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Article

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Pakistan journal of applied economics

Pakistan Journal of Applied Economics, Vol.33 No.2, (211-230), Winter 2023

CROWDING OUT EFFECT OF INCREASED ELECTRICITY TARIFF ON HOUSEHOLD RESOURCE ALLOCATION IN PAKISTAN

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Abstract

This study aims to investigate the effect of the price increase of electricity on the well-being of households at various income levels. More precisely, the study endeavours to determine the crowding-out impact of increased electricity tariffs on households' budgetary allocation of resources to different income groups. This study uses the Household Income and Expenditure Survey (HIES) 2013-14 and 2018-19 to estimate the conditional Engel curves for eleven expenditure categories using the Quadratic Almost Ideal Demand System (QUAIDS). Results of the study show a significant difference in the composition of budgetary expenditures of households during the low tariff period compared to the high tariff period. An increase in the electricity expenditure leads to a fall in the budget shares devoted to education, health, housing, water, and fuel (other than electricity). This study reveals how frequent tariff reforms in the electricity sector burdened the limited household resources and thus impeded prosperity.

Keywords: Crowding-Out, Electricity, Prices, Household, Income, SDGs.
JEL Classification: D26, L94, E3, D1, D33, Q01.

I. Introduction

The importance of energy as a fulcrum of the economic development of any nation cannot be undermined. Its significance gets reiterated globally with the explicit announcement of Sustainable Development Goals (SDGs) with specific reference to Goal seven on Sustainable Energy. In Pakistan, Affordable and Clean Energy, which is target 7.1 of the sustainable development goal (SDG), was considered a category-1 target that requires immediate policy intervention by the Government of Pakistan.[1]

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This submission is part of a research activity funded by the 'Research for Social Transformation & Advancement' (RASTA), a Pakistan Institute of Development Economics (PIDE) initiative, through the Competitive Grants Programme Award [Grant No. CGP-01-157/2021-22]. The correspondingauthor was the Principal Investigator (PI) in this research project.

[1] Summary for NEC, SDGs National Framework, 2018.

The socio-economic welfare of a nation significantly depends on the availability of affordable energy by all individuals in society. However, the indiscriminate accessibility of electricity at reasonable rates is a challenge for the power sector of Pakistan and has raised several questions about its efficiency. Presently, the power sector of Pakistan is characterized by frequent electricity outages, high transmission and distribution (T&D) losses, massive circular debt, ineffective retrieval capacity, mounting fuel costs, currency depreciation, and many more. All these factors accumulated to raise the cost of power generation, thus translating into higher electricity tariff rates for end-consumers.

The situation was further aggravated during the recent COVID-19 pandemic. The slowdown of economic activity in 2019-21, lowered the demand for electricity in the country which has resulted in the decline in electricity generation. According to the State of Industry Report 2020, power generation plants of electricity, functioning under the 'Take or Pay' rule, were under-utilized during the pandemic, increasing the unit price of electricity. Further, the load-shedding policy of DISCOs at the feeder level also enhanced the per unit cost of electricity generation as it hampers the sale of electricity from the 'Take or Pay' power plants. The power outages also compel the consumers to use costly and inefficient gas or petrol generators or UPS, thus impacting significantly the efficient allocation of resources at all levels, especially at the household level.

In addition to the above factors, the Government of Pakistan has also initiated major power sector reforms, including the phase-wise reduction of subsidies for the residential sector. The reform process was initiated more than a decade ago, initially at a relatively slower pace. However, in recent years, frequent increases in electricity tariffs were recorded that not only impact negatively the consumers belonging to middle- and upper-income households, but lower-income households are believed to be hurt the most. It has been recorded that electricity tariffs for the lifeline slab increased by about 182 per cent from 2008 to 2021. According to the World Bank (2017), although households belonging to lower-income groups consume fewer units of electricity, a rise in electricity prices would have a profound impact on their well-being.

It is worth mentioning that the residential sector is the main consumer of electricity in Pakistan. According to the Economic Survey 2020-21, the share of the residential sector in total energy consumption is 49.1 per cent. Hence, an increase in electricity tariff would have a significant impact on households at all income levels.

The international literature suggests the likely impact of power sector distortions on household well-being and poverty in a developing country. Nevertheless, the research work on electricity affordability at the household level in Pakistan is very limited. Particularly, the welfare effect of the recent increase in electricity prices because of the gradual reduction of subsidies has not yet been assessed in any research study. The main contribution of this research is thus to investigate the effect of the price increase of electricity on the well-being of households at various income levels. More precisely, the current study contributes by determining the crowding-out impact of increased electricity prices on households' budgetary allocation of resources to different

income groups. It is revealed that a rise in electricity costs deteriorates households by reducing the income left for spending on various other consumptions of goods and services. To accomplish these objectives, this study employs the Household Income and Expenditure Survey (HIES) 2013-14 and 2018-19, assuming electricity tariffs were relatively low in 2013-14 compared to 2018-19. Where HIES 2018-19 is the latest survey at the time of the study.

To explain the crowding-out effect of electricity expenditure and its impact on intra-household resource allocation, the conditional demand function, as suggested by Pollak (1969), is estimated. In the context of the current study, the crowding-out effect of electricity expenditure entails reduced consumption of goods and services because of the increasing cost of electricity consumption. The conceptual framework of this paper followed the most recent genre of empirical studies on the crowding-out impact of commodity expenditure [John (2008), John, et al., (2006), Hussain, et al., (2018)].

This research paper is thus organized as follows. Section II reveals the background of electricity tariff reforms. Section III presents the data and methodology applied in econometric estimations of the above-defined objectives. Then, Section IV of the research paper provides results, analysis, and thorough discussion, which further support public policy provision in this research area. The final Section V concludes the study and discusses the viable policy options.

II. Background on Energy Tariff Reforms

In 2012-13, as reported by the World Bank in 2014, roughly 50 per cent of subsidies were allocated to the residential sector, with approximately 25 per cent going to manufacturing and industrial sectors and the rest distributed among various other sectors. These statistics highlight the significant electricity consumption by residential households, accentuating the potentially far-reaching effects of tariff reforms on their welfare. Therefore, this section will investigate the historical advancement of tariff slabs, the per unit electricity price changes within each slab, and structural adjustments specific to the residential sector in recent years.

According to the Ministry of Energy, before September 2008, residential households were subjected to the highest standard tariff level when their electricity usage crossed the 1000-unit threshold. However, post-September 2008, the highest tariff tier was applied once consumption exceeded 700 units. This adjustment, which lowered the threshold by 300 units for the highest tariff level, had a noteworthy effect on the electricity costs incurred by households. Additionally, in the fiscal year 2013-14, a significant structural change was implemented, substituting the ‘all-slab benefit’ with the ‘previous-slab benefit’ policy. Under this revised policy, households were charged according to just two electricity consumption tiers. Moreover, in September 2023, the government further discontinued the ‘previous slab benefit’ for electricity consumers, leading to an unusual spike in tariff rates.

TABLE 1

Percentage increase in Tariff Structure for residential electricity (%)

Periods/ Slabs	2008-2021	2019-2021
Less than 50	182.2	97.5
1to100	139.6	33.7
101 to 200	105.3	24.0
201 to 300	147.9	19.1
301 to 700	166.0	10.1
more than 700	143.0	8.7
peak hours	165.6	8.7
off-peak hours	223.4	12.2

Source: Authors' estimation using K-electric and Economic survey statistics.

Based on data extracted from the K-electric website and the Economic Survey, there is a clear association between electricity consumption and escalating tariff rates. However, Table 1 emphasizes a significant issue that the lowest slab, designated as the lifeline tariff tier, has experienced the most substantial tariff surge, reaching a staggering 97 per cent increase between 2019 and 2021. This sharp rise is cause for concern. Furthermore, spanning from 2008 to 2021, the lifeline slab has seen the highest tariff rate escalation, reaching an alarming 182 per cent. This tariff hike is particularly worrisome because the lifeline tariff is designed to shield the most economically vulnerable individuals. Existing literature posits that even though lower-income groups consume less electricity, an uptick in electricity prices would disproportionately impact their well-being [World Bank (2017)].

III. Review Literature

Energy subsidies, particularly electricity subsidies, have been the focus of research in various policy institutions like the IMF, the World Bank and academia. Although the timeline of the policy shift, concerns, and welfare impact may vary from one country to another, however, the foremost aim is to reduce electricity consumption (or move towards efficient consumption), reduce government expenditure and increase the overall well-being of poor through income redistribution [Granado, et al., (2012)]. Hence, this section presents a summary of valuable international and national research on the issue to determine, firstly, the outcome of this policy shift in various economies. Secondly, the literature on Pakistan's economy, to date, is reviewed to determine the policy objectives of the electricity price reforms in Pakistan and to find the research gap.

Literature shows that a surge in electricity tariffs not only declines the affordability of households but also influences overall well-being. According to Makmun and Ab-

durrahman (2003), a rise in electricity rates has an undesirable effect on the real income of the people as it decreases the purchasing power of the households. If not accompanied by other compensatory measures, this decline would possibly enhance poverty [Ikhsan and Purbasari (2012)]. Current reforms are, thus, believed to have a significant socio-economic impact, particularly on deprived families. Literature suggests varying responses of different income groups to tariff hikes. Households with a comparatively lower elasticity of demand, largely with higher consumption of electricity, are less likely to alter electricity usage in response to a rise in tariff. However, this situation would enhance the revenues of the government [Moshiri (2015)]. On the other hand, poor households with consumption of fewer units mostly have inelastic demand. Thus, a decline in well-being is anticipated to be highly associated with a rise in tariffs [Lampietti (2004)].

With the onset of the 1990 power sector restructuring and reform, mechanisms were initiated in Pakistan but at a very slow pace primarily because of the unstable political situation of the country. There was also great resistance from the general public to any rise in electricity tariffs at that time. However, Pakistan practically initiated the tariff reform process more than a decade ago, but again, the pace of reform was sluggish until at least 2013. According to WB (2017), electricity subsidies in the residential sector have been reduced to about 0.4 per cent of GDP from 2013 to 2016. Like many other developing economies, national literature on the issue expressed scepticism regarding the well-being of society from increased electricity tariffs. Although one of the objectives mentioned in the National Power Policy (2013), was to safeguard poor households from tariff reforms through various compensatory and redress mechanisms, on the one hand, while generating a sense of responsibility among consumers and ensuring efficient utilization of electricity, on the other.

Considering the above National power policy objective, WB (2017), through a qualitative survey of families from Khyber Pakhtunkhwa (KPK), Punjab and Sindh provinces, found the affordability issues for paying electricity bills among households. However, the reform process was not in full swing at the time of the interview. Recipients of the Benazir Income Support Program (BISP) also complained about the higher electricity bill. The study thus revealed the insufficient compensatory efforts by the government so far. Besides affordability, the unreliability of electricity service is another major problem faced by households. The study revealed a lack of confidence and trust in Discos and K-electric in the general public. However, the study suggested further reforms in the sector. The author is of the view that subsidy elimination from this sector would further ease the fiscal pressure and bring sustainability. In contrast, fiscal resources would be used to eliminate the negative effects that arose from tariff reforms through more spending on social assistance programs and other compensatory mechanisms for people experiencing poverty.

Walker T. et al., (2014), a policy paper published by the World Bank, also considered the impact of electricity tariff reforms on welfare while demonstrating how to continue subsidy elimination reforms in Pakistan. This study simulates the welfare im-

pact based on the 2014-15 budget forecast for electricity subsidies with the assumption of a sufficient increase in electricity prices to achieve the government's subsidy target and with no compensatory measures taken. With these assumptions, the study found that 97 per cent of electricity consumers, except for lifeline users, would face a rise in electricity expenditure. However, lifeline users and nonusers would also indirectly face relatively small welfare losses. The study estimated only a 1.7 per cent welfare loss for poor households, while richer households would face greater welfare loss. The study proposed various compensatory options to the government to mitigate the negative impact of policy reforms. These included amendments to BISP, targeted cash payments to poor households based on poverty scores, along with improving efficiency in electricity usage, production, and distribution.

Zhang, Fan. (2019), another study by the World Bank assessed the welfare impact of tariff reforms and estimated the economic cost of distortion for three main South Asian economies: India, Bangladesh, and Pakistan. The study considered economic losses from subsidy elimination more distortionary than the fiscal losses in the presence of subsidies. For Pakistan, the estimated economic cost due to energy sector distortions was 6.53 per cent of GDP in 2015, of which 4.75 per cent is because of unreliable access to electricity. Meanwhile, the estimated fiscal cost due to electricity subsidies was 0.80 per cent of GDP.

It has been noticed that scarce economic literature exists for Pakistan from welfare or poverty perspectives. However, the importance of the topic can be realized by the characterization of losses mentioned by Joskow (2008). According to Joskow (2008), lack of efficiency in production and distribution, poor or unreliable services, social and environmental loss, etc., are all first-order effects, while price distortions are second-order losses. It is a matter of fact that Pakistan is currently facing both first- and second-order effects or losses in the electricity sector. It has been noticed that government electricity policy seems more inclined towards correcting second-order distortions; hence, it is recommended that at least similar attention should also be given to fixing the first-order distortions in the power sector.

IV. Data and Methodology

1. Conceptual Framework

In this study, households using grid electricity are employed, while households that do not have grid electricity connections are excluded from the sample. Households report zero electricity expenditures either because they do not have access to grid electricity, even if they have adequate income, or because households cannot afford electricity expenditure, given their income.

The study assumes that households face lower tariff rates and thus lower expenditures in 2013-14 compared to a significant increase in tariff and thus higher electricity

expenditures in 2018-19. This implies that there is a difference in the spending patterns of households between the two periods. The crowding-out attribution of electricity expenditure in displacing expenditure on other commodities comes with the assumption that a household that spends on electricity decides on paying the electricity bills before deciding on the quantities of the other goods and services. Given this, a household's demand for a particular commodity is conditional on the household's electricity expenditures and the remainder of household income after paying electricity bills. Following the recent literature, we estimated and compared a set of Engel curves for electricity expenditure during low tariff rates with conditional Engel curves for electricity expenditure during high tariff rates for a common set of commodities. If, on average, the quantity demanded of a commodity for the typical household in 2013-14 is less (more) than the quantity demanded of the same commodity for a typical household in 2018-19, then the difference can be attributed, ceteris paribus, to increase in electricity tariff during this period.

For estimation purposes, let us assume that households have already decided on their budget for electricity consumption, and a certain amount is been pre-allocated for it. This effectively means that the household now has to maximize its utility subject to the expenditure above the pre-allocated expenditure for electricity. If electricity is the n^{th} good, we assume that the first $n-1$ goods are available in the market for the prices $\{p_1, ..., p_{n-1}\}$ over which the household has no control, and the total expenditure on these goods is given by M ($M = Y - P_e E$, where P_e is the price of electricity and E is the quantity consumed).

2. Empirical Technique: Quadratic Almost Ideal Demand System (QUAIDS)

In the first stage of our empirical approach, we compared the mean expenditure shares for the food and various non-food expenditure categories between the two time periods, using the t-test on the equality of means. Statistically significant differences in the expenditure dedicated to other commodities in the budgets of households between 2013-14 and 2018-19 indicate the unadjusted difference in budget share between the two periods. However, these unadjusted differences in expenditure shares do not take into account households' socio-economic, housing, and demographic characteristics that may influence spending patterns. Therefore, we formally tested the crowding-out hypothesis using multivariate regression analysis, controlling for household-specific characteristics. To determine differences in spending patterns of households between the two periods, the regression models estimated conditional Engel curves for 11 expenditure categories using the Quadratic Almost Ideal Demand System (QUAIDS) developed by Banks, et al., (1997).

Several studies on the crowding-out effect emphasized the potential endogeneity of total expenditure and expenditure on pre-determined commodities (electricity expenditure in this case) and, therefore, used the instrumental variable (IV) method to

obtain consistent and unbiased -estimators. In this study, we instrumented household total expenditure by total income and the assets of a household. Electricity expenditures are instrumented by electrical equipment owned by a household.

If a household's expenditure in one category is correlated with expenditures in other categories, the error terms in the Engle curve estimations are likely to be correlated, potentially leading to increased variance in the estimated coefficients and inefficient coefficient estimates. Because of this, we use an estimation method that is robust to the use of instrumental variables along with Seemingly Unrelated Regression (SUR). Hence, the paper estimates the system of Engel curves using the Three-stage Least Squares (3SLS) method, which is robust to the application of IVs in SUR. Because the dependent variables of the 12 equations add up to one (adding up restriction), we arbitrarily drop one equation from the system of Engel curves before proceeding with the 3SLS estimation. The 'Miscellaneous goods' is dropped in Equation (1).

$$G_i = \alpha_{1i} + \alpha_{2i}\, afford + \alpha_{3i}\, P_e E + \delta_{0i}\, a + \beta_{1i}\, lnM + \beta_{2i}\, lnM^2 \qquad (1)$$

where,

n_i = the sample size of each stratum.
G_i = the budget share of commodity *i* in the remaining budget excess of expenditures on electricity
afford = the binary variable takes the value 0 for the year 2013-14 and 1 for 2018-19
$P_e E$ = Electricity Expenditure
a = the set of socio-economic characteristics of the households, like household size, age, average education of a household, dwelling type, number of rooms in a household, and occupancy status of a household.
M = the total expenditure minus the expense on electricity bills.

3. Data Description

Household cross-section data from the household income and expenditure survey (HIES) for the years 2013-14 and 2018-19 collected by the Pakistan Bureau of Statistics, Government of Pakistan, is employed for this study. The data contain information on consumption expenditure for a wide variety of goods from 17,301[2] households in 2013-14 and 24,114[3] households in 2018-19. This nationally representative and official household consumption survey collected information on the consumption of over 350 commodities in 2018-19 and more than 200 commodities in 2013-14. Expenditures on 12 distinct categories, which are exhaustive and mutually

[2] Total 17,989 households were sampled in 2013-14, however, 688 are excluded because of incomplete information.

[3] Total of 24,809 households, excluding Gilgit Baltistan and AJK, were sampled in 2018-19 HIES. However, 695 household are excluded during estimation because of incomplete information.

exclusive, including food, tobacco, clothing and footwear, Housing and fuel, furniture, health, transport, communication, recreation and culture, education, restaurant, and miscellaneous expenditures, are considered for the analysis. The consumption module in HIES recorded expenditures on food items either as a monthly or fortnightly expenditure. Similarly, non-food items like tobacco products and energy and fuel commodities are recorded as monthly expenditures, while other non-food commodities are as yearly expenditures (for instance, clothing, housing, recreation, education, and health). For our analysis, all consumption expenditures are converted into average annual expenditures for both years.

Among households with electricity connections, vast heterogeneity in the expenditure of electricity is noticed among income groups. Analyses are thus carried out for three income groups. The middle-income group represents households between the 3rd and 8th quintiles of the distribution of household income. Lower and higher income groups are those below and above this range, respectively.

V. Analysis and Discussion

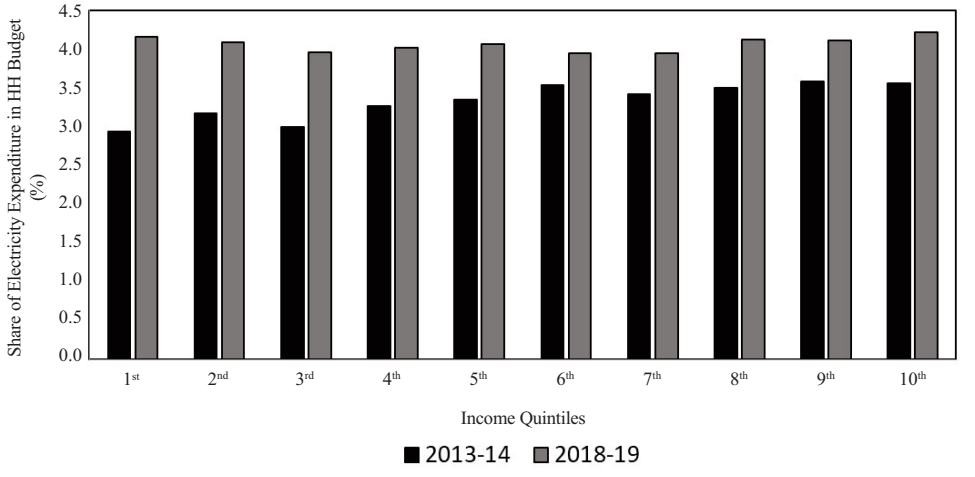
This section aims to study the difference in resource allocation of a household and, thus, the crowding-out effect of increased electricity tariffs on a household's budgetary expenditure from 2013-14 to 2018-19.

According to HIES-2018-19, about 97 per cent of urban and 83 per cent of rural households are consuming grid electricity, hence reporting positive electricity expenditure for these households. All such electricity consumers are believed to be affected directly by increasing electricity tariffs.

Figure 1 shows the share of electricity expenditure as a percentage of total household expenditure for different income quintiles in 2013-14 and 2018-19. The figure is divided into ten income quintiles, with the first quintile being the lowest-income group and the tenth quintile being the highest-income group.

Overall, there has been an increase in the share of electricity expenditure in total household expenditure for all income quintiles from 2013-14 to 2018-19. This indicates that households, regardless of their income levels, are compelled to spend a larger portion of their budget on electricity because of the rise in electricity tariffs.

It was noted that during 2013-14, the upper-income quintiles (6^{th} to 10^{th}) exhibited a trend of allocating a greater portion of their household budget towards electricity expenses compared to the lower-income quintiles (1^{st} to 5^{th}). This phenomenon could be ascribed to an elevated electricity consumption stemming from larger residential properties, a higher number of household appliances, and an overall elevated standard of living prevalent within these higher-income segments. However, a shift in this pattern occurred by the year 2018-19, whereby all income strata began devoting comparable proportions of their budget to electricity expenditure. This shift suggests the possible emergence of an escalated electricity tariff structure for the upper-income



Source: Authors' estimation.

FIGURE 1

Share of Electricity Expenditure by Income Quintiles (%)

quintiles in relative terms. However, these changes could also be influenced by various factors: energy efficiency improvements, shifts in household consumption patterns, and economic conditions.

Table 2 provides the mean consumption share of expenditure categories by income quintiles for households during the low electricity tariff (2013-14) and high electricity tariff (2018-19). The food group has the top share in consumption expenditure across all income quintiles. Yet, the percentage of food groups is comparatively higher in the lower-income households and lower in the higher-income households[4]. Meanwhile, expenditure shares of furniture, transport, communication, recreation, and education are comparatively higher in the higher-income group and lower in the lower-income group.

Results of the Student's t-test for the differences in mean expenditures between the periods of high and low electricity tariffs for low, medium, and high-income groups are also reported in Table 2. Expenditure category shares during the low tariff period are considered reference categories. Hence, a positive percentage point difference entails that households spend more, on average, on that consumption category during the high tariff period. In contrast, a negative percentage point change suggests less expenditure on that particular consumption category. T-stat columns show statistically significant differences in budget shares between the two periods for all income classes except health for low-income households, tobacco for middle-income households, and health and education for high-income classes.

[4] In this study, the first two income quintiles are considered low-income groups, the middle six are middle-income groups, and the last two are considered high-income groups.

TABLE 2

Student t-test for the difference in budget allocation between low and high electricity tariff

Expenditure categories	Low-Income Households				Middle-Income Households				High-Income Households			
	Shares: Low tariff	Shares: High tariff	Difference	t-stat	Shares: Low tariff	Shares: High tariff	Difference	t-stat	Shares: Low tariff	Shares: High tariff	Difference	t-stat
Food & Beverages	51.03	46.08	-4.95*	-17.6	45.38	42.46	-2.92*	-20.3	35.1	34.42	-0.68*	-2.3
Tobacco	1.77	1.49	-0.28*	-4.2	1.25	1.24	-0.01	-0.6	0.73	0.85	0.12*	3.6
Clothing & Footwear	6.62	8.07	1.45*	18	7.2	8.25	1.05*	23.8	6.91	7.83	0.92*	11.1
Furniture	2.62	3.37	0.75*	15.6	2.75	3.54	0.79*	23.3	3.65	4.03	0.38*	4
Health	3.55	3.68	0.13	1.4	3.34	3.54	0.2*	3.8	3.48	3.33	-0.15	-1
Transport	4.73	4	-0.73*	-6.5	7.23	6.31	-0.92*	-12.3	10.31	8.29	-2.02*	-10.5
Communication	1.64	1.49	-0.15*	-4.5	2.09	1.73	-0.36*	-17.1	2.74	2.35	-0.39*	-8.2
Recreation & Culture	1.78	1.15	-0.63*	-8.2	1.96	1.45	-0.51*	-15.6	2.08	1.44	-0.64*	-11.7
Education	0.68	0.48	-0.2*	-4.7	2.27	2.06	-0.21*	-4.3	4.93	5.18	0.25	1.5
Restaurant	2.33	3.39	1.06*	6	1.77	2.42	0.65*	12.1	2.41	3.02	0.61*	5.5
Housing, water & fuel	16.16	20.27	4.11*	18.9	16.04	18.7	2.66*	23.6	16.45	18.76	2.31*	9.7
Misc.	7.09	6.53	-0.56*	-5.6	8.72	8.3	-0.42*	-6.7	11.2	10.5	-0.7*	-3.6

Source: Authors' estimation
Note :*Represent statistically significant value.

The differences in resource allocation of households observed in Table 2 for various expenditure categories do not control the demographic and socio-economic characteristics of households. Hence, in addition to the above, a more vigorous and theoretically sound econometric analysis is carried out by employing the conditional demand model as expressed in Equation 1. In this section, the used model, which is conditional on electricity expenditure, is estimated, firstly, to test whether the increased tariff alters the preferences over the commodity categories from one period to another. Secondly, this model statistically examines the nature of crowding out of other categories because of increased electricity expenditure- as a result of increased tariff- controlling for demographic and socio-economic characteristics of households.

Table 3 shows adjusted differences of increased tariffs for different income levels. It demonstrates the mean share of expenditures on various categories (columns 2, 4, 6) during the low tariff period (2013-14), considered the reference category. Similar to Table 2, a positive percentage point difference implies that households, on average, allocated a more significant share to that consumption category during the high tariff period than the low tariff period. In contrast, a negative percentage point difference implies that households allocated a smaller share in the high tariff period.

TABLE 3

Adjusted Differences of Increased Tariff on Expenditure Shares by Income Groups

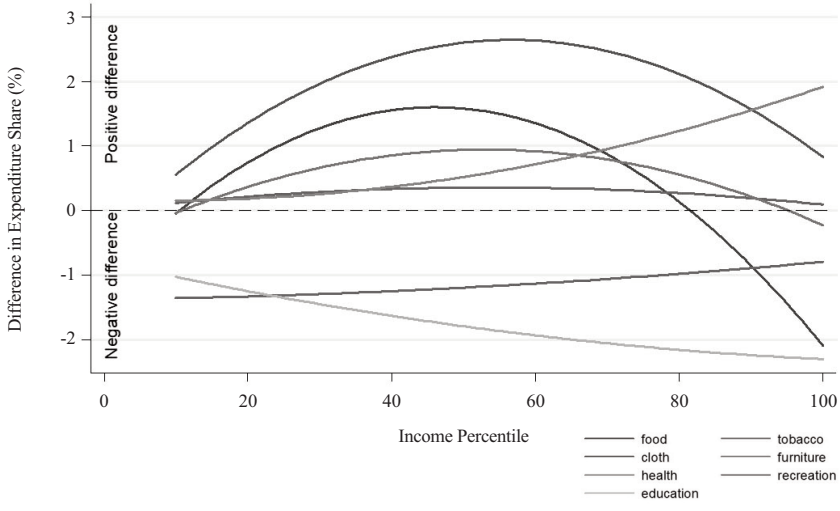
Expenditure categories	Low-Income Households (lower 20%)		Middle-Income Households (Middle 60%)		High-Income Households (Highest 20%)	
	Low Tariff	High Tariff	Low Tariff	High Tariff	Low Tariff	High Tariff
	Mean Share (%)	Difference (% point)	Mean Share (%)	Difference (% point)	Mean Share (%)	Difference (% point)
Food & Beverages	51.03	0.84**	45.38	-0.14	35.10	-1.79*
Tobacco	1.77	0.27*	1.25	0.17*	0.73	0.14*
Clothing & Footwear	6.62	0.73*	7.20	1.18*	6.91	1.11*
Furniture	2.62	0.53*	2.75	1.00*	3.65	-0.83*
Health	3.55	-0.19*	3.34	0.66*	3.48	1.92*
Transport	4.73	-2.72*	7.23	-1.57*	10.31	0.29
Communication	1.64	-0.18	2.09	-0.13	2.74	-1.28*
Recreation & Culture	1.78	-1.04*	1.96	-0.98*	2.08	-1.06*
Education	0.68	-1.10*	2.27	-1.66*	4.93	-2.79*
Restaurant	2.33	4.06*	1.77	1.52*	2.41	0.01
Housing, water & fuel	16.16	-1.59*	16.04	-0.16	16.45	3.97*

Source: Authors' estimation using K-electric and Economic survey statistics.
Note: *,** significant at 1 and 5 per cent.

Table 3 reveals statistically significant differences in expenditure allocations for most of the expenditure categories. For instance, with the increase in tariffs, low-income households, on average, allocated less on health, transport, recreation, education, housing, and fuel. While the allocated share of most of the necessities, like food, tobacco, and clothing has been increased. A more or less similar pattern is observed for middle-income households, except that their allocated share for food and beverages shows statistically insignificant results, while their allocated share on health has increased to 0.66 per cent. High-income households also altered their budgets except for transport and restaurants.

Similar to the estimated results shown in Table 3, the adjusted differences are estimated using Equation 1 for household expenditures at the 10, 20, 30, 40, 50, 60, 70, 80, 90, and 100th income percentiles. Coefficient estimates for α_{2i} From equation 1, the statistical significance is for the consumption groups (i.e. food, tobacco, clothing, furniture, health, recreation, and education) as demonstrated in Figure 2. Adjusted differences < 0 means households allocated fewer resources to the consumption group after the increase in tariff.

Figure 2 illustrates that adjusted differences in the food and beverages share have increased for low and lower-middle-income households' consumption expenditure distribution and are gradually decreasing for higher-middle-income households, while negative for higher-income households. It is also observed that the magnitude of the difference is greater for higher-income households. In 2018-19 (tariff increase) at the 90th percentile, households allocated about two percentage points less of household spending on food and beverages compared to the period of 2013-14.



Source: Authors' estimation.

FIGURE 2

Adjusted Differences in Consumption Share by Income Percentiles

Adjusted differences in the clothing or apparel share are positive at entire household expenditure levels. In contrast, adjusted differences for education and recreation are negative for entire households. At the 10th percentile (lower-income households), the mean share of education is 1.15 per cent less. At the 60th percentile (middle income), the mean share of education is two percentage points less. While at the 100th percentile (high-income households), the mean share of education is 2.64 percentage points less. On the other hand, adjusted differences in the health expenditure share are positive at all levels of household expenditure distribution; however, the magnitude of the difference is lower for low-income and higher for high-income households.

These results show a nontrivial difference in the composition of household budgetary expenditures during the low tariff period compared to the high tariff period. An increase in the cost of electricity has a direct and indirect effect on welfare. It is well documented that electricity prices sometimes bring macroeconomic instability, like rising inflation and higher unemployment rates, thus hurting low-income people, Moshiri, (2015). Therefore, on the one hand, the indirect effects of increased electricity prices compelled poor households to cut their spending on commodities other than necessities. On the other hand, it raises the cost of different food and non-food items, which increases the expenditure of poor households on essentials.

Results show that the displacements due to electricity expenditure occur for commodities that constitute human capital investments, like education, housing, water, fuel and health, etc., thus having severe implications on households' well-being. Electricity tariff reforms, with the nonexistence of adequate health compensation, insurance, or other public provision of finances, could lead to welfare loss, particularly among poor households. Hence, inadequate measures by the Government could adversely affect human capital investments crucial for long-term prosperity.

It is also worth mentioning that some limitations have been noticed in the study. Firstly, consumption expenditure data for all categories, including electricity expenditures, are estimated and self-reported values, and not the exact ones. Therefore, recording or misreporting mistakes could create biases in crowding out computations. Therefore, the results of the study should be interpreted, keeping in view these possibilities.

VI. Conclusion and Policy Implication

This study aims to analyze the impact of a rise in electricity tariffs on the welfare of households. The main objective of the study is to find the crowding-out effect of increased electricity tariffs on households' budgetary allocation of resources at various income levels. The conditional demand function is estimated to achieve the study's objective.

Results show statistically significant differences in expenditure allocations for most expenditure categories between low and high tariff periods. It has been found that after an increase in tariff, low-income households, on average, allocated less budget for health, transport, communication, recreation, education, housing and fuel. A more or less similar pattern is observed for middle-income households. High-income households also altered their budgets except for transport and restaurants. This shows that the purchasing power of consumers has been depleted over the years. These results reveal that the direct and indirect effect of increased electricity tariffs forced low and middle-income households to reduce their human capital investment in education, housing, water, fuel, and health because of the rising budgetary expenditure on necessities.

Our study thus establishes how frequent tariff increases in the energy sector might burden limited household resources and could impede households' prosperity. This implies that electricity tariff reforms with the nonexistence of adequate health compensation, insurance, good education and other public provision of finances, could lead to welfare loss, particularly among poor households. Adequate actions by the government could help achieve human capital investments, which are crucial for long-term prosperity. The analysis thus enlightens policymakers in assessing poverty relief policies through measures of ensuring food security and other necessities of life like education, health care, housing, water, fuel.

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Appendix

Share of total Budget Expenditure	Low-Income Households (lower 20%), N=7083		Middle-Income Households (Middle 60%), N=23492		High-Income Households (Highest 20%), N=7806	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Food and Beverages						
afford	0.84	0.07	-0.14	0.70	-1.79	0.01
P_eE	0.00	0.00	0.00	0.01	0.00	0.00
household size	1.88	0.00	1.34	0.00	1.97	0.00
age	0.04	0.02	0.13	0.00	-0.20	0.00
average hh-education	-0.11	0.11	-0.07	0.26	-0.07	0.44
dwelling type	0.37	0.02	0.77	0.00	0.58	0.10
number of rooms	0.78	0.00	1.01	0.00	0.74	0.00
occupancy status	-0.86	0.00	-0.55	0.00	-0.94	0.00
lnM	741.54	0.00	3046.32	0.00	-111.31	0.13
ln^2M	-31.09	0.00	-120.56	0.00	2.23	0.41
a_{1i}	-4370.68	0.00	-19197.99	0.00	1095.25	0.03
Tobacco						
afford	0.27	0.01	0.17	0.00	0.14	0.01
P_eE	0.00	0.37	0.00	0.00	0.00	0.00
household size	0.29	0.00	0.08	0.00	0.08	0.00
age	0.04	0.00	0.03	0.00	0.01	0.05
average hh-education	-0.03	0.11	-0.04	0.00	-0.01	0.32
dwelling type	0.03	0.48	0.02	0.20	0.06	0.04
number of rooms	0.15	0.01	-0.04	0.01	0.01	0.58
occupancy status	-0.02	0.51	0.03	0.03	0.00	0.98
lnM	179.60	0.00	33.98	0.01	-37.05	0.00
ln^2M	-7.64	0.00	-1.38	0.01	1.29	0.00
a_{1i}	-1055.61	0.00	-208.53	0.01	263.10	0.00
Clothing						
afford	0.73	0.09	1.18	0.00	1.11	0.00
P_eE	0.00	0.00	0.00	0.00	0.00	0.00
household size	1.96	0.00	0.40	0.00	0.25	0.00
age	0.04	0.01	-0.01	0.01	-0.04	0.00
average hh-education	-0.08	0.20	-0.01	0.51	0.08	0.00
dwelling type	0.40	0.01	0.35	0.00	0.13	0.04
number of rooms	1.43	0.00	0.36	0.00	0.23	0.00
occupancy status	0.27	0.05	-0.17	0.00	-0.13	0.01
lnM	911.96	0.00	534.31	0.00	-90.22	0.00
ln^2M	-39.19	0.00	-21.35	0.00	3.07	0.00
a_{1i}	-5312.70	0.00	-3340.18	0.00	659.67	0.00

Share of total Budget Expenditure	Low-Income Households (lower 20%), N=7083		Middle-Income Households (Middle 60%), N=23492		High-Income Households (Highest 20%), N=7806	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Furniture						
afford	0.53	0.00	1.00	0.00	-0.83	0.00
P_eE	0.00	0.00	0.00	0.00	0.00	0.00
household size	0.30	0.00	-0.18	0.00	-0.09	0.00
age	0.01	0.16	0.01	0.07	0.01	0.15
average hh-education	-0.02	0.35	0.08	0.00	-0.19	0.00
dwelling type	0.09	0.02	-0.12	0.00	0.04	0.63
number of rooms	0.34	0.00	-0.11	0.00	-0.12	0.01
occupancy status	0.01	0.86	-0.06	0.02	-0.15	0.02
lnM	224.83	0.00	-286.03	0.00	191.11	0.00
ln^2M	-9.61	0.00	11.42	0.00	-7.06	0.00
a_{1i}	-1315.35	0.00	1796.71	0.00	-1289.10	0.00
Health Expenditure						
afford	-0.19	0.13	0.66	0.00	1.92	0.00
P_eE	0.00	0.02	0.00	0.00	0.00	0.00
household size	0.00	1.00	-0.25	0.00	-0.07	0.08
age	0.02	0.00	0.06	0.00	0.09	0.00
average hh-education	-0.07	0.00	0.04	0.00	0.24	0.00
dwelling type	0.19	0.00	0.13	0.00	-0.20	0.22
number of rooms	-0.19	0.01	0.11	0.01	0.04	0.66
occupancy status	0.01	0.89	0.02	0.61	-0.14	0.24
lnM	-67.68	0.01	345.75	0.00	-253.09	0.00
ln^2M	2.79	0.01	-13.44	0.00	9.67	0.00
a_{1i}	412.37	0.00	-2214.87	0.00	1661.62	0.00
Transportation						
afford	-2.72	0.00	-1.57	0.00	0.29	0.45
P_eE	0.00	0.89	0.00	0.00	0.00	0.00
household size	-1.14	0.00	-0.46	0.00	-0.37	0.00
age	-0.08	0.00	-0.01	0.28	0.05	0.01
average hh-education	-0.07	0.05	0.03	0.07	0.38	0.00
dwelling type	-0.17	0.03	-0.15	0.00	-0.13	0.52
number of rooms	-1.02	0.00	-0.34	0.00	0.05	0.67
occupancy status	0.05	0.47	-0.03	0.44	-0.21	0.17
lnM	-556.29	0.00	-424.20	0.00	-447.74	0.00
ln^2M	23.72	0.00	16.97	0.00	17.02	0.00
a_{1i}	3272.47	0.00	2661.62	0.00	2958.04	0.00

Share of total Budget Expenditure	Low-Income Households (lower 20%), N=7083		Middle-Income Households (Middle 60%), N=23492		High-Income Households (Highest 20%), N=7806	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Communication	-0.18	0.13	-0.13	0.24	-1.28	0.00
afford	0.00	0.00	0.00	0.46	0.00	0.00
P_eE	0.36	0.00	0.10	0.00	0.00	0.74
household size	0.02	0.00	-0.02	0.00	0.02	0.00
age	0.06	0.00	0.07	0.00	-0.07	0.00
average hh-education	0.06	0.16	-0.25	0.00	0.09	0.14
dwelling type	0.47	0.00	-0.13	0.01	-0.06	0.09
number of rooms	0.06	0.15	-0.04	0.36	0.13	0.01
occupancy status	340.18	0.00	-1014.51	0.00	161.06	0.00
lnM	-14.46	0.00	39.94	0.00	-6.03	0.00
ln^2M	-2002.16	0.00	6439.73	0.00	-1074.53	0.00
a_{1i}						
Recreation						
afford	-1.04	0.00	-0.98	0.00	-1.06	0.00
P_eE	0.00	0.00	0.00	0.02	0.00	0.00
household size	-0.57	0.00	-0.18	0.00	-0.10	0.00
age	-0.03	0.00	-0.01	0.07	-0.02	0.00
average hh-education	-0.07	0.00	-0.08	0.00	-0.13	0.00
dwelling type	-0.16	0.00	0.11	0.01	-0.02	0.57
number of rooms	-0.45	0.00	-0.02	0.60	-0.09	0.00
occupancy status	-0.03	0.52	0.02	0.48	0.03	0.31
lnM	-255.17	0.00	716.64	0.00	124.67	0.00
ln^2M	11.01	0.00	-28.16	0.00	-4.55	0.00
a_{1i}	1483.56	0.00	-4552.63	0.00	-848.27	0.00
Education						
afford	-1.10	0.00	-1.66	0.00	-2.79	0.00
P_eE	0.00	0.00	0.00	0.00	0.00	0.00
household size	0.04	0.17	-0.28	0.00	-0.84	0.00
age	-0.02	0.00	-0.09	0.00	-0.06	0.00
average hh-education	-0.05	0.00	-0.14	0.00	-0.80	0.00
dwelling type	0.05	0.05	0.08	0.01	-0.10	0.61
number of rooms	-0.18	0.00	-0.40	0.00	-0.91	0.00
occupancy status	0.06	0.02	0.13	0.00	0.61	0.00
lnM	-67.26	0.00	98.02	0.00	795.82	0.00
ln^2M	2.79	0.00	-3.70	0.00	-28.75	0.00
a_{1i}	404.25	0.00	-641.79	0.00	-5476.37	0.00

Share of total Budget Expenditure	Low-Income Households (lower 20%), N=7083		Middle-Income Households (Middle 60%), N=23492		High-Income Households (Highest 20%), N=7806	
	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Restaurant	4.06	0.00	1.52	0.00	0.01	0.96
afford	0.00	0.00	0.00	0.00	0.00	0.03
P_eE	-2.64	0.00	-0.27	0.00	-0.24	0.00
household size	-0.02	0.43	0.01	0.27	0.04	0.00
age	0.45	0.00	0.23	0.00	-0.06	0.01
average hh-education	-0.52	0.02	-0.31	0.00	-0.01	0.91
dwelling type	-2.09	0.00	-0.60	0.00	-0.35	0.00
number of rooms	0.15	0.50	0.36	0.00	0.47	0.00
occupancy status	-1426.97	0.00	-1515.92	0.00	240.86	0.00
lnM	60.99	0.00	60.04	0.00	-8.68	0.00
ln^2M	8369.50	0.00	9571.94	0.00	-1662.45	0.00
a_{1i}						
Housing, water and Fuel						
afford	-1.59	0.00	-0.16	0.66	3.97	0.00
P_eE	0.00	0.00	0.00	0.00	0.00	0.14
household size	-0.69	0.00	0.36	0.00	-0.13	0.02
age	-0.02	0.21	-0.15	0.00	-0.01	0.74
average hh-education	-0.10	0.14	-0.26	0.00	0.73	0.00
dwelling type	-0.27	0.06	-0.87	0.00	-0.39	0.08
number of rooms	0.56	0.02	0.17	0.28	0.60	0.00
occupancy status	0.42	0.00	0.22	0.14	0.70	0.00
lnM	-243.63	0.00	-2208.14	0.00	-814.44	0.00
ln^2M	9.81	0.01	86.21	0.00	29.96	0.00
a_{1i}	1517.92	0.00	14129.97	0.00	5539.08	0.00