-minorista/estadisticas.

[3] Over the last several years (2012–2014), the electricity sectors presented significant operational deficits as reported by "Corporación Dominicana de Empresa Eléctricas Estatales" (CDEEE).

can also be grouped into informal and formal users. Informal users, who are not registered as clients in utility databases and do not pay for the service, represent around 20 percent of total households. Formal users can further be divided into two types, those who are billed a fixed amount and those who are billed according to their metered consumption. The first group represents around 37 percent of total users, and their fixed payment is calculated by the utility according to characteristics of the households, such as ownership of appliances and household income (MEPyD 2014).

Formal clients face an incremental block tariff (IBT) schedule.[4] Table 1 presents the tariff schedule for residential users as of December 2015, showing variability in the cost of electricity at different levels of consumption. However, it is worth mentioning that since 2013, these tariffs have remained fixed (in nominal terms) and below cost recovery levels. The actual costs of providing electricity services depend greatly on the cost of fossil fuels (the main source of generation), therefore the implicit tariff subsidy depends on international oil & gas prices (as the country is a net importer of these resources). The fact that final tariffs did not adjust over time limits to some degree the variability I exploit in this paper.

To depict the substantial heterogeneity in types of user (with different qualities of service) and the different prices they face, Figure 2 presents the distribution of type of user (informal, fixed tariff, and formal) in relation to the tariff per electricity consumption block and the average electricity price in the sample under analysis.

Over the last several years, the utilities have made efforts to improve the quality of services and reduce levels of informal access to electricity services. However, along with this process, one of the main concerns at the policy level is users' capacity to pay for electricity services. In fact, regardless of the strongly subsidized tariff scheme, electricity services make up a substantial share of household budgets

[4] Under IBT monthly electricity consumption blocks have different tariffs, and the total electricity bill is calculated by adding the consumption at the tariffs of the corresponding block.

(see Jimenez et al., 2016). For this reason, the government has begun to gradually deliver electricity subsidies in the form of cash transfers, upon verification of household socioeconomic conditions. This subsidy, called 'Bono Luz,' provides support up to US$10 per month for households consuming less than 100 KWh per month.

In this context, one of the challenges faced by the electricity distribution sector is how to adjust prices in order to improve the quality of service, and at the same time achieve a net gain in consumer welfare. In the case under study, in which utilities are state-owned and governmental policies have historically affected the electricity sector, a key part of this challenge is to understand the trade-offs between changes in prices and changes in other characteristics of the electricity service.

3. Data

The data for the analysis comes from a household survey that I implemented in seven cities in the Dominican Republic, which represent 67% of the urban population.[5] Approximately 2,500 households were interviewed in November 2015 and February 2016 following a random sampling procedure. The survey captured detailed information on household socioeconomic characteristics including monthly household income, household size, years of schooling of the household head, age of the household head, and ownership of appliances. As the interest is in examining attitudes toward electricity services, I considered electric appliances that tend to be intensively used: refrigerator, water pump, washing machine, television, radio, and inverter.[6]

[5] Calculated with Population Census of 2010.

[6] These variables are similar to those used in the literature (e.g. McRae 2015; Reiss and White, 2005; Boogen et al., 2014). In addition, given the severe problems with water scarcity in the Dominican Republic, water pumps are used intensively across the country, depending heavily on electricity to

With regard to the characteristics of the electricity services, the data also contain information on the reliability of electricity services (i.e., typical number of interruptions, and hours with electricity service per day), billing (i.e., if bills for electricity services arrive in a timely manner), attention to claims, voltage stability, whether the household receives notifications of interruptions, if the household pays a fixed amount per month for electricity services, if the household receives electricity subsidies, and monthly electricity expenditures. With the exception of household income and electricity expenditures, all of these variables are categorical.

Following the utilities' practice, end-users are classified into three groups according to the number of hours of service they receive per day. Information on the stability of voltage is not available at the household level, so it was collected by asking end-users to classify their service as low, regular, or stable voltage current. Similarly, end-users were asked to assess, on a binary scale, other service attributes such as reliability of billing delivery, notification of interruptions, and response to claims.

The main dependent variables, consumer satisfaction and price fairness perception, were collected via direct structured questions. The household heads were asked to evaluate their overall satisfaction with electricity services on a scale from 1 (appalling) to 5 (excellent). Consumer satisfaction is measured dichotomously, with a value of 1 if the respondent selects 3 or higher, and zero otherwise. Four different questions addressed price fairness perception. One yes/no question asked if electricity prices are considered to be fair. This question will be used in the main model, described in the next section. Then, the same question was asked using a scale from 1 (very unfair) to 5 (very fair). Similar questions were asked, but instead of referencing price, these asked end-users to

produce enough pressure to store water. Similarly, given the long and continuous electricity service interruptions that are common, households in the country tend to depend on inverters to store electricity (see Jimenez et al., 2015).

evaluate the amount they are usually charged by the electricity service. These questions will be used in the robustness check.

The final sample contains 2,455 households, after dropping observations with incomplete information for the analysis. Regardless of the cross-sectional nature of this dataset, the context under study provides relevant sources of temporal and cross-sectional variability.

Table 2 presents the descriptive statistics, showing significant variability that resembles that reported by official sources. The distribution of this sample by type of user and service also resembles that reported by the utilities. Formal users, defined as those with meters who pay for the service, represent 53% of the total sample. Users paying a fixed fee for services make up 25% of total users, and informal users represent 22%. Around 40% of the sample have a service type that provides [18 24] hours of service per day, while 25% have a worse quality of service (0 12]. Around 66% report having stable voltage, and only 5% a very unstable current. The average household in our sample has 3.7 members, with a total monthly income of around US$590.[7]

Also, this sample shows differences in levels of satisfaction and price fairness perceptions by type of client and by pricing block. Figure 3 shows that the average level of satisfaction with the service increases in the higher blocks of consumption, which are associated with better quality services. However, price fairness perceptions decrease in higher blocks (where customers pay higher tariffs).

Regarding the price of electricity services, note that, given the increasing block tariff schedule and the different types of users, households face very different costs for service. For formal, metered clients, electricity prices and consumption can be derived from their electricity expenditures. However, for users paying a fixed fee,

[7] This amount is consistent with the household income calculated from the National Survey of the Labor Force from 2015.

who do not have a meter, we only observe the sum payment. Therefore, to assign prices to these users, I estimate their electricity consumption based on parameters for formal clients and obtain the prices as the ratio of expenditures to the estimated electricity consumption.[8,9] This represents an average price, while formal users face different marginal and average prices. Therefore, in the main regression, I use average prices to exploit the greater number of observations[10]. In the case of informal users, both the marginal and average prices are zero.[11] Figure 4 summarizes the distribution of the imputed monthly electricity consumption, along with the marginal and average estimated prices. Consumption tends to concentrate below the threshold of 200 KWh, and in this sample, a small number of households fall within the highest band. Annex 1 shows that the kernel distributions of actual consumption (Figure 2) and imputed consumption are similar, according to the Kolmogorov-Smirnov test.

The temporal variability in exposure to subsidies and service upgrades is used to evaluate changes in satisfaction and price perception over time. Since electricity prices have not changed over the last five years, the cash transfer subsidy for electricity consumption represents the only source of variability in the cost of the services. In the sample, around 31% of households receive direct electricity

[8] That is, consumption by formal users is regressed against their socioeconomic characteristics. I then use the sample to predict electricity consumption for users paying a fixed fee. This approach is equivalent to the utilities' practice for defining the fixed amount. The fixed amount to be paid by a household is based on an estimation of their potential consumption given their characteristics. These estimations are based on visits by utility personnel, who in addition to assessing potential consumption, also assess household economic conditions.

[9] While this simple approach may be subject to biased estimates, the predictions from the sample are reasonable. Alternatively, I tried the approach of Reiss and White (2005), however, this returned implausible estimates of consumption. I interpret these results as resulting from the lack of variability in our data (the cross-sectional nature of the data, and a tariff schedule that has not changed recently).

[10] Nonetheless, I obtain similar results in a regression that considers only formal users and marginal price.

[11] Informal households do pay a marginal price of zero for electricity consumption; however, they may pay some amount to connect to the grid, and they are also subject to disconnection by the utility. This could represent an additional 'fixed payment' for electricity service. This dataset does not have information on the size or frequency of these payments. I assume that such payments are small and spread out over relatively long periods of time, such that the average price tends to zero.

subsidies. The distribution of the sample by the year in which the client started receiving the subsidy is presented in Figure 5.

Concerning upgraded services, the dataset is complemented with administrative information on service improvements performed by the electricity companies. This information captures the month and year in which the utilities upgraded the services in a given area, such as an entire district. Figure 6 presents the distribution of the sample receiving such an upgrade, showing that the program has been more active since 2013.

It is worth highlighting that the data on the quality of electricity services in our sample is reported by each household. There is no administrative information from the utilities on actual quality at the household level, only in broad areas of attention.[12] A potential drawback is, therefore, that reported perceptions of quality may not reflect actual quality. The literature suggests that consumer attitudes (i.e., satisfaction and price fairness perception) reflect actual variation in attributes of the provided services (See for example Trugeon et al. (2004) with regard to water, and Konya et al. (2014) with regard to electricity). To validate this point in the present study, Annex 2 compares the average levels of SAIDI and SAIFI registered by the utility (with the regulator) to those estimated from this sample.[13] Annex 2 shows that the quality reported by households in this sample closely reflects that presented by the utilities, even though our sample does not cover the entire area served by the utilities.

[12] Generally, this is due to the lack of public utility infrastructure in the country. For formal users, it would require smart meters in each dwelling.
[13] SAIFI: System Average Interruption Frequency Index; SAIDI: System Average Interruption Duration Index.

4. Methodology

4.1 Conceptual framework

To provide a unified framework for consumer satisfaction and price fairness perception, I assume a simple mediation setting in which the electricity service attributes exert their influence on user satisfaction directly and through price fairness perception. Figure 7 depicts these direct and indirect channels. I operationalize this setting following a similar model as in Mastrobuoni et al. (2014). Satisfaction (S^*) and price fairness perception (f^*) can be expressed as:

$$S^* = g(X, f^*, Z)$$

$$f^* = h(X, Z)$$

Where the super-index "*" indicates that satisfaction and price fairness perception are not observed latent variables. Here, S^* and f^* are assumed to be smooth functions of service attributes (X) and socioeconomic characteristics of the users (Z). That S^* depends on f^*, but not vice versa, is conceptually consistent with the formation of those attitudes in which satisfaction represents the post usage evaluation, while price perception is related to one of the characteristics of using the services (i.e. actual cost of service). This separation also allows tractability, since bi-directionality would represent a recursivity issue in estimating the system of equations. Then, identification assumptions to attach causal interpretation to this model are that price fairness perception is not driven by satisfaction, and that, after controlling for X and Z, there are no systematic un-observables affecting both equations. Note that if these assumptions are valid, the estimations should be robust to the instrumentation of f^*in the satisfaction equation. This seems to be the case; see Table 6.

This setting also exploits variability in the characteristics of the electricity service (such that user attitudes vary meaningfully). It is reasonable to argue that the type of service to which users are exposed does not depend on their attitudes. In section two, I described the context in which users have been connected to a type of service which was exogenous to their decisions. However, these events occurred between the '60s and the '90s, and no administrative data is available to validate this assumption. Therefore, I rely on evidence from a choice experiment implemented in the same sample of respondents. In this experiment, households are offered an improved service or the option of maintaining their status quo service. These experiments verify whether households have unobservable reasons to prefer the status quo. The results indicate that households tend to reject low-quality services regardless of price trade-offs, a pattern that is stronger among informal users, suggesting the current services they receive are exogenously determined. For details on the characteristics of the CE see Jimenez (2017).[14][15]

The focus is on service attributes such as actual price (p), service reliability (r), voltage stability (v), and price fairness perception (f^*). It is expected that the utility to users responds negatively to a price increase, $S_p^* = \partial S^*/\partial p \leq 0$, positively to an increase in price fairness perception, $S_f^* = \partial S^*/\partial f^* > 0$, and positively to an increase in service reliability, $S_r^* = \partial S^*/\partial r > 0$ (or voltage stability).

The reduced form of the previous equations gives

$$\widetilde{S^*} = \tilde{g}(X, Z)$$

This equation, however, joins the direct and the potential indirect effects via price perception. For example, in this reduced form, the total effect of a change in

[14] A critique of this argument is that households may lie, choosing the best services at a corresponding cost under the expectation that they will receive the improvement later without having to pay for the services. However, the results of the decision made by the respondents show a clear trade-off between price and quality, indicating that the price tag of each quality of service matters in household decisions.

[15] In a sequential setting, however, it is possible that better services improve price fairness perception. Here, I rely on the previous assumptions; that there are no un-observables related to satisfaction, such that price fairness depends only on X and Z (not S^*).

price or service reliability would respectively be

$$\widetilde{S_p^*} = S_p^* + f_p^* S_f^*$$

$$\widetilde{S_r^*} = S_r^* + f_r^* S_f^*$$

where the first component of the right-hand side represents the direct effect of a change in price (reliability in the second equation), and the second component represents the indirect effect, working through the price perception equation.

If conditional on prices, satisfaction does not depend on price fairness perception, or if fairness does not depend on price (reliability) then $\widetilde{S_p^*}$ ($\widetilde{S_r^*}$) will equal the direct effect, S_p^* (S_r^*). In general, it is expected that $S_f^* > 0$, $f_p^* < 0$ and $f_r^* > 0$, so it would be expected that $\widetilde{S_p^*} < S_p^*$ and $\widetilde{S_r^*} > S_r^*$. An interesting point is the following. Assume a price change and an increase in service reliability. To evaluate the size of those effects in our framework, everything else remaining constant, $\widetilde{S_r^*} > \widetilde{S_p^*}$ may be due to $S_r^* > S_p^*$ and $f_r^* S_f^* > f_p^* S_f^*$. Or, it may also be the case that, given $S_f^* > 0$, $\widetilde{S_r^*} < \widetilde{S_p^*}$ but $f_r^* > f_p^*$, when $(f_r^* - f_p^*)$ is sufficiently large, the indirect effect dominates. These relations are of an empirical nature, and they have policy-relevant implications. In the latest scenario, if service improvements that usually come at a cost have a net positive effect on consumer satisfaction through price fairness perception, that would be a relevant indication that customers are willing to accept higher prices that reflect better services.[16]

In general, this framework applies to the three types of users in the context under analysis—informal users, clients who pay a fixed monthly amount, and clients who pay a variable amount (at any of the tariff blocks). In this paper, I do not model household-sorting between these groups. Instead, I assume that conditional on

[16] In this set-up, the two changes are not connected, although they could be connected through a third "quality equation," similar to a simultaneous equation approach. A quality equation could be included that would depend on supply and demand factors. I do not have explanatory variables on the supply side.

observables, the type of service a household receives is as if exogenously determined by the overall quality of the infrastructure that is available to them.

4.2 Empirical approach

4.2.1 Satisfaction and Price Fairness Perceptions

S^* and f^* are only observed in a binary state.

$$S = \begin{cases} 0 & if \quad S^* \leq 0 \\ 1 & if \quad S^* > 0 \end{cases} \qquad\qquad f = \begin{cases} 0 & if \quad f^* \leq 0 \\ 1 & if \quad f^* > 0 \end{cases}$$

where being unsatisfied with the service or considering prices to be unfair is indicated by $S^* \leq 0$ or $f^* \leq 0$. I assume an additive index function, with a linear specification for satisfaction and price fairness perception:

$$f^* = X'\alpha + Z'\beta + u \qquad (1)$$

$$S^* = X'\gamma + Z\delta + \theta f + \varepsilon \qquad (2)$$

In this formulation, the same group of covariates determines fairness and satisfaction, and the fairness perception is allowed to have an impact on satisfaction. In this system, the point is to evaluate the direct and indirect effects.

The error terms u and ε are assumed to be drawn from the same Type I extreme value distribution. For calculating the standard errors, I allow the error terms to be correlated across equations (for the same individual), and clustered within the same sub-district.

Following standard procedures (e.g. Peracchi 2001; Greene 2000), the probability of being satisfied with the service equals

$$p^s = \frac{\exp(X'\gamma + Z\delta + \theta f)}{1 + \exp(X'\gamma + Z\delta + \theta f)}$$

The probability of answering that the price is considered to be fair equals

$$p^f = \frac{\exp(X'\alpha + Z'\beta)}{1 + \exp(X'\alpha + Z'\beta)}$$

In the satisfaction equation, the derivative with respect to a given attribute (x)—i.e. marginal effects—is given by:

$$\frac{\partial p^s}{\partial x} = \frac{\gamma_x * \exp(X'\gamma + Z\delta + \theta f)}{[1 + \exp(X'\gamma + Z\delta + \theta f)]^2}$$

In the fairness equation, the corresponding marginal effect is:

$$\frac{\partial p^f}{\partial x} = \frac{\alpha_x * \exp(X'\gamma + Z\delta + \theta f)}{[1 + \exp(X'\gamma + Z\delta + \theta f)]^2}$$

The direct and indirect effect is given by:

$$\frac{\partial p^s}{\partial x} = \frac{(\gamma_x + \theta\alpha_x) * \exp(X'\gamma + Z\delta + \theta f)}{[1 + \exp(X'\gamma + Z\delta + \theta f)]^2}$$

Where the total effect of a change in the x attribute is the sum of the direct effects, γ_x, and the indirect effect, $\theta \, {}^{\partial f}/_{\partial x}$. This derivation works for continuous variables, such as average prices in our case. For binary or categorically coded variables (i.e. gender, level of electricity service reliability), it is not appropriate to apply the derivative with respect to a small change (since the variable represents a change of state, e.g. Greene 2012). For example, voltage quality (say x) can take three labels 'excellent (a)', 'regular (b)' or 'worst (c)'. Taking 'worst' as a base label, the estimated coefficient for the factor binary variable 'regular' would be γ_{xb} in the satisfaction equation, and α_{xb} in the fairness equation. Then the marginal effect on price fairness perception would be:

$$\frac{\partial p^{f}}{\partial x} \cong \frac{\exp(X'\alpha + Z'\beta)\,|_{x_b=1}}{1+\exp(X'\alpha + Z'\beta)\,|_{x_b=1}} - \frac{\exp(X'\alpha + Z'\beta)\,|_{x_b=0}}{1+\exp(X'\alpha + Z'\beta)\,|_{x_b=0}}$$

In the satisfaction equation:

$$\frac{\partial p^{s}}{\partial x} \cong \frac{\exp(X'\gamma + Z\delta + \theta f)\,|_{x_b=1}}{1+\exp(X'\gamma + Z\delta + \theta f)\,|_{x_b=1}} - \frac{\exp(X'\gamma + Z\delta + \theta f)\,|_{x_b=0}}{1+\exp(X'\gamma + Z\delta + \theta f)\,|_{x_b=0}}$$

This calculation is performed setting the other variables at mean values.[17] Therefore, in the case of attributes measured as categorical variables, I employ a fully nonlinear specification, using a nested indicator function for different values.[18] This specification is straightforward for binary variables—billing reliability, quality of attention to claims, notification, and subsidy—and takes the following form for variables with three categories:

$$x \in [a, b, c]$$

$$\mathrm{I}_{x_{a,b}}\ if\ \ x_j \in [a, b] \quad , \quad \mathrm{I}_{x_a} if\ x_j \in [a]$$

The attribute x can take values a, b or c. The indicator variable $\mathrm{I}_{x_{a,b}}$ takes value 1 if $x_j \in [a, b]$ and zero otherwise. Similarly, the indicator variables I_{x_a} takes value 1 if $x_j \in [a]$, zero otherwise. In this specification, the coefficient for $\mathrm{I}_{x_{a,b}}$ will capture the effect of going from c to b, and the coefficient for I_{x_a} will capture the effect of going from b to a. The constant terms will absorb all the base values. The estimated coefficients represent improvements in the service. For example, the base label of service reliability is the highest number of interruptions per day, while the base label of voltage stability is the highest number of perceived voltage instabilities. The

[17] While this approach is still problematic for other categorical variables, it is a necessary simplification. This is because, in general, with factor variables it is not clear which values represent the average.
[18] Also following Mastrobuoni et al. (2014).

estimated coefficients will capture the change in attributes representing an improvement in those attributes.

4.2.2 Adaptation of Satisfaction and Price Fairness Perception

In this setting, satisfaction and price perception are expected to respond to service improvements and subsidies. However, it is not clear if the effects of those events will maintain, dilute, or increase over time. To address whether satisfaction and perception of price fairness change over time, I exploit the temporal variation in exposure to different types of service and to electricity subsidies.

To estimate the association between the exposure to a service improvement (M) or to a subsidy (B) with the levels of satisfaction and price fairness perception, I extend the specifications of equations (1) and (2) to include factor variables indicating the level of exposure for improvements (I_{t^B}) and subsidies (I_{t^M}).

$$f = \sum_{t^B} \delta_{t^B} I_{t^B} + X'\alpha + Z'\beta + u \quad , \quad t^B \in [a^B, b^B, c^B, d^B] \qquad (3)$$

$$S = \sum_{t^M} \omega_{t^M} I_{t^M} + X'\gamma + Z\delta + \theta f + \varepsilon \quad , \quad t^M \in [a^M, b^M, c^M, d^M] \qquad (4)$$

The sub-indices t^B and t^M stand for four levels of exposure. The levels of exposure are selected based on the sample distribution observed in Figures 1 and 2. In the case of service reliability improvements, the levels are: receiving an improvement in or before 2012 (a^M), receiving an improving in 2013 or 2014 (b^M), receiving an improving in 2015 or later (c^M), and not having received any improvement (d^M). For subsidies, the cut-offs are having received a subsidy in or before 2009 (a^B), between 2010 and 2012 (b^B), in or after 2013 (c^B), and not having received a subsidy (d^B). To avoid perfect collinearity with the variable service reliability (r), coded as a categorical variable, I use the average number of interruptions within a week as reported by the household (as a continuous variable). Similarly, in the case of subsidy, I drop the binary variable for receiving a subsidy, such that its effect will be captured by the indicator variables. The base labels are set to not having received a service improvement, and not having received a subsidy.

This strategy assumes that, after controlling for a set of socioeconomic characteristics, consumers that received or did not receive the improvement or the subsidy are comparable on average.[19] I also assume that receiving a subsidy affects perceptions of the cost of electricity services, changing the perception of price fairness. This seems like a reasonable assumption, since the subsidies take the form of cash transfers aimed at providing relief to households from the cost of electricity services.

5. Results

5.1 Main Results

Table 3 summarizes the results of the main Logit model. Columns (1) and (2) present the estimated coefficients for the satisfaction and the fairness equations, respectively. For clarity of interpretation, columns (3) and (4) present the derived marginal probabilities. The last two columns, (5) and (6), present the indirect and total effects on satisfaction, respectively. All regressions control for city fixed effects (which also capture un-observables related to the electricity company serving a given household's location) and for a set of household socioeconomic characteristics (household income, household size, years of schooling of the household head, age of the household head), ownership of appliances (water pump, refrigerator, washing machine, TV, radio and inverter), and whether the reported consumption of

[19] Gradually paced improvements tend to occur first where they are more economically profitable for the utilities, typically in the service of better-off customers, making the assumption of the independence of observables a reasonable one.

Also, in the case of the price fairness equation, it is worth mentioning that I could not use exogenous variation in international oil prices, because tariffs to the final end-user have not adjusted to the decline in these prices since mid-2014.

Note that to study adaptation, I cannot use tariffs either, because these have not changed over the last five years.

electricity represents more than one family. The standard errors are clustered at the sub-district level, allowing for error correlation within a finer geographical area of service.

The estimations suggest substantial differences in the service attributes that determine satisfaction and those that influence price fairness perceptions.

In the *satisfaction equation*, the statistically relevant attributes are reliability of service, voltage stability, price fairness, and attention to claims. The largest marginal direct effect is for service reliability, where going from less than 6 hours of service per day to over 18 hours per day increases the probability of being satisfied with the electricity service by about 40%. The marginal effect of going from less than 6 hours to (12 18] hours of service per day is 8%. The perceptual response to improvements in service reliability appears to be nonlinear, as the two parameters are statistically different.[20] In the case of voltage stability, going from highly unstable voltage to regular voltage increases the probability of being satisfied by 6%, while increasing to very stable service increases satisfaction by 11%. Even though these margins seem to be sizably different, the hypothesis that they are statistically equal cannot be rejected at the 95% confidence level.[21] Regarding claims, improving this attribute would increase the probability of being satisfied by around 8%. Interestingly, while price fairness is statistically significant at 1%, variables related to the cost of service are not relevant. These results maintain even when the specification excludes fairness as a dependent variable (see Table 5, column (4)), suggesting that end-users can separate satisfaction from fairness perception, and that price-related attributes only have an impact on satisfaction to the extent that they affect perception.

[20] In the satisfaction equation, column (1) of Table 2, for the service reliability attribute, the hypothesis that $\gamma_{(12\ 18]} = \gamma_{(18\ 24]}$ is not accepted with a p-value of 0.00 and Chi2 of 93.25.

[21] In the satisfaction equation, column (1) of Table 2, for the voltage stability attribute, the hypothesis that $\gamma_{some\ instabilities} = \gamma_{no\ instabilities}$ is not rejected with a p-value of 0.083 and Chi2 of 3.01.

As for the *price fairness equation*, the statically significant attributes are average electricity prices, tariff scheme (fixed fee for service), subsidies, and attention to claims. Note that as the coefficient of fairness perception in the satisfaction equation approaches 1, all the effects of the relevant covariates in the fairness equation shift almost completely to satisfaction. That is, increasing the monthly electricity expenditure by RD$1 would reduce price fairness perception and satisfaction by around 1.7%. Assuming linearity with respect to this effect, increasing the electricity tariff to the maximum for all end-users (from zero to RD$11.1/KWh under the tariff schedule of 2016, see Table 1), would result in a marginal effect of around -17% on price fairness and satisfaction.[22] At average oil prices of 2016, this would be equivalent to eliminating subsidies via electricity tariffs. The negative effect on consumer attitudes would be half the effect of improving reliability to [18 24] hours of service per day.

On the other hand, being subject to a fixed payment amount and receiving a subsidy increase the probability of having a positive price perception by 14% and 9.8%, respectively. Claims are the only attribute that significantly influences both attitudes. The marginal effect of improving response to claims is around 12.7%.

According to these results, price and price-related attributes operate mainly through customers' perceptions of price fairness. That is, they are entirely mediated through fairness perception, having no direct effect on customer satisfaction. These results also suggest that customers can disentangle their evaluations of attributes with regard to satisfaction with the overall services from evaluations of their cost.

These estimations also suggest that socioeconomic characteristics of households do not seem to have a significant effect on satisfaction and price perception. This may indicate that having accounted for service attributes, there is no significant heterogeneity in satisfaction and price perception across customer segments. With

[22] This calculation does not consider the direct marginal effect of price on satisfaction, which is statistically zero.

regard to price perception, these results contrast with those of Fiorio and Florio (2011) and Clifton et al. (2014), who find that socioeconomic characteristics of the respondent tend to have explanatory power.[23] However, these authors did not control for service attributes (either perceived or actual) or household income; thus their specifications and results are not necessarily comparable.

5.2 Satisfaction and Price Fairness by Exposure to Type of Service

This subsection evaluates whether satisfaction and price perception respond to the period of exposure to different levels of service reliability and the relative cost of electricity service (receiving subsidies or not). Table 4 shows that in comparison with the base level of no improvement and no electricity subsidy, customers tend to report more satisfaction after an improvement, however, the length of exposure seems to affect neither satisfaction nor price fairness perception. Receiving an improvement in reliability has a marginal effect of around 24% on consumer satisfaction, while receiving an electricity subsidy has a marginal effect of around 13% on the perception of price fairness. Subsequent coefficients are not significant. This suggests that, in the context under study, the gains in customer satisfaction due to service improvements and cost of the services tend to last over time.

[23] The findings of Clifton et al. (2014) indicate that dwelling-ownership is negatively correlated with satisfaction with electricity prices, has a weak statistical correlation with education and household size, and is not significant for employment status and age.

5.3 Robustness Checks

To check the robustness of the main results, Table 5 presents estimates for different dependent and independent variables and methods. In these regressions, price fairness perception is constructed from customer responses to the 1–5 rating scale. These new variables take the value of one if consumers ranked price fairness a 3 or greater, and zero otherwise. Using this new variable, columns (1) and (2) present the estimation without and with fixed effects, respectively. In column (3), instead of average electricity price, I use the ratio of electricity expenditure to household income × 100. In the case of satisfaction, Column (4) excludes price fairness perception as an independent variable. In the case of the fairness equation, column (4) uses for price fairness a construction based on the opinion of the respondents with regard to 'amount spent' on electricity on a rating scale type of question. For both equations, the LPM panel indicates the same specifications estimated by the linear probability method.

The results resemble the main model estimations, both with regard to the magnitude and the statistical significance. Using different constructions for price fairness and cost of services and excluding city–fixed effects do not change the main results significantly. Further, the exclusion of price fairness as a dependent variable in the satisfaction equation—columns (4) and (8)—does not change the estimations of price-related attributes with regard to their statistical significance. This reinforces the previous observations, in the sense that those variables operate mainly through price perception. In addition, the LPM return estimations can be interpreted as marginal probabilities, similarly to the corresponding estimations in columns (3) and (4) of Table 3.

To evaluate that fairness drives satisfaction but not vice-versa, I use an instrumental variable (iv) for fairness in the satisfaction equation. If fairness is not endogenous, then our estimates should not change significantly. I use as an instrument the indicator for receiving an electricity subsidy because previous results show that this only influences satisfaction through price fairness (thus, it seems to fulfill the relevance and exclusion restrictions).[24] The estimation is performed with a linear probability model (using two-stage least squares), such that the results are comparable to the margins presented in Column (3) of Table 3. Table 6 shows the iv estimates, which closely resemble the main estimations. The notable exception is that, while unremarkable in terms of magnitude, the coefficient of fairness is not statistically significant. This may be a result of the expected loss of efficiency from using the iv, however, it is also a call to carefully interpret the estimates presented here.

6. Conclusions

This paper examines consumer satisfaction and price perception with regard to electricity services in a developing country, the Dominican Republic. The results suggest that consumer satisfaction and price perception are distinctively influenced by quality-related attributes and by cost-related attributes, respectively. That is, satisfaction with overall electricity services is driven by quality characteristics such as reliability, voltage stability, and attention to claims, and it seems to respond to price-related attributes through perceptions of price fairness. In turn, price fairness perception is driven by the cost of electricity services, subsidies, the scheme of the tariff, and attention to claims. Socioeconomic characteristics seem not to play a role in explaining perceptions, suggesting that these attitudes are homogeneous across different segments of users. The results imply that satisfaction gains from quality improvements largely exceed tariff increases at a level equivalent to the elimination of subsidies for electricity services.

[24] Further, the simple correlation between satisfaction and receiving a subsidy is around 2% and not statistically significant. The correlation between fairness and receiving a subsidy is around 20%, significant at 1% confidence. We use only subsidy as an instrumental variable because the significance of other variables changes (although marginally) in the robustness check in table 5. For example, paying a fixed amount becomes weakly significant (at 10% confidence) in some specifications.

This paper also exploits temporal variation in exposure to improved electricity services and subsidies to evaluate whether user attitudes change over the length of exposure. Both in the case of satisfaction and price fairness perception, the results suggest that attitudes do respond to changes in attributes, but these attitudes do not seem to adapt or change with longer exposure. That is, after an improvement in the quality of service or after being subject to a subsidy, consumers have a more favorable view of electricity services, and their cost, respectively, and those views maintain regardless of whether the consumer received the improvement (or subsidy) recently or a long time ago.

If we were to interpret these results causally, they indicate that service improvements and related tariff adjustments would produce net lasting gains in overall end-user satisfaction.

References

Bolton, L.E., Warlop, L. and Alba, J.W., (2003). Consumer perceptions of price (un)fairness. Journal of consumer research, 29(4), pp.474-491.

Boogen, N., Datta, S., and Filippini, M. (2014). Going beyond Tradition: Estimating Residential Electricity Demand Using an Appliance Index and Energy Services. Aachen: RWTH Aachen University, E.ON Energy Research Center.

Boyd-Swan, C., and Herbst, C. M. (2012). Pain at the pump: Gasoline prices and subjective well-being. Journal of Urban Economics, 72(2), 160-175.

Clements, M. B. J., Coady, D., Fabrizio, M. S., Gupta, M. S., Alleyne, M. T. S. C., & Sdralevich, M. C. A. (2013). Energy subsidy reform: lessons and implications. International Monetary Fund.

Clifton, J., Díaz-Fuentes, D., and Fernández-Gutiérrez, M. (2014). The impact of socio-economic background on satisfaction: evidence for policy-makers. Journal of Regulatory Economics, 46(2), 183-206.

Di Tella, R., Galiani, S. and Schargrodsky, E., 2012. Reality versus Propaganda in the Formation of Beliefs about Privatization. Journal of Public Economics, 96(5-6), pp.553-567.

Di Tella, R., Haisken-De New, J., and MacCulloch, R. (2010). Happiness adaptation to income and to status in an individual panel. Journal of Economic Behavior & Organization, 76(3), 834-852.

Diener, E., Lucas, R.E. and Scollon, C.N. (2006). Beyond the hedonic treadmill: revising the adaptation theory of well-being. The American psychologist, 61(4), pp.305–14.

Fiorio, C. V., and Florio, M. (2011). “Would you say that the price you pay for electricity is fair?” Consumers' satisfaction and utility reforms in the EU15. Energy Economics, 33(2), 178-187.

Gallina, A., Inchauste, G., Isa, P., Lee, C. and Sánchez, M., The Dominican Republic: From Generalized to Targeted Subsidies. The Political Economy of Energy Subsidy Reform, p.45.

Greene, W. H. (2000). Econometric analysis 4th edition. International edition, New Jersey: Prentice Hall.

Homburg, C., Koschate, N., & Hoyer, W. D. (2005). Do satisfied customers really pay more? A study of the relationship between customer satisfaction and willingness to pay. Journal of Marketing, 69(2), 84-96.

Jimenez, R., Serebrisky, T., & Mercado, J. (2016). What does “better” mean? Perceptions of electricity and water services in Santo Domingo. Utilities Policy, 41, 15-21.

Jimenez Mori, R. (2017). Are Blackout Days Free of Charge?: Valuation of Individual Preferences for Improved Electricity Services.

Kojima, M., Bacon, R. and Trimble, C. (2014). Political economy of power sector subsidies: a review with reference to Sub-Saharan Africa. Working Paper 89547. World Bank.

McRae, S. 2015. “Infrastructure Quality and the Subsidy Trap.” American Economic Review 105 (1): 35–66

Konya, M., P.E., Ameren Missouri; Kathy Ball. 2014. Customer Perception and Reality: Unraveling the Energy Customer Equation. Paper 1686-2014. SAS® Institute.

Mastrobuoni, G., Peracchi, F., & Tetenov, A. (2014). Price as a signal of product quality: Some experimental evidence. Journal of Wine Economics, 9(02), 135-152.

Mercado, J. (2017). “El Sector Eléctrico Dominicano: Revisión Histórica y Opciones de Política.” Inter-American Development Bank, Washington, DC. Mimeo.

Nugent, J. B., & Switek, M. (2013). Oil prices and life satisfaction: asymmetries between oil exporting and oil importing countries. Applied Economics, 45(33), 4603-4628.

Orsingher, C., Valentini, S., & de Angelis, M. (2010). A meta-analysis of satisfaction with complaint handling in services. Journal of the Academy of Marketing Science, 38(2), 169-186.

Peracchi, F. (2001). Econometrics, Jonh Wiley & Sons Ltd. Chichester, West Sussex.

Rekettye, G., & Pinter, J. (2006). Customer satisfaction and price acceptance in the case of electricity supply. International Journal of Process Management and Benchmarking, 1(3), 220-230.

Reiss, P. and White, M. (2005). Household Electricity Demand, Revisited, The Review of Economic Studies, Volume 72, Issue 3, 1, 853–883.

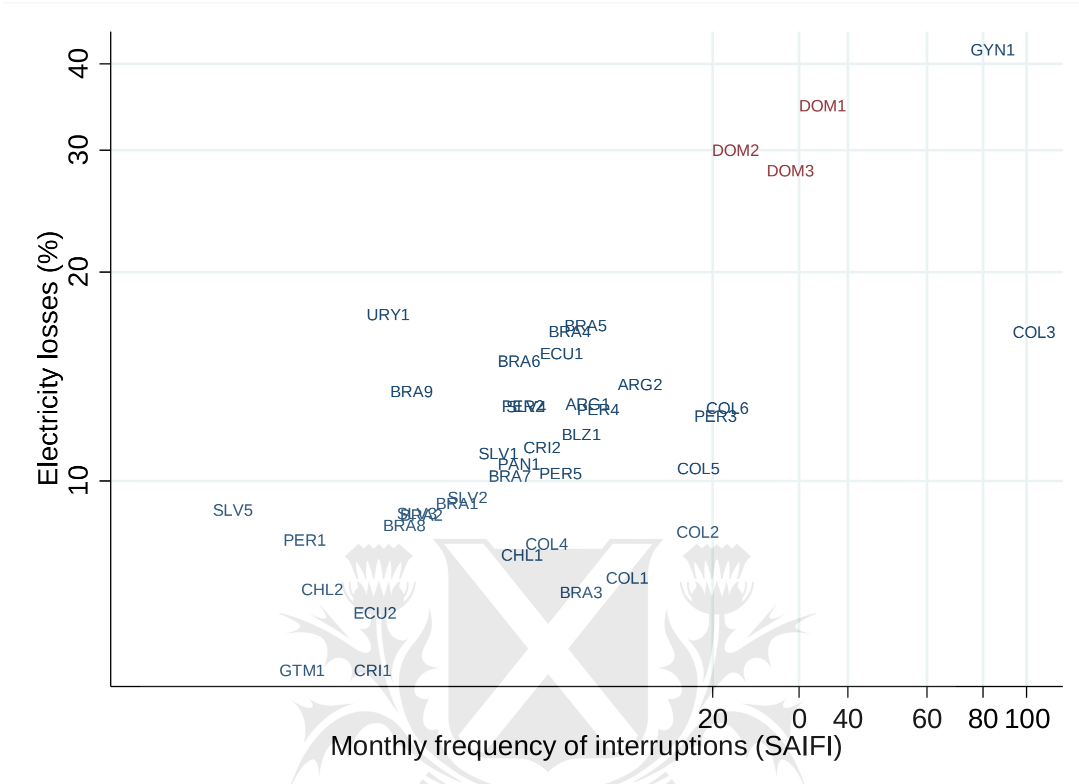
Stanton, P. J., Cummings, S., Molesworth, J., & Sewell, T. (2001). Marketing strategies of Australian electricity distributors in an opening market. Journal of Business & Industrial Marketing, 16(2), 81-93.

Suchánek, P., Richter, J., & Králová, M. (2014). Customer satisfaction, product quality and performance of companies. Review of Economic Perspectives, 14(4), 329-344.

Turgeon, S., Rodriguez, M.J., Thériault, M. and Levallois, P. (2004). Perception of drinking water in the Quebec City region (Canada): the influence of water quality and consumer location in the distribution system. Journal of Environmental Management, 70(4), pp.363-373.

Xia, L., Monroe, K. B., & Cox, J. L. (2004). The price is unfair! A conceptual framework of price fairness perceptions. Journal of marketing, 68(4), 1-15.

Figure 1: Electricity Losses and Quality of Service in Latin American Utilities



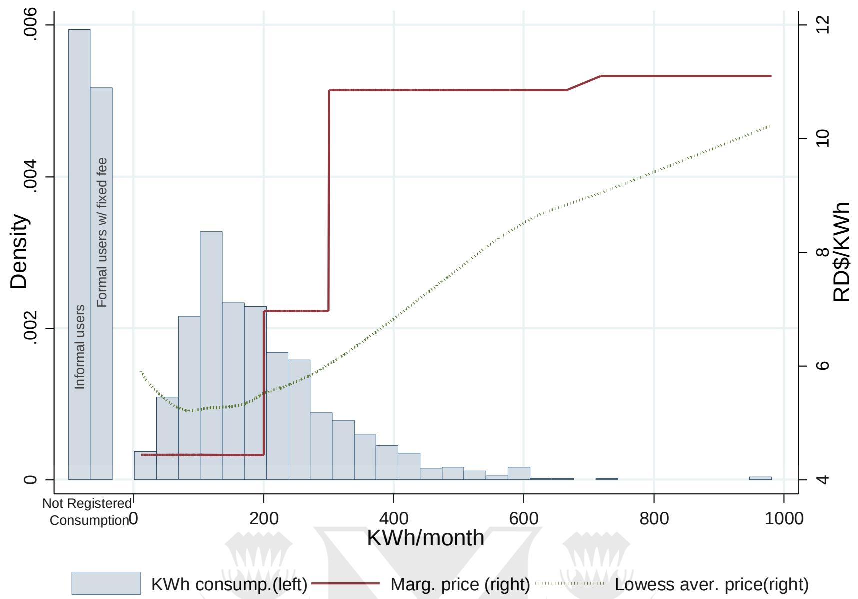
Note: contains 41 Electricity Distribution utilities in 15 Latin American countries. DOM: The Dominican Republic, NIC: Nicaragua, GYN, Guyana, COL: Colombia, PER: Peru, ARG: Argentina, BRA: Brazil, ECU: Ecuador, CRI: Costa Rica, CHL: Chile, GTM: Guatemala, SLV: Salvador, PAN: Panama. The information corresponds to the year 2015, and it was collected from publicly available sources (utility web pages, regulators, ministries). Axes are in log-scale. Axis-y, Electricity losses (%), represents the share of electricity for which the utility does not charge, representing direct financial losses. In the axis-x, SAIFI stands for System Average Interruptions Frequency Index. The figure shows that the case under study has among the poorest performance in the Latin American region.

Table 1: Tariff Schedule

Tariff Schedule	End-User Tariff	Indexed tariff		
	Dec. '15	Dec. '13	Dec. '15	Jun. '16
Fixed Component				
Consumption between 0 and 100 KWh	37.95	41.57	31.35	29.44
Consumption over 101 KWh	137.25	150.3	113.38	106.47
Variable Component				
Block 1: consumption between 0 and 200 KWh	4.44	10.09	7.61	7.15
Block 2: consumption between 201 and 300 KWh	6.97	10.09	7.61	7.15
Block 3: consumption between 301 and 700 KWh	10.86	12.43	9.38	8.81
Block 4: consumption over 701 KWh	11.1	12.43	9.38	8.81

Source: Corporación Dominicana de Empresas Eléctricas Estatales.
Note: Tariff schedule corresponds to the BTS (simple low voltage, for its name in Spanish) that covers 89.5% of residential end-users. The residential tariffs shown for 2015 have not changed since 2013. The indexed tariffs are adjusted for inflation and cost of fuel for electricity generation. The table shows that in 2013, with oil prices around US$100/barrel, all tariff bands presented a lag with regard to the indexed tariffs. In contrast, as international oil prices have dropped, the lag has shrunk in all consumption blocks to the point of a cross-subsidy from the highest consumption block to the lower consumption ones. However, the change in the actual cost of providing the service did not pass through the final tariffs.

Figure 2: Distribution of Consumption, Tariff Schedule and Average Price

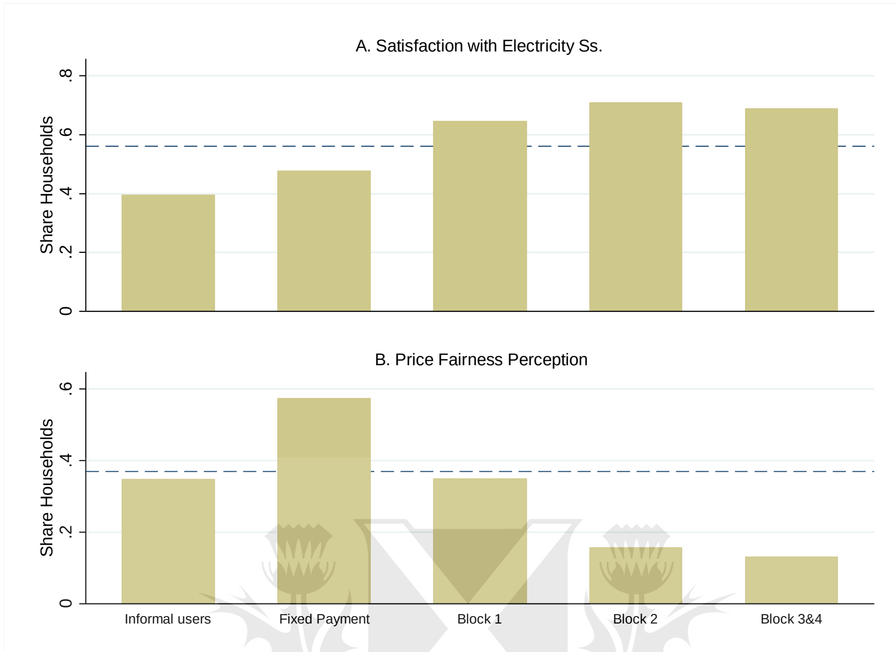


Note: Bars indicate the density of end-users (left-y-axis) for each level of electricity consumption per month (x-axis). The solid red line represents the variable component of the tariff for each block of electricity consumption. This reads in the right-y-axis (see also Table 1). Households pay 4.44 pesos per kWh for the first 200 KWh/month. For an additional 100 KWh, they pay 6.97 pesos per kWh/month. For additional 400 KWh, end-users pay 10 pesos per kWh/month, and 11 pesos for further monthly consumption. The dashed line is the lowess-fit for the average price paid in this sample. For clarity, I exclude five observations with consumption higher than 1000 KWh/month; the patterns do not change, except that the average price continues to converge toward the variable tariff component.

Table 2: Summary Statistics

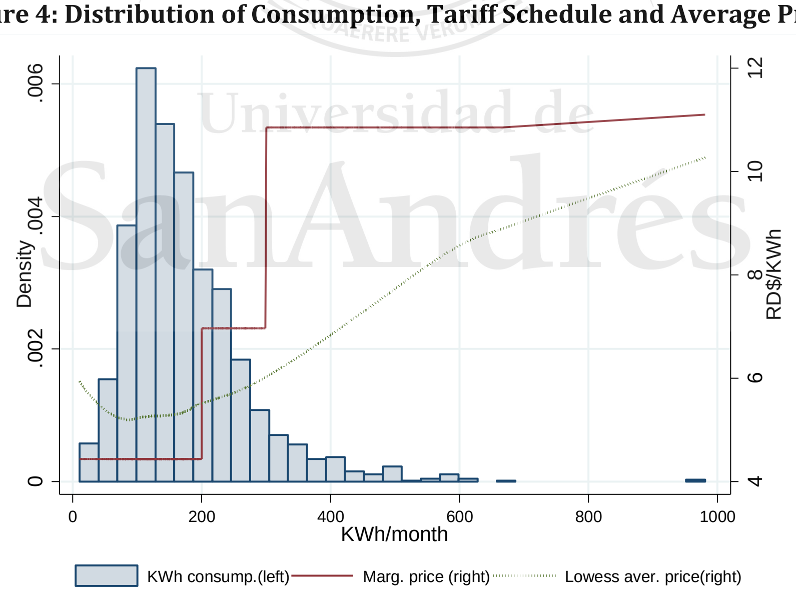
	Subjects	Mean	SE
Satisfaction with electricity services (Y=1, N=0)	2,455	0.56	0.01
Fairness perception of electricity services (Y=1, N=0)	2,455	0.37	0.01
Type of Clients			
Clients with meter	1,290	0.53	0.01
Clients paying a fixed fee	620	0.25	0.01
Informal end-users	545	0.22	0.01
Type of Electricity Services (hours of service per day)			
[18 24]	991	0.40	0.01
(12 18)	854	0.35	0.01
(0 12]	610	0.25	0.01
Cost of Electricity Services			
Average electricity price (for those who pay, in RD$/KWh)	1,910	4.89	0.04
Average monthly electricity expenditure (for those who pay, in US$)	1,910	21.28	0.52
Household electricity consumption (imputed values)	2,427	175.92	2.18
Voltage Stability			
Very stable	1,535	0.63	0.01
Some instabilities	757	0.31	0.01
Very unstable	163	0.07	0.01
Other Electricity Service characteristics			
Billing reliability	2,455	0.53	0.01
Attention to claims - Negative	2,455	0.32	0.01
Attention to claims - Positive	2,455	0.55	0.01
Receive notification of interruptions (Y=1, N=0)	2,455	0.02	0.00
Receive subsidy (Y=1, N=0)	2,455	0.24	0.01
Household Characteristics			
Montly household income (US$)	2,455	589.53	14.66
Family size	2,455	3.70	0.03
Schooling of the household head	2,455	8.09	0.10
Age of the household head	2,455	50.94	0.29
Own a refrigerator (Y=1, N=0)	2,455	0.89	0.01
Own a water pump (Y=1, N=0)	2,455	0.23	0.01
Own a washing machine (Y=1, N=0)	2,455	0.85	0.01
Own a TV (Y=1, N=0)	2,455	0.95	0.00
Own a radio (Y=1, N=0)	2,455	0.40	0.01
Own an inverter (Y=1, N=0)	2,455	0.31	0.01
Elec. Expend. Incl. other households in the dweling (Y=1, N=0)	2,455	0.00	0.00

Figure 3: Satisfaction and Price Fairness Perception by Group of End-Users



Note: Dashed line indicates the overall average. Blocks of clients are defined according to Table 1.

Figure 4: Distribution of Consumption, Tariff Schedule and Average Price



Note: Bars indicate the density of end-users (left-y-axis) for each level of imputed electricity consumption per month (x-axis). The solid red line represents the variable component of the tariff for each block of electricity consumption. The dashed line is the lowess-fit for the average price paid in this sample (for formal users and users paying a fixed fee). For clarity, I exclude five observations with consumption higher than 1000 KWh/month.

Figure 5: First Year Receiving Improved Electricity Service

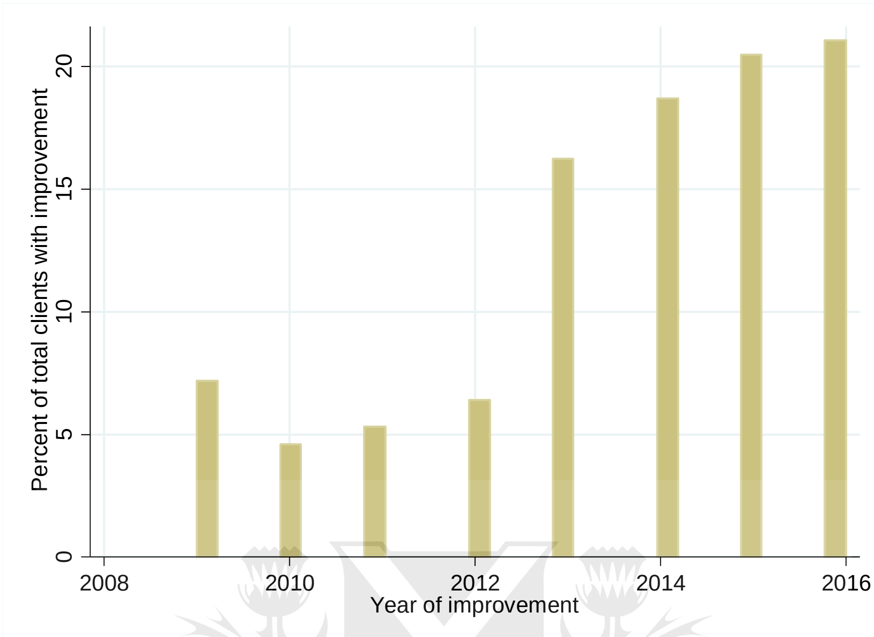
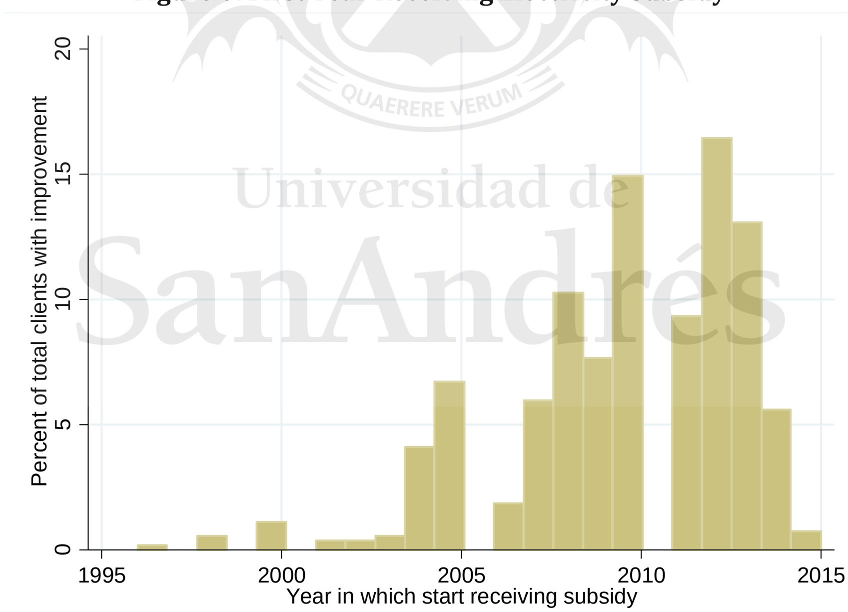


Figure 6: First Year Receiving Electricity Subsidy



Note: Figures present the distribution of households receiving direct subsidies or upgraded electricity service by the year in which they received the "benefit."

Figure 7: Model Paths Between Electricity Attributes, Price Fairness Perception and Consumer Satisfaction

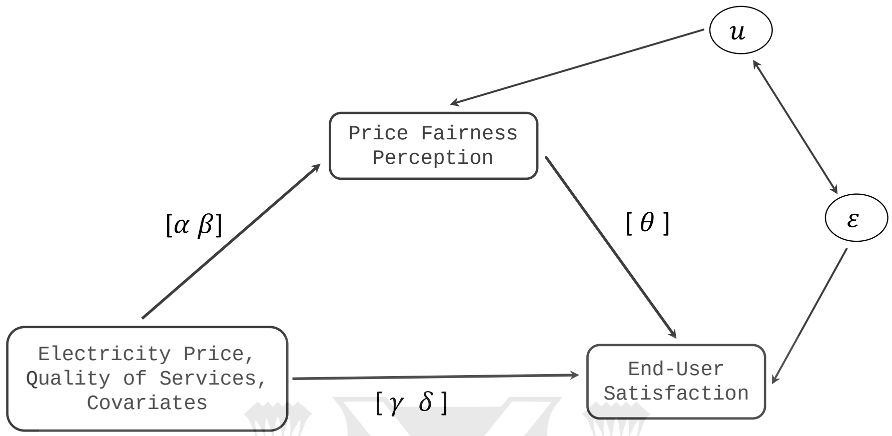


Table 3: Main Model Results

	Coefficients		Margins			
	Satisfaction	Fairness	Satisfaction	Fairness	Indirect Effect	Total Effect
	(1)	(2)	(3)	(4)	(5)	(6)
Price fairness	0.900***		0.143***			
	(0.138)		(0.018)			
Number of interruptions						
[18 24] hours service per day	2.719***	-0.134	0.430***	-0.027	-0.024	0.406***
	(0.189)	(0.145)	(0.020)	(0.027)	(0.027)	(0.031)
(12 18) hours service per day	0.471**	0.175	0.075***	0.036	0.032	0.107***
	(0.172)	(0.143)	(0.020)	(0.025)	(0.026)	(0.036)
Average electricity price (per KWh)*	0.014	-0.084**	0.002	-0.017**	-0.015***	-0.013***
	(0.033)	(0.029)	(0.005)	(0.005)	(0.006)	(0.006)
Billing reliability	-0.015	0.207	-0.002	0.042	0.038	0.036
	(0.162)	(0.126)	(0.024)	(0.026)	(0.024)	(0.025)
Attention to claims						
Negative experience	0.234	-0.078	0.037	-0.016	-0.014	0.023
	(0.197)	(0.150)	(0.028)	(0.030)	(0.028)	(0.039)
Positive experience	-0.425*	-0.634***	-0.067**	-0.129***	-0.116***	-0.183***
	(0.193)	(0.150)	(0.026)	(0.028)	(0.036)	(0.041)
Voltage						
Stable voltage current	0.404***	0.039	0.064***	0.008	0.007	0.071***
	(0.123)	(0.092)	(0.018)	(0.021)	(0.017)	(0.025)
Some instabilities	0.709**	0.604**	0.112**	0.123**	0.111***	0.223***
	(0.275)	(0.200)	(0.039)	(0.042)	(0.037)	(0.055)
Notification	0.328	0.288	0.052	0.059	0.053	0.105
	(0.503)	(0.304)	(0.069)	(0.060)	(0.056)	(0.078)
Fixed billing amount	0.208	0.729***	0.033	0.148***	0.133***	0.166***
	(0.137)	(0.142)	(0.023)	(0.025)	(0.033)	(0.03)
Electricity subsidy	-0.010	0.678***	-0.002	0.138***	0.124***	0.122***
	(0.142)	(0.116)	(0.022)	(0.023)	(0.027)	(0.037)
Holding a meter	-0.166	-0.566***	-0.026	-0.115***	-0.104	-0.13***
	(0.194)	(0.149)	(0.028)	(0.030)	(0.03)	(0.04)
Ln(household income)	-0.036	0.055				
	(0.066)	(0.075)				
Household size	-0.028	-0.066*				
	(0.038)	(0.031)				
Schooling of the household head	-0.013	-0.001				
	(0.012)	(0.012)				
Age of the household head	-0.009*	-0.007*				
	(0.004)	(0.003)				
Own a pump water	-0.087	-0.195				
	(0.140)	(0.121)				
Own a refrigerator	0.346*	-0.081				
	(0.175)	(0.163)				
Own a washing machine	0.139	0.120				
	(0.158)	(0.135)				
Own a TV	0.009	0.122				
	(0.243)	(0.171)				
Own a Radio	0.351**	0.033				
	(0.118)	(0.099)				
Own a Inverter	-0.023	0.010				
	(0.118)	(0.110)				
Number of households	2,455	2,455				

Notes: Coefficients/Robust standard errors in parentheses are city fixed effects. *** p<0.01, ** p<0.05, * p<0.1. All regressions include city fixed effects if electricity billing includes consumption of other families within the same household, and a constant.

Table 4: Exposure & Attitudes

	Coefficients		Margins	
	Satisfaction	Fairness	Satisfaction	Fairness
	(1)	(3)	(2)	(4)
Price fairness	0.864***		0.139***	
	(0.115)		-0.018	
Exposure to improved service:				
ω_c: since 2015 vs ω_b	-0.195		-0.032	
	(0.299)		(0.048)	
ω_b: since 2013-2014 vs ω_a	0.024		0.004	
	(0.295)		(0.048)	
ω_a: since 2012 (or before) vs no improvement	1.489***		0.240***	
	(0.253)		(0.040)	
Exposure to subsidy:		-0.029		-0.006
δ_c: since 2013 vs δ_b		(0.255)		(0.052)
		0.045		0.009
δ_b: since 2010-2012 vs δ_a		(0.204)		(0.042)
		0.656***		0.134***
δ_a: since 2009 vs not receiving subsidy		(0.167)		(0.034)
Av. number of interruptions per month	-0.028***	-0.002	-0.004***	-0.000
	(0.003)	-0.002	(0.000)	(0.000)
Average electricity price	0.027	-0.084**	0.004	-0.017**
	(0.031)	-0.027	(0.005)	(0.005)
Billing reliability	0.061	0.219	0.010	0.045
	(0.144)	-0.13	(0.023)	(0.026)
Attention to claims (positive experience)	0.226	-0.085	0.037	-0.017
	(0.175)	-0.148	(0.028)	(0.030)
Attention to claims (negative experience)	-0.478**	-0.649***	-0.077**	-0.132***
	(0.159)	-0.137	-0.026	(0.028)
Stable Voltage	0.386***	0.043	0.062***	0.009
	(0.112)	-0.102	(0.018)	(0.021)
Some instabilities	0.707**	0.588**	0.114**	0.120**
	(0.229)	-0.208	(0.037)	(0.042)
Notification	0.101	0.232	0.016	0.047
	(0.427)	-0.298	(0.069)	(0.061)
Fixed billing amount	0.219	0.760***	0.035	0.155***
	(0.146)	-0.124	(0.023)	(0.025)
Electricity subsidy	-0.055		-0.009	
	(0.136)		(0.022)	
Holding a meter	-0.142	-0.627***	-0.023	-0.128***
	(0.170)	-0.153	(0.027)	(0.031)
Number of subjects	2,455	2,455	2,455	2,455

Notes: robust standard errors are in parentheses. All regressions control for household income, age, schooling, and gender of the household head, ownership of appliances (refrigerator, water pump, washing machine, tv, radio, inverter), share electricity billing, and city-fixed effects. *** $p<0.01$, ** $p<0.05$, * $p<0.1$.

Table 5: Robustness Checks

	Satisfaction								Price Fairness							
	Logit				OLS				Logit				OLS			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Price fairness	1.018***	0.985***	0.984***		0.161***	0.154***	0.154***									
	(0.111)	(0.112)	(0.113)		(0.017)	(0.017)	(0.017)									
Average electricity price (per KWh)	0.017	0.017		0.002	0.004	0.004		0.001	-0.072**	-0.071**		-0.092***	-0.017**	-0.017**		-0.019***
	(0.031)	(0.032)		(0.032)	(0.005)	(0.005)		(0.006)	(0.026)	(0.026)		(0.026)	(0.006)	(0.006)		(0.006)
Elec. expend./hh income X 100			0.003				0.001				-0.041***				-0.009***	
			(0.010)				(0.001)				(0.010)				(0.002)	
Number of interruptions																
[18 24] hours service per day	2.616***	2.726***	2.722***	2.628***	0.478***	0.487***	0.487***	0.490***	0.008	0.082	0.120	-0.085	0.002	0.018	0.026	-0.023
	(0.153)	(0.166)	(0.166)	(0.158)	(0.024)	(0.025)	(0.025)	(0.025)	(0.117)	(0.126)	(0.126)	(0.132)	(0.027)	(0.029)	(0.029)	(0.028)
(12 18) hours service per day	0.435***	0.432***	0.429***	0.492***	0.091***	0.084***	0.083***	0.096***	0.318**	0.364**	0.373**	0.125	0.072**	0.081**	0.084**	0.027
	(0.122)	(0.126)	(0.126)	(0.124)	(0.024)	(0.024)	(0.024)	(0.024)	(0.114)	(0.118)	(0.118)	(0.120)	(0.026)	(0.026)	(0.026)	(0.025)
Billing reliability	-0.128	-0.012	0.001	0.019	-0.025	-0.006	-0.003	0.002	-0.068	0.209	0.164	0.200	-0.015	0.048	0.037	0.040
	(0.131)	(0.149)	(0.145)	(0.149)	(0.022)	(0.024)	(0.023)	(0.024)	(0.109)	(0.122)	(0.121)	(0.128)	(0.025)	(0.027)	(0.027)	(0.026)
Attention to claims																
Negative experience	0.324	0.243	0.246	0.223	0.043	0.028	0.029	0.030	0.109	0.049	0.049	-0.054	0.025	0.009	0.008	-0.010
	(0.172)	(0.179)	(0.179)	(0.173)	(0.028)	(0.028)	(0.028)	(0.029)	(0.142)	(0.146)	(0.145)	(0.152)	(0.033)	(0.033)	(0.033)	(0.033)
Positive experience	-0.362*	-0.422**	-0.419**	-0.522***	-0.063*	-0.074**	-0.073**	-0.092***	-0.431***	-0.491***	-0.494***	-0.497***	-0.100***	-0.112***	-0.112***	-0.103***
	(0.156)	(0.161)	(0.161)	(0.157)	(0.026)	(0.027)	(0.027)	(0.027)	(0.131)	(0.134)	(0.134)	(0.141)	(0.030)	(0.030)	(0.030)	(0.031)
Voltage																
Stable voltage current	0.507***	0.451***	0.453***	0.396***	0.086***	0.076***	0.076***	0.069***	-0.136	-0.188	-0.190	0.014	-0.032	-0.043	-0.044	0.002
	(0.113)	(0.114)	(0.114)	(0.112)	(0.020)	(0.020)	(0.020)	(0.020)	(0.097)	(0.099)	(0.100)	(0.101)	(0.022)	(0.022)	(0.022)	(0.021)
Some instabilities	0.701**	0.704**	0.706**	0.818***	0.118**	0.116**	0.117**	0.139***	0.669***	0.664***	0.637***	0.562**	0.153***	0.149***	0.144***	0.113**
	(0.252)	(0.252)	(0.252)	(0.248)	(0.036)	(0.036)	(0.036)	(0.037)	(0.184)	(0.186)	(0.186)	(0.206)	(0.042)	(0.042)	(0.041)	(0.040)
Notification	0.627	0.378	0.386	0.321	0.058	0.016	0.017	0.019	0.312	0.064	0.032	0.723*	0.074	0.020	0.013	0.157*
	(0.445)	(0.454)	(0.454)	(0.402)	(0.047)	(0.047)	(0.047)	(0.045)	(0.279)	(0.295)	(0.296)	(0.291)	(0.065)	(0.066)	(0.065)	(0.064)
Fixed billing amount	0.325*	0.244	0.255	0.359*	0.064*	0.048	0.050*	0.067*	0.650***	0.549***	0.532***	0.822***	0.146***	0.120***	0.116***	0.184***
	(0.144)	(0.147)	(0.144)	(0.144)	(0.026)	(0.026)	(0.026)	(0.026)	(0.124)	(0.128)	(0.128)	(0.124)	(0.028)	(0.028)	(0.028)	(0.028)
Electricity subsidy	0.009	-0.004	0.008	0.114	0.006	0.001	0.003	0.020	0.505***	0.548***	0.557***	0.636***	0.116***	0.124***	0.123***	0.136***
	(0.130)	(0.136)	(0.134)	(0.134)	(0.022)	(0.022)	(0.022)	(0.023)	(0.112)	(0.116)	(0.116)	(0.116)	(0.025)	(0.026)	(0.025)	(0.025)
City fixed effects	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y
N	2,455	2,455	2,455	2,455	2,455	2,455	2,455	2,455	2,455	2,455	2,455	2,455	2,455	2,455	2,455	2,455

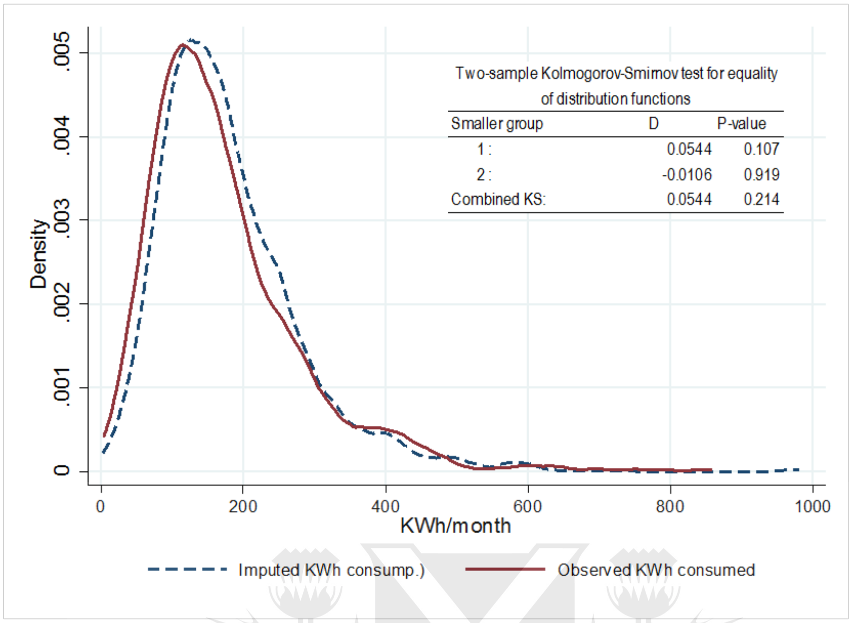
Notes: Standard errors are in parentheses (clustered by sub-district). All regressions control for household income, age, schooling, and gender of the household head, ownership of appliances (refrigerator, water pump, washing machine, tv, radio, inverter), and shared electricity billing. *** p<0.01, ** p<0.05, * p<0.1.

Table 6: Robustness Check – iv in the Satisfaction Equation

	2SLS
	Satisfaction
Price fairness	0.137
	(0.16)
Number of interruptions	
[18 24] hours service per day	0.494***
	(0.03)
(12 18) hours service per day	0.091***
	(0.02)
Average electricity price (per KWh)	0.003
	(0.01)
Billing reliability	-0.004
	(0.02)
Attention to claims	
Negative experience	0.03
	-0.028
Positive experience	-0.074*
	-0.034
Voltage	
Stable voltage current	0.068***
	(0.02)
Some instabilities	0.123**
	(0.04)
Notification	0.011
	(0.05)
Fixed billing amount	0.045
	(0.04)
Electricity subsidy	
Holding a meter	-0.039
	(0.04)
Ln(household income)	-0.004
	(0.01)
Household size	-0.004
	(0.01)
Schooling of the household head	-0.002
	(0.00)
Age of the household head	-0.001*
	(0.00)
Own a pump water	-0.017
	(0.02)
Own a refrigerator	0.059*
	(0.03)
Own a washing machine	0.018
	(0.03)
Own a TV	0.005
	(0.04)
Own a Radio	0.052**
	(0.02)
Own an Inverter	-0.003
	(0.02)
Number of households	2,455

Notes: Coefficients/Robust standard errors in parentheses are city fixed effects. *** p<0.01, ** p<0.05, * p<0.1. All regressions include city fixed effects if electricity billing includes consumption of other families within the same household, and a constant. The specification is the same as that of Table 3. Here, I use two-stage least square for estimation. The estimates are comparable to those in Column (3) of Table 3.

Annex 1: Observed and Imputed Distributions of Electricity Consumption



Annex 2: Quality Reported by the utilities vs. Quality reported by Households in this sample