Policy Brief: Impact of Electricity Tariff Reform on Households Electricity Consumption in Ethiopia

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Do households respond to electricity price increases? What is the evidence from Ethiopia? Can the Ethiopian Electric Utility company increase prices without significantly changing households' electricity consumption? We provide insights based on a baseline and follow up survey of urban Ethiopian households.

Key messages and recommendations

- Electricity consumption decreased in Ethiopia by a small amount after the introduction of tariff reform, but this effect did not persist. Electricity consumption in the overall sample appeared unchanged in the post reform period.
- The increased price was not large enough to significantly reduce electricity consumption among all customers.
- Households did not appear to substitute other fuels such as charcoal for electricity following the tariff increase.
- Electricity price increases can be coupled with the rollout of prepaid meter.
- Modest gradual tariff increases, such as those deployed in Ethiopia, facilitate governments' efforts to raise electricity supplier revenues without substantially reducing households' electricity consumption.

Background and Method

In Ethiopia, prior to late 2018, the electricity price had not been changed for more than a decade. Electricity prices in the country were among the lowest in sub-Saharan Africa, and this situation had created an immense financial burden for the public-owned utility company. Recognizing these problems, the Ethiopian Electric Utility in cooperation with the Ethiopian Energy Authority introduced a new tariff structure and raised rates starting in December 2018. Customers consuming fewer than 50 kWh of electricity per month (presumably low-income households with low electricity needs) did not experience a change in electricity price. Households or firms that consume more electricity faced increasingly higher costs of electricity per kWh following the reform.

We examined the effect of the new tariff on urban households' electricity consumption using about 2000 urban household panel survey data and six years of electricity consumption data from the utility company. We used the urban part of Ethiopian Multi-Tier Framework (MTF) of electricity access survey in Ethiopia administered by the World Bank in 2016 as a baseline. We conducted a follow up survey in 2019, shortly after the first phase of the tariff hike.

Electricity Consumption and Expenditure

Using monthly data obtained from the Ethiopian Electric Utility, we analysed the trend in electricity consumption measured in kWh and expenditure measured in Ethiopian Birr (ETB). The two lines in Figure 1 show an overall increasing trend in the consumption of electricity and electricity expenditure, although at a slow rate.

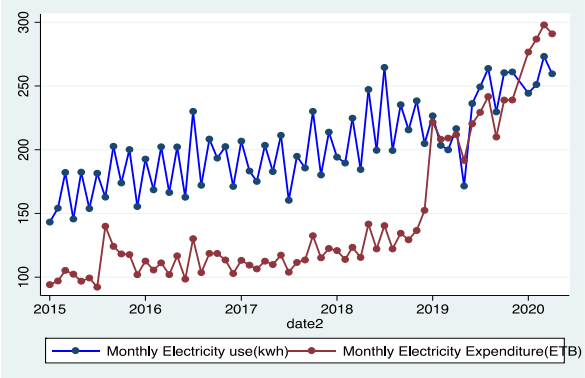

Fig-1: Mean monthly electricity use (consumption) and expenditure

Between the end of 2018 and middle of 2019, there is a brief drop in electricity consumption (blue line). This coincides with the first increment of the electricity price hike. Households initially responded to the increase in electricity price by reducing consumption. However, this initial downward response did not persist. By the middle of 2019, consumption of electricity had rebounded strongly. Households may have adapted to the increase in prices and returned to their long-term increasing consumption trend, after realizing that the benefits of maintaining pre-hike levels of consumption outweighed the additional costs. By the beginning of 2020, households' electricity reached levels that are more than 60% higher than in 2015.

Household expenditure was below 150 ETB/kWh a month over the entire pre-reform period. Following the reform in

2019, expenditures immediately increased to more than 200 ETB/kWh a month, and then began to increase again in mid-2019 when electricity consumption returned to its pre tariff hike level, before jumping once more in late 2019 as the second price hike occurred.

Charcoal Expenditure

If the tariff increases led to declines in electricity consumption, households might shift to other fuel sources, and particularly to biomass fuels such as charcoal for cooking.

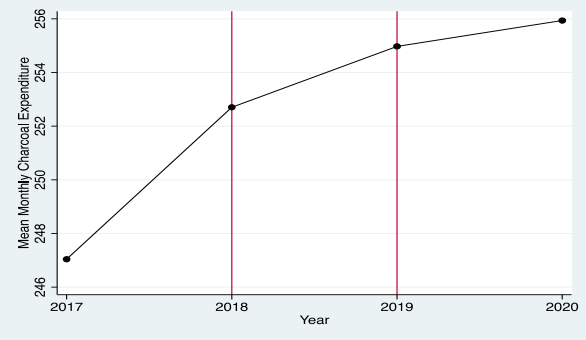

Fig-2: Monthly charcoal expenditure

Like the increasing trend in electricity consumption, charcoal consumption was rising before and after the tariff change, and perhaps begins to level off towards the end of the period. The increase in both electricity and charcoal consumption before the tariff change implies that households use both fuels concurrently, possibly for different activities. For example, households may use charcoal for boiling coffee, tea and cooking some types of dishes, while using electricity for baking, entertainment, refrigeration, etc. In the years between 2018 and 2019 (the period enveloping the initial tariff change), when electricity consumption decreased, charcoal consumption continued to rise. This suggests that some households may have compensated for lower electricity consumption by increasing use of charcoal. After 2019, both charcoal and electricity returned to their increasing trends, implying renewed complementarity in these fuels.

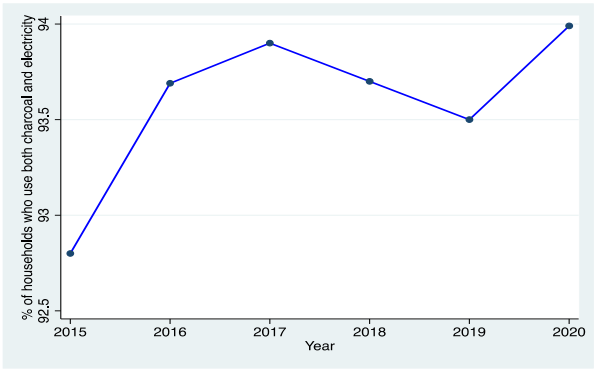

Figure-3: Percentage of households using both charcoal and electricity

Quantitative Impact Analysis

In addition to the descriptive results discussed above, we used a specific quantitative analysis method called event study regression method. It is a method that compares outcomes for a given household before and after the event happened, in this case the increased in electricity tariff. An indicator variable that takes a value of zero before the event and one after the event is used as the main explanatory variable in a quantitative (regression) analysis. In Table 1, this variable is 'Post Tariff reform period', which takes a value of one for the post-tariff reform period and zero for the pre-reform period. The estimated coefficient of this variable shows the magnitude of the effect of the new tariff. In this method, we also control other factors that may affect electricity consumption such as income, household size, number of households sharing the dwelling, dwelling type, marital status, etc.

Because the tariff may have different effect between owners of pre-paid and post-paid meter owners, we also analyse the effect of the price on these two types of customers. The rationale for including this interaction is that households with different meter types may have very distinct awareness and responses to the tariff change. Pre-paid meter owners can read their expenditures (remaining recharged amount) on the meter screen as they are consuming electricity, while all but the most fastidious post-paid meter owners typically only receive this information at the end of the month. The results in Panel B of Table 1show the result with interaction, while Panel A is the result without interaction.

Table-1: Quantitative result (outcome variable: electricity consumption in kwh)

EXPLANATORY VARIABLES	Panel-A		Panel-B	
	Coef.	Se	Coef.	Se
Post Tariff reform period (=1 for post tariff reform periods, =0 for pre reform periods)$	-1.551	1.444	5.122***	1.818
Prepaid meter (1=yes, 0=no)	1.425	4.831	6.253	4.895
Prepaid meter #Post Tariff reform			-18.063***	2.995
Other Controls	Yes		Yes	
Constant	203.565***	32.741	202.533***	32.726
Observations	39,195		39,195	
R-squared	0.14		0.15	
Number of households	1,844		1,844	

***Indicates significant impact at1% level of significance, ** indicates significant impact at 5% level of significance, * indicates significant impact at 10% level of significance, $ pre-reform periods refers to 2015,2016, 2017 and 2018 and post-reform period refers to 2019 and 2020.

In Panel A, the coefficient of the time indicator is negative and statistically indistinguishable from zero, suggesting no effect of the tariff increase on electricity consumption. The negative sign is suggestive of a slightly declining trend, which is perhaps due to the short-term decline observed in Figure1(the blue line). The lack of precision in the coefficient estimate likely reflects the fact that this declining trend is counterbalanced by an increasing trend starting in mid-2019 such that the magnitude of the overall change attributable to the tariff hike is no different from zero.

When the time dummy variable is interacted with the pre-paid meter owners, however, the result is substantively different. The coefficient on the post-reform indicator becomes positive and significant, while the interaction with pre-paid meter ownership is negative, large, and significant. The negative sign and significance of this interaction suggests that pre-paid customers did substantially reduce their consumption of electricity, by about 18kWh per month after the tariff reform. Their monthly average consumption reduced from 225kWh per month before the reform to 207kWh after the reform. Meanwhile, the positive sign and significance of the time indicator coefficient shows that overall average electricity consumption is higher in post reform periods by about 5kWh per month. In terms of economic significance, a 5 kWh/month increase is relatively small and insignificant (it is equivalent to an amount of additional spending of about 5 ETB (or $0.125) per month), and likely reflects only minor electricity consumption increases.

Policy Implications

Modest gradual tariff increases, such as those deployed in Ethiopia, facilitate government efforts to raise electricity supplier revenues. Our study finds that this can be achieved without substantially reducing household electricity consumption. This is likely to be true especially where electricity is substantially under-priced. Another implication of this study is that increase in electricity tariff rates can be coupled with the rollout of prepaid meters, which help reduce electricity consumption due to information feedback. Additional revenue obtained from the increased tariffs can be used to improve services and enhance access to electricity in other parts of the country. Finally, we suggest that as the tariff increases continue in Ethiopia, further examination of the reform experience is necessary.

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