Pakistan Economic and Social Review
Volume 60, No. 2 (Winter 2022), pp. 221-249

WELFARE IMPLICATIONS OF ENERGY SUBSIDY REFORMS UNDER THE IMF STABILIZATION PROGRAM: THE CASE OF HOUSEHOLD SECTOR IN PAKISTAN

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Abstract. Pakistan entered IMF extended fund facility program in 2019 where one of the commitments was to reduce the subsidies in the energy sector. Withdrawal of subsidies led to rapid increase in the prices of energy products causing reallocations within the household budget, resulting into pervasive implications for household welfare. Bearing this in view, current study analyzes effects of exponential fuel price increases on household welfare in Pakistan due to subsidy reforms and international oil price changes, at national and disaggregated provincial levels for different income quintiles. Changes in fuel consumption patterns have been examined using Quadratic Approximation of Almost Ideal Demand System (QUAIDS) through Iterated Linear Least Squares (ILLS) method. Subsequently, the welfare impacts of fuel price changes have been calculated by employing the computed elasticities through QUAIDS. The micro-level data from Household Integrated Expenditure Survey (HIES) 2018-19 was used for this purpose. The empirical estimates of QUAIDS and compensated price elasticities show that the fuels are price elastic in rural areas, and price inelastic in urban areas. Similarly, the household fuel consumption expenditures by upper quintiles are price inelastic while the expenditures by lower quintiles are price elastic across the provinces. The household welfare computed through compensating variation estimates indicates significant

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welfare losses to households in Pakistan. These losses are higher for the lower income strata. This calls for targeted subsidy programs to insulate poorer households from energy price shocks. Effective policy implementation related to existing and upcoming energy subsidy and taxation frameworks can maintain household welfare at an acceptable level.

Keywords: Welfare implications, Energy Subsidy Reforms, IMF, Household sector, Pakistan

JEL Classification: I38, Q41, F33, P46

I. INTRODUCTION

Pakistan entered into IMF extended fund facility (EFF) in 2019 for a $6 billion disbursement over the period of 39 months conditional upon commitments (IMF, 2019) of managing the fiscal deficit through subsidy reduction (mainly energy), avoiding building up of circular debt, restructuring tariff determination, and improving energy efficiency. Energy sector reforms in the form of gradual subsidy withdrawal from petroleum, power, and other energy sectors are considered to reduce the burden on the government and reduce inefficient energy consumption. The electricity tariff subsidy reforms approved by the Ministry of energy in 2021 were implemented in three phases. The first phase covered the identification of tariffs for the protected vulnerable residential users, creating a new protected consumer category with consistent consumption of fewer than 200 units for 6 months, and breaking down the consumption slab of 301-700 units into smaller equal-sized slabs to make the future electricity tariff rates more progressive (GOP, 2021b). The second phase required reforms for agriculture consumers and the third phase covered Industrial and commercial users in addition to agriculture consumers. The final target of reforms is to reduce the total net subsidy for an unprotected group of residential consumers and to attain zero net subsidies for industrial, commercial, and agricultural consumers. Similarly, the subsidies on other sectors of energy are being aggressively removed by the government under IMF conditionalities which is going to affect consumer welfare (GOP, 2021a, 2021b).

Energy sector subsidies are a source of providing financial support to the lower income groups in both developing and developed economies. In addition to the structural issues faced by Pakistan, recent shocks of the COVID-19 pandemic and increased global oil prices have put immense pressure on the social spending of the government, health and social welfare programs. Subsidized electricity and oil consumption has supported consumer welfare during these shocks and helped consumers to fulfill their energy needs. Reduction in such subsidies has direct effect on the consumers (Abrar *et al*., 2019) who are at the verge of energy insecurity. Energy subsidy reforms carry significant distributional consequences, where direct consequences are reduced consumption of energy sources by consumers owing to increased energy prices (Arze del Granado *et al*., 2012; Coady *et al*., 2015; Renner *et al*., 2018), whereas indirect consequences include the increased price of other commodities affecting the overall prices in the economy. Extremely high costs of electricity and other energy sources as a result of subsidy removal makes it unaffordable for lower-income households to sustain their basic energy requirements, affecting their welfare. Household energy expenditures are the second highest after food expenditures, therefore, increased energy prices augment budgetary spending requirements and force households to sacrifice food, education, and health expenditures with strong welfare implications for a low-income household[1]. In addition, this situation can reduce the number of households having affordable electricity access and reverse the efforts of the country to attain sustainable development goal of sustainable energy for all. Households' switch to alternative fossil fuel sources available at low cost can have alarming environmental implications. In contrast, positive effects of subsidy reduction are increase in government savings which can be utilized in public welfare sectors like healthcare and education ensuing a welfare gain on part of the society as a whole.

Recent surges in oil prices and changing world scenarios have compelled developing and underdeveloped economies to resort to strict subsidy removal programs to curtail huge imported energy bills (Acharya & Sadath, 2017; Coady *et al*., 2015; Ilyas et al., 2022; Zhang, 2015). Aggressive reductions in subsidies allocated to electricity and petroleum

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[1] Average household income increased to Rs. 41,545 in 2019 From Rs. 35,662 in 2016. The average household income increased by 16 percent.

products have been witnessed in Pakistan (World Bank, 2022). Literature supports the decision of subsidy reforms as well because subsidies are considered ineffective in fulfilling the desired objective of welfare increase and poverty reduction (Awan *et al*., 2019; Ilyas *et al*., 2022). The welfare effects of subsidies to consumers and producers have been established in literature, and subsidies are used by the majority of the economies to support various groups in the economy (Arze del Granado *et al*., 2012; Coady *et al*., 2015; Renner *et al*., 2018).

The literature on Pakistan is scant in terms of analysis of the impact on welfare due to subsidy removal from more than one energy sources (Abrar *et al*., 2019; Aziz *et al*., 2016). Awan *et al*. (2019) and Ilyas *et al*. (2022) analyzed the effect on household welfare as a result of reduction in electricity subsidies. In the recent past, subsidy removal reforms in other energy sectors like petrol, diesel and natural gas have been implemented. The current study aims to quantify the effects on household welfare as a result of the aggressive reduction in subsidies on various energy products and hence increased energy prices. We want to assess the response of households in terms of their expenditures on energy products to changes in the prices of energy sources like electricity, natural gas, LPG, kerosene, firewood and petrol. The rest of the paper is organized as follows. Section II presents the literature review, section III elaborates the theoretical framework of the study, and section IV explains data sources and methodology of the study. Section V outlines the results and corresponding discussion, while the study concludes by section VI.

II. REVIEW OF LITERATURE

Fuel consumption by households depends upon many factors including prices. In case of Pakistan, Irfan *et al*. (2018) studied the responsiveness of household fuel demand due to fuel price changes in Pakistan using pooled cross section data from Pakistan Living Standard Measurement Survey (PSLM) for years 2007-08, 2010-11, 2013-14 encompassing 47, 921 households. All prices were converted to real prices for 2007-08. Linear Approximate Almost Ideal Demand System (LA-AIDS) model results showed that all fuel types were price inelastic except natural gas for urban households at the national level. Natural gas and LPG were found to be more price elastic in rural areas relative to urban areas. Based on policy simulations study concluded that adoption of clean fuels financed through government subsidies can encourage reduction of indoor air pollution. A cost effective reduction in the solid fuel use in Pakistan is possible by implementing an LPG subsidy over natural gas subsidy. While, Waleed and Mirza (2020) evaluated the dynamic behavioral patterns in the fuel consumption of households as a result of change in prices using two stage budgeting framework for energy and QUAIDS based on Household Integrated Economic Survey (HIES) data for 2015-16. Estimates of compensated price elasticities suggested that firewood and kerosene consumption is less responsive to price changes in rural areas compared to urban areas, whereas, demand for cleaner fuels was less responsive to change in prices in urban areas. Hence, literature supports the effect of price changes on household fuel consumption decision.

Welfare implication analysis in a single subsector of energy i.e. electricity and transport has been carried out for various countries. Bhuvandas and Gundimeda (2020) observed the welfare implications of transport fuel price changes on the Indian households using LA-AIDS model. Results based on household consumption expenditure survey 2011-12 suggested that transport fuel is price elastic in both urban and rural areas across income groups. Lower and middle income groups were more vulnerable to transport fuel price changes. Subsidy reforms will be an effective means to reduce the residential transport energy consumption in this region. For electricity market, Ilyas *et al*. (2022) analyzed the distributional impact of phasing out residential electricity subsidies on household welfare in Pakistan. Estimation of direct and indirect effects of phasing out electricity subsidies found a significant decrease in real expenditures of household in all expenditure quintiles due to increase in electricity prices. But this decline has been higher for rich households compared to the poor households implying that subsidy benefits are regressive. Indirect effects of subsidy removal are greater than the direct effects, as increased electricity prices owing to subsidy removal can stimulate increased prices of other commodities. Cost-driven inflation with lags can reduce the household welfare in the distant future. Awan *et al*. (2019) carried out a welfare analysis of electricity subsidies in Pakistan and claimed that Tariff Differential Subsidy (TDS) as an untargeted subsidy is piling financial burden and increasing welfare losses. Different scenarios were developed to assess the effect of direct transfer mechanism of TDS on social welfare. Results of CGE Model and Social Accounting Matrix (SAM) 2010-11 suggested that TDS largely benefits urban higher income portion of the population comparative to providing relief for the poor. Removal of TDS can result in increased electricity prices and reduced welfare for lower income rural households. TDS should be phased out and more targeted towards poor population. In addition, removal of TDS is beneficial in terms of reduced fiscal deficit and financial adversities of the government. Henceforth, removal of subsidy in any sector will affect the prices and resultantly the welfare of the households in form of reduced fuel consumption and other household goods.

Even the oil-rich economies can face adverse effects of subsidy removal as depicted in the literature (BuShehri & Wohlgenant, 2012; Pacudan & Hamdan, 2019). For Kuwait, BuShehri and Wohlgenant (2012) measured the welfare effects of subsidy reduction on residential electricity demand for different household groups using a micro-model. A small increase in the price of electricity would reduce annual consumption by 4741 million kWh and annual subsidy by US$734 million. The measured consumer welfare loss was approximately US$145 million. In contrast, the study estimated welfare gain in terms of financial and environmental benefits to society ranging from US$658 million to US$889 million. Higher welfare gains suggested that if electricity price reforms are combined with a rebate scheme to compensate welfare loss faced by households, it can offset any political resistance to reform. In Brunei Darussalam, Pacudan and Hamdan (2019) studied the welfare impacts of energy pricing policy changes in form of electricity tariff reforms. Replacement of declining block tariff (DBT) scheme in 2012 by an increasing block tariff (IBT), was a rate structure change not a subsidy removal with electricity tariff lower than long run marginal cost. The study set the tariff rate at short-run marginal cost and found that a change in subsidy removal scenario with IBT, where non-poor urban and white-collar worker households faced higher welfare losses and increased share of electricity expenditures. Price elasticity scenarios with both IBT and DBT cases suggested higher welfare losses under inelastic demand rather than elastic demand. Although, the electricity expenditures remained below percent level, electricity reforms found to have spared the lowest income households from potential effects of subsidy removal. Zhang

(2015) estimated a short-run residential electricity demand function to assess the distributional effect of more than 50 percent electricity tariff increase on households using Turkish household budget survey data of 2008. The heterogeneity in the price sensitivity of the households is allowed while estimations and results suggest high responsive of rich households' consumption towards changes in energy prices. Estimated welfare loss of poor households is 2.9 times higher than the rich households. Therefore, loss in welfare due to subsidy reforms is not the issue of oil deficient countries only. Price changes due to subsidy reforms can affect the household welfare in oil rich economies.

The change in household welfare as a result of change in energy prices has been a topic of interest in literature for South Asia and developing economies (Abrar *et al*., 2019; Acharya & Sadath, 2017; Arze del Granado *et al*., 2012). Abrar *et al*. (2019) found a greater increase in energy prices than general CPI which caused higher expenditure spending by consumers from 1984 to 2012 and subsequently consistent welfare loss which decreased in magnitude overtime. Rural consumers suffered greater welfare loss compared to their urban counterparts. The study used Household Integrated Economic Survey for the period 1984/85 to 2011/12 and Almost Ideal Demand System to estimate the effect of energy pricing policies on consumers' welfare in rural and urban Pakistan. Likewise, Aziz *et al*. (2016) analyzed the effect of increased energy prices on consumer's welfare in Pakistan from 1987 to 2012. The study quantified the consumer welfare via compensating variation (CV) post demand elasticity measurement through Linear Almost Ideal Demand System (LA-AIDS) for different energy sources. The study also evaluated the welfare impact as a result of two price shocks for Pakistan to estimate the impact of energy price change in different time periods. Results found coal, gasoline and high-speed diesel as relatively less price elastic energy sources, whereas, High Octane Blended Component (HOBC), kerosene and Compressed Natural Gas (CNG) fuels as relatively more price elastic. Electricity and natural gas demand was found to be unit elastic. More income compensation for welfare loss is required by affected households in order to attain previous utility level. The need for implementing a mix of price control and income support policies for each energy source is highlighted in conformation with the results. Acharya and Sadath (2017) analyzed the welfare effects of energy subsidy reform in India from 1970-71 to 2014-15. Results of Auto-regressive Distributed Lag model and Error Correction model submitted that demand for all fossil fuels is relatively price inelastic but is highly income elastic. Any increase in price level due to a subsidy reform can cause reduction in real income and related welfare implications, increased energy expenditures and reduced energy usage accordingly. Subsidy if not reaching to the deserving earlier could have fueled the requirement to reduce it across the board, but if targeted properly, the damaging effects of subsidy removal can be minimized, and fiscal goals can be achieved at a lower welfare cost.

Dennis (2016) examined the responsiveness of household welfare towards removal of fossil fuel subsidies, and found clear affirmative welfare implications for government with mixed welfare outcomes for private households. Majority of the households had welfare gain but in some cases welfare loss was observed. The study suggested that government can efface the welfare loss through provision of compensation equivalent to the welfare loss faced by the household through different targeted social reforms financed by fiscal savings. Arze del Granado *et al*. (2012) reviewed the effect of fuel subsidy reforms on the household welfare in twenty developing economies for the time period 2005-2009 and found substantial burden of subsidy reform. A $0.25 decrease in subsidy estimated to decrease the household income for all income groups by 5 percent. Most of this effect is indirect in form of increased prices of other commodities. Benefit leakage to higher income groups make fuel subsidies a costly approach to safeguard poor in an economy.

Freund and Wallich (1996) analyzed the effect of increases in household energy prices on the household welfare for Poland. Subsidies on household energy prices had a regressive impact, as the rich households tend to make higher expenditures on energy products along with greater consumption in absolute. It is suggested that instead of subsidies, a targeted social assistance-based relief program for poor along with increased energy prices will resolve this issue. Social assistance options can consist of in-kind transfers to the poor in addition to lifeline electricity pricing, coupons and in-cash transfers. The study simulated the effects of changes in energy prices up to the efficient levels and found it politically unfeasible and found weak social assistance targeting.

Lin and Jiang (2011) applied a price-gap approach to estimate energy subsidies for Chinese economy estimated at CNY 356.73 billion in 2007, i.e., 1.43 percent of GDP. After electricity and coal sector the highest subsidies were allocated to the consumption of oil products. The study used a CGE model to estimate the economic effects of energy subsidy reforms. The study estimated a significant decrease in energy demand and emissions as a result of removal of energy subsidies along with a negative macroeconomic effect. We conclude that offsetting policies could be adopted such that certain shares of these subsidies are reallocated to support other sustainable development measures leading to reduced energy intensity and improved environment.

Moshiri and Martinez Santillan (2018) analyzed the impact of possible energy price changes as a result of government policy reforms in Mexico targeting increased energy efficiency and lower energy prices in the long run. As a result of energy market reforms, subsidy removal raised energy prices in the short run and affect household consumption and welfare in different income groups. The study used QUAIDS model using nonlinear SURE method using Mexican household budget survey for the period of 2002-2012. Study results depict significant heterogeneity in the elasticities across different energy types and income groups. Energy demand in Mexico is estimated as income elastic but has mixed effects for change in energy prices. A nine times stronger welfare effect of the price changes on low-income households is obtained compared to the middle income households. Alternatively, low income households endure 18 times higher effect of price changes relative to high-income households. The study recommended the need of a social package to overcome the resistance against price changes and develop socially acceptable reforms.

Renner, Lay and Schleicher (2019) analyzed and extended the welfare implications of energy price change scenarios for Indonesian economy at the household level. Household energy demand system (QUAIDS) distinguished first and second order welfare effects over different income quintiles. Impact heterogeneity is considered to be caused by ownership of energy-processing durables. Energy prices act as an instrument to decrease use of energy in addition to causing adverse welfare effects.

Cheelo and Haatongo-Masenke (2018) evaluated the effect of removal of 'blanket' fuel and electricity subsides on the poor population in Zambia and found that poor did not get much benefit from the removal of said subsidies. The paper suggests that subsidies should be maintained to protect the interests of the poor. Giuliano *et al*. (2020) analyzed the distributional effects of reduction in residential electricity and natural gas subsidies in Buenos Aires Metropolitan Area, Argentina since 2016 using household survey data and benefit-incidence analysis. Policy reform which also consisted of social safety scheme for the poor has been analyzed for proper targeting mechanisms. Study found that social tariff is comparatively pro-poor significantly covering the poorest households. The distributional impact of subsidies is found to be progressive and pro-rich. The energy budget shares in terms of monthly expenditures on electricity and piped gas increased as a percentage of household income. Consequently, the literature signifies the prominence of this issue and highlights its economic and associated welfare costs to the masses in the developing world.

III. THEORETICAL FRAMEWORK

Energy reforms in economy include reduction in energy subsidies which are mainly stimulated by increased international oil prices and the effect of these two transfers in the form of increased domestic market energy prices for households. Resulting increase in energy prices can drastically reduce the household energy expenditures and can cause different welfare implications (Sovacool, 2017). Households' response to demand for energy goods is the reduction in the consumption of expensive energy products, substitution with alternative low cost sources and decreased expenditures on other household budget items (Hancevic *et al*., 2016). Issuance of energy subsidy has positive effects as the consumer subsidies provide a temporary cushion against economic shocks and does not decrease purchasing power for essential items. Negative implications include hindrance in implementation of decarbonization policies and excessive use of fossil fuels. In addition, weak redistribution effects arise where subsidies favor high income households in developing countries more than the low income households (Clements *et al*., 2014; Coady *et al*., 2015).

Following Yu (2014), let us assume the price of i^{th} good has changed from P^1 to P^2, the corresponding compensating variation (CV) is shown in equation (1);

$$CV = E(P_i^2, U^1) - E(P_i^1, U^1) \qquad (1)$$

Where CV refers to compensating variation, P_i^1 is the price of i^{th} good in time period t_1, and U^1 is the utility level in t_1. P_i^2 is the price of i^{th} good in time period t_2. $E(P_i^1, U^1)$ is the expenditure to attain the U^1 level of utility at price P_i^1 and $E(P_i^2, U^1)$ is the expenditure to attain the U^1 level of utility at increased (changed) price, P_i^2. The difference is known as compensating variation. By normalizing equation (1), we get

$$E(P_i^2, U^1) = \frac{CV}{E(P_i^1, U^1)} \qquad (2)$$

Replacing $E(P_i^2, U^1)$ with E_2 and $E(P_i^1, U^1)$ with E_1, equation (2) can be rewritten as equation (3),

$$E_2 = \frac{CV}{E_1} \qquad (3)$$

E_2 is the fraction of additional expenditure required to compensate the welfare loss due to price change. Following Friedman and Levinsohn (2002), E_2 can be approximated using equation (4);

$$E_2 = E_1 + \sum q_i^1 \Delta P_i + \frac{1}{2}\sum \sum s_{ij}^1 \Delta P_i \Delta P_j \qquad (4)$$

Where $s_{ij}^1 = \frac{\partial^2 c(P^1,U)}{\partial P_i \partial P_j} = \frac{\partial h_i^1}{\partial P_j}$, by Shephard's Lemma and h_i^1 is the Hicksian demand for i^{th} good, therefore,

$$CV \approx \sum q_i^1 \Delta P_i + \frac{1}{2}\sum \sum s_{ij}^1 \Delta P_i \Delta P_j \qquad (5)$$

Assuming P_i changes while Pj remains fixed, equation (5) can be written as

$$CV \approx q_i^1 \Delta P_i + \frac{1}{2}\frac{\partial h_i^1}{\partial P_i}(\Delta P_i)^2 \qquad (6)$$

Putting the value of CV from equation (6) into equation (3),

$$E_2 = \frac{q_i^1 \Delta P_i + \frac{1}{2}\frac{\partial h_i^1}{\partial P_i}(\Delta P_i)^2}{E_1} \qquad (7)$$

Through algebraic simplification, we get

$$E_2 = \frac{h_i^1 P_i^1}{E_1}\left[\frac{\Delta P_i}{P_i^1} + \frac{1}{2}\frac{\partial h_i^1 P_i^1}{\partial P_i h_i^1}\left(\frac{\Delta P_i}{P_i^1}\right)^2\right] \quad (8)$$

Here,

$\frac{h_i^1 P_i^1}{E_1} = w_i$, share of i^{th} commodity in expenditure

$\frac{\partial h_i^1 P_i^1}{\partial P_i h_i^1} = \varepsilon_{ip}^h$, Compensated or Hicksian price elasticities,

$\frac{\Delta P_i}{P_i^1} = GP_i$, Growth in prices,

Equation (8) can be rewritten as

$$E_2 = w_i\left[GP_i + \frac{1}{2}\varepsilon_{ip}^h (GP_i)^2\right] \quad (9)$$

Hence, E_2, which refers to the welfare change, depicted as expenditure required to compensate due to price change (increase) depends on share of that commodity in the total expenditures, growth in prices and the responsiveness of compensated demand as a result of price change.

IV. DATA SOURCE AND METHODOLOGY

DATA SOURCE

The study used Household Integrated Economic Survey (HIES) 2018-19 by Pakistan Bureau of Statistics (PBS) (GOP, 2018–19) to estimate the expenditures of households on different energy sources. The period of field enumeration of PSLM/HIES 2018–19 was from August 2018 to June 2019. It covers 24,809 households with 1,802 urban and rural Primary Sampling Units (PSUs). Whereas, the data for price changes has been obtained from Sensitive Price indicator also compiled by PBS.

EMPIRICAL METHODOLOGY

This study has employed the Quadratic Approximation of Almost Ideal demand system (QUAIDS) to compute budget shares, their determinants, budget elasticities, and own and cross-price elasticities.

These estimations have been used to calculate the impacts of price changes due to the IMF program in the case of Pakistan.

The Quadratic Approximation of Almost Ideal Demand System (QUAIDS) has been estimated by employing the empirical methodology of Lecocq and Robin (2015). This empirical strategy is based on the Iterated Linear Least Square Method introduced by Blundell and Robin (1999).

Equation (10) empirically estimates the Quadratic Approximation of Almost Ideal Demand system.

$$w_i^h = \alpha_i + \gamma_i' \mathbf{p}^h + \beta_i \{x^h - a(\mathbf{p}^h, \boldsymbol{\theta})\} + \lambda_i \frac{\{x^h - a(\mathbf{p}^h, \boldsymbol{\theta})\}^2}{b(\mathbf{p}^h, \boldsymbol{\theta})} + u_i^h \quad (10)$$

Where, $\boldsymbol{w_i^h}$ refers to the budget share of good '*i*', *i*= 1,2,3….,N for household *h= 1,2,…H,* and $\boldsymbol{x^h}$ is the log of total household expenditure. $\mathbf{p}^h$ refers to the log Price N-vector. θ is the set of all parameters, and u_i^h shows the error term.

If *h* superscripts are omitted and equation (10) is differentiated with respect to *x* and *p* respectively, we get equations (11) and (12). Equation (11) is used to compute compensated elasticities.

$$\mu_i = \beta_i + 2\tau_i \frac{\{x - a(\mathbf{p}, \boldsymbol{\theta})\}}{b(\mathbf{p}, \boldsymbol{\theta})} \quad (11)$$

$$\mu_{ij} = \gamma_{ij} - \mu_i \left(\alpha_j + \gamma_j \mathbf{p}\right) - \lambda_i \beta_j \frac{\{x - a(\mathbf{p}, \boldsymbol{\theta})\}^2}{b(\mathbf{p}, \boldsymbol{\theta})} \quad (12)$$

Using equation (11) and (12), the expenditure/income elasticities (e_i) are computed through equation (14). corresponding compensated elasticities are computing through equation (13) as follows:

$$\varepsilon_{ij}^h = \varepsilon_{ij}^u + \varepsilon_i w_j \quad (13)$$

$$\varepsilon_i = \frac{\mu_i}{w_i} + 1 \quad (14)$$

$$\varepsilon_{ij}^u = \frac{\mu_{ij}}{w_i} - \delta_{ij} \quad (15)$$

The expenditure and compensated elasticities are then used to compute the welfare impact of price change. The study used equation (9) to compute the associated welfare loss in terms of expenditures required to compensate the impact of increased prices on household welfare. The welfare analysis is based on 10 simulations, i.e. SIM-1 denotes the price increase of 10 percent, SIM-2 indicates 20 percent price increase, up to SIM-10 which corresponds to a 100 percent increase in the price of employed commodities/groups.

V. RESULTS AND DISCUSSION

Table 1 presents the descriptive summary statistics of the variables at the aggregate national level.

QUAIDS ESTIMATES AND FUEL SHARE

Equation (10) estimates the Quadratic Approximation of Almost Ideal Demand System. The estimates of the budget shares and their determinants are given in appendix A, Price of electricity is negatively associated with the budget share of all the commodities except for petrol. When the price of electricity increases, the share of electricity, natural gas, LPG, kerosene, and firewood declines while the share of petrol increases for households in Pakistan (see Appendix A). The reason behind this intuition can be traced back to the multipurpose use of petrol in households in addition to being used as a transportation fuel. However, increased electricity interruptions have also amplified the usage of petrol in terms of generator fuel. Similar evidence has been provided by Bansal and Dua (2022).

TABLE 1

Descriptive Summary Statistics: Aggregate / National Level

Variable	Unit of Measurement	Mean	Std. Dev
Electricity Share	Percentage	0.0528	0.513
Gas Share	Percentage	0.0162	0.917
LPG Share	Percentage	0.0072	0.0213
Firewood Share	Percentage	0.0463	0.0657
Kerosene Share	Percentage	0.0009	0.0098
Petrol Share	Percentage	0.462	0.5995
Non-energy goods share	Percentage	0.4142	0.607
Price of Electricity	Rs/Kwh	16.667	1.57
Price of Natural Gas	Rs/Kg	92.820	10.04

Variable	Unit of Measurement	Mean	Std. Dev
Price of LPG	Rs/Cylinder	1325.32	150.71
Price of Firewood	Rs/40kg	610.97	108.03
Price of Kerosene	Rs/Litre	154.86	9.75
Price of Petrol	Rs/Litre	99.16	7.67
Price of Non-Energy	Percentage Points	111.512	2.79
Household Size	Numeric	6.45	3.228
HH Head Age	Years	45.85	13.60
Expenditures	Rs	28261.64	21179.25
Income	Rs	41554.58	48717.78

Authors' Calculations. Data Source: PSLM/HIES 2018–19

The price of gas in Pakistan is administratively determined, therefore, this study used the prices of CNG as a proxy. The price of natural gas is negatively associated with the shares of electricity, natural gas, and firewood. On the contrary, being substitutes for natural gas, the share of LPG, Kerosene, and Petrol increases with the increase in prices of CNG. Likewise, Natural gas, kerosene, and firewood are the substitutes for LPG, therefore, the share of these fuels declines with the increase in the price of LPG.

Change in kerosene price insignificantly determines the shares of commodities at the household level. The increase in firewood price increases the LPG share and petrol share while the share of electricity, natural gas, and firewood decreases with the increase in the price of firewood. The price of petrol is positively linked with the share of electricity, natural gas, and firewood. Consequently, on average, when the price of petrol surges, household increase the share of electricity, gas, and firewood.

The Engel curve holds in terms of all the fuels except for the case of LPG and petrol as the share of petrol and LPG increases when total expenditures increase. The quadratic approximation of almost ideal demand system confirms the existence of a nonlinear relationship for all the fuels. The share of electricity decreases at first but when expenditures are further increased this share also increases. The share of LPG increases at first and then decreases, due to the fact that LPG is used as a cooking fuel in households. Likewise, the share of petrol increases when total household expenditures are increased, but with further rise in expenditure, this share starts to decrease in case of Pakistan. In terms of demographic factors of fuel share at household level, estimates of QUAIDS in Appendix A shows an inverse association among size of the household and share of modern fuels such as electricity, natural gas, and LPG, on the contrary, the share of traditional fuel increases as household size increases. Similar evidences also prove the same notion (Gundimeda & Köhlin, 2008; Waleed & Mirza, 2020) for the cases of India and Pakistan respectively. Moreover, households having a connection to natural gas, consume a higher share of the budget on modern fuels, on the contrary, households without connection of piped gas consume more primitive fuels such as firewood and kerosene oil.

This study has employed two dummy variables to uniquely distinguish between the BISP[2] beneficiary households and foreign remittances receiving households. The results show that the households under the BISP program have lower modern fuels such as LPG, piped natural gas, electricity, and petrol. On the contrary, the consumption of traditional fuels is higher for BISP households. The remittance-receiving household has consumed more modern fuels compared to the households which are not receiving foreign remittances. Likewise, the share of modern fuels increases as households move from lower income quintile to higher income quintiles.

OWN AND CROSS-PRICE COMPENSATED ELASTICITIES

Tables 2, 3, and 4 present the computed compensated elasticities at the aggregated, rural and urban areas at national level for the case of Pakistan. The Hicksian cross-price elasticities and own-price elasticities are computed by using equations (13) and (14) respectively in the theoretical framework section through QUAIDS.

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[2] Benazir Income Support Program (BISP) is a social security program which provides monthly payments to poor households. The program is funded by World Bank.

TABLE 2

Own and Cross-Price Compensated Elasticities at Aggregated National Level

Prices	Electricity β/se	Gas β/se	LPG β/se	Kerosene β/se	Firewood β/se	Petrol β/se	Non-energy β/se
E-Share (w_1)	-2.259*** (0.05)	-0.132 (0.10)	-0.119 (0.09)	-0.042 (0.04)	0.044 (0.04)	1.603*** (0.18)	0.905*** (0.23)
NG-share(w_2)	-0.518 (0.36)	-1.478** (0.73)	0.992 (0.65)	0.204 (0.29)	0.111 (0.29)	1.482 (1.35)	-0.793 (1.71)
LP-Share(w_3)	-0.656*** (0.11)	1.387*** (0.23)	-0.522*** (0.20)	0.320*** (0.09)	0.466*** (0.09)	-0.537 (0.42)	-0.458 (0.53)
K-Share(w_4)	-2.832*** (0.76)	3.461** (1.43)	3.889*** (1.31)	0.333 (0.58)	0.971* (0.55)	-2.031 (2.59)	-3.791 (3.25)
F-Share(w_5)	0.062 (0.07)	0.04 (0.15)	0.119 (0.13)	0.02 (0.06)	-1.374*** (0.06)	-0.798*** (0.28)	1.931*** (0.35)
P-Share(w_6)	0.150*** (0.05)	0.035 (0.11)	-0.009 (0.10)	-0.003 (0.04)	-0.053 (0.04)	-1.281*** (0.20)	1.161*** (0.26)
NE-share(w_7)	0.11 (0.07)	-0.025 (0.14)	-0.01 (0.13)	-0.007 (0.06)	0.168*** (0.06)	1.506*** (0.27)	-1.742*** (0.34)

Authors' Calculations

TABLE 3

Own and Cross-Price Compensated Elasticities for Rural areas at National Level

Price in logarithms	Electricity β/se	Gas β/se	LPG β/se	Kerosene β/se	Firewood β/se	Petrol β/se	Non-energy β/se
E-Share (w_1)	-2.428*** (0.056)	-0.168 (0.109)	-0.132 (0.097)	-0.047 (0.043)	0.047 (0.043)	1.798*** (0.203)	0.931*** (0.257)
NG-share(w_2)	-1.581 (1.017)	-2.575 (1.984)	2.666 (1.811)	0.542 (0.788)	0.016 (0.763)	3.752 (3.663)	-2.820 (4.613)
LP-Share(w_3)	-0.620*** (0.107)	1.332*** (0.217)	-0.545*** (0.192)	0.307*** (0.086)	0.489*** (0.085)	-0.556 (0.403)	-0.406 (0.507)
K-Share(w_4)	-1.745*** (0.443)	2.123** (0.860)	2.406*** (0.777)	-0.177 (0.346)	0.609* (0.332)	-0.973 (1.584)	-2.244 (1.998)
F-Share(w_5)	0.037 (0.046)	0.001 (0.093)	0.082 (0.083)	0.013 (0.038)	-1.235*** (0.037)	-0.202 (0.175)	1.304*** (0.220)
P-Share(w_6)	0.149*** (0.053)	0.033 (0.107)	-0.010 (0.096)	-0.002 (0.043)	-0.021 (0.042)	-1.306*** (0.201)	1.157*** (0.254)
NE-share(w_7)	0.105 (0.074)	-0.034 (0.149)	-0.010 (0.132)	-0.007 (0.059)	0.187*** (0.058)	1.570*** (0.276)	-1.81*** (0.35)

Authors' Calculations

TABLE 4

Own and Cross-Price Compensated Elasticities for Urban areas at National Level

	Electricity *β*/se	Gas *β*/se	LPG *β*/se	Kerosene *β*/se	Firewood *β*/se	Petrol *β*/se	Non-energy *β*/se
E-Share (w_1)	**-2.008***** **(0.041)**	-0.073 (0.081)	-0.101 (0.072)	-0.035 (0.032)	0.034 (0.032)	1.315*** (0.151)	0.868*** (0.191)
NG-share (w_2)	-0.152 (0.157)	**-1.095***** **(0.316)**	0.427 (0.282)	0.089 (0.126)	0.115 (0.124)	0.710 (0.594)	-0.094 (0.749)
LP-Share (w_3)	-0.755*** (0.128)	1.544*** (0.258)	**-0.459**** **(0.226)**	0.359*** (0.102)	0.438*** (0.100)	-0.531 (0.478)	-0.596 (0.599)
K-Share (w_4)	38.711 (90.018)	-47.191 (110.740)	-52.513 (122.569)	-19.091 (42.016)	-13.652 (32.251)	38.106 (91.745)	55.632 (136.184)
F-Share (w_5)	17.976 (112.617)	29.049 (183.782)	30.563 (191.441)	6.506 (44.834)	-96.406 (584.283)	-497.023 (3047.224)	509.334 (3115.599)
P-Share (w_6)	0.154*** (0.055)	0.040 (0.112)	-0.008 (0.100)	-0.004 (0.045)	-0.112** (0.044)	**-1.251***** **(0.212)**	1.181*** (0.264)
NE-share (w_7)	0.120* (0.067)	-0.006 (0.134)	-0.011 (0.120)	-0.007 (0.054)	0.135** (0.053)	1.393*** (0.252)	**-1.624***** **(0.317)**

Authors' Calculations

All the employed fuels as well as the non-energy commodity group have elastic compensated demand with the only exception of LPG which has inelastic demand at aggregated national level (See table 2). These estimates are higher than the previously computed elasticities by Waleed and Mirza (2020) and Irfan et al. (2018). This is due to the fact that the aforementioned studies do not incorporate the consumption of petrol and non-energy commodities while computing elasticities.

Table 3 presents the elasticities for the case of rural households at national level. As per the computed elasticities, except LPG, all the fuels have elastic demand. In rural areas, the primitive fuels such as firewood and kerosene are relatively less elastic than the aggregated national level. These results are aligned with study conducted in India by Gundimeda and Köhlin (2008).

Moreover, modern fuels such as electricity and natural gas have relatively flatter demand indicating these fuels as luxuries for the rural households as compared to aggregated national level. For rural households, when price of electricity increases by 1 percent, its demand goes down by 2.4 percent. On the contrary, firewood which is a substitute of modern fuels in rural areas, its demand increases by 0.149 percent due to 1 percent increase in price of electricity.

Table 4 shows the computed own and cross-price compensated elasticities for urban households. The computed own price elasticity for modern fuels is relatively inelastic in urban households as compared to rural areas. Similar results have been reported by Irfan *et al*. (2018) and Waleed and Mirza (2020). The major reason behind this difference is that the urban households consider modern fuels such as electricity, natural gas and LPG as a necessity. As per Table 4, one percent increase in the price of natural gas, on average, it leads to 1.095 percent decrease in its demand. Irfan *et al*. (2018) reported a slightly elastic natural gas with elasticity of -1.390. The cross-price elasticity of LPG is 1.544 with respect to natural gas. It confirms that in urban areas, LPG is the substitute for natural gas.

WELFARE IMPACTS

Estimations based on equation (10) measure the associated welfare loss in terms of expenditures needed to compensate the impact of increased prices. Price simulations are carried out in the welfare analysis, where SIM-1 is the price increase of 10 percent, SIM-2 indicates 20 percent price hike, up to SIM-10 which corresponds to a 100 percent increase in the price of employed commodities/groups. Financial turmoil experienced by Pakistan on account of global price increase particularly in energy commodities and IMF program, increased the prices of fuels in last few years. Another reason contributing to this price hike is the IMF program, which compelled the removal of subsidy on fuels. The price of electricity has increased by 64 percent since 2018, gas price has increased by 267 percent, price of LPG by 210 percent, whereas kerosene price rose by 136 percent. Firewood price increase by 71 percent, increase in petrol price is 238 percent and price of non-energy commodities increased by 80 percent (PBS, 2020).

TABLE 5

Welfare Impacts as Percent of HH Expenditures at National Aggregate

Percentage Change in Welfare								
	Price	Electricity	Natural Gas	LPG	Kerosene	Firewood	Petrol	Non-Energy
Changes in Price	10%	0.5%	0.1%	0.1%	0.0%	0.4%	5.4%	4.2%
	20%	1.2%	0.3%	0.2%	0.0%	0.8%	11.4%	9.2%
	30%	1.9%	0.4%	0.3%	0.0%	1.2%	18.1%	14.8%
	40%	2.8%	0.6%	0.4%	0.0%	1.7%	25.5%	21.0%
	50%	3.8%	0.8%	0.5%	0.1%	2.3%	33.5%	28.0%
	60%	4.8%	1.0%	0.6%	0.1%	2.9%	42.1%	35.6%
	70%	6.0%	1.3%	0.7%	0.1%	3.5%	51.4%	43.9%
	80%	7.3%	1.5%	0.9%	0.1%	4.2%	61.3%	52.9%
	90%	8.7%	1.8%	1.0%	0.1%	5.0%	71.9%	62.6%
	100%	10.2%	2.1%	1.1%	0.1%	5.7%	83.2%	73.0%

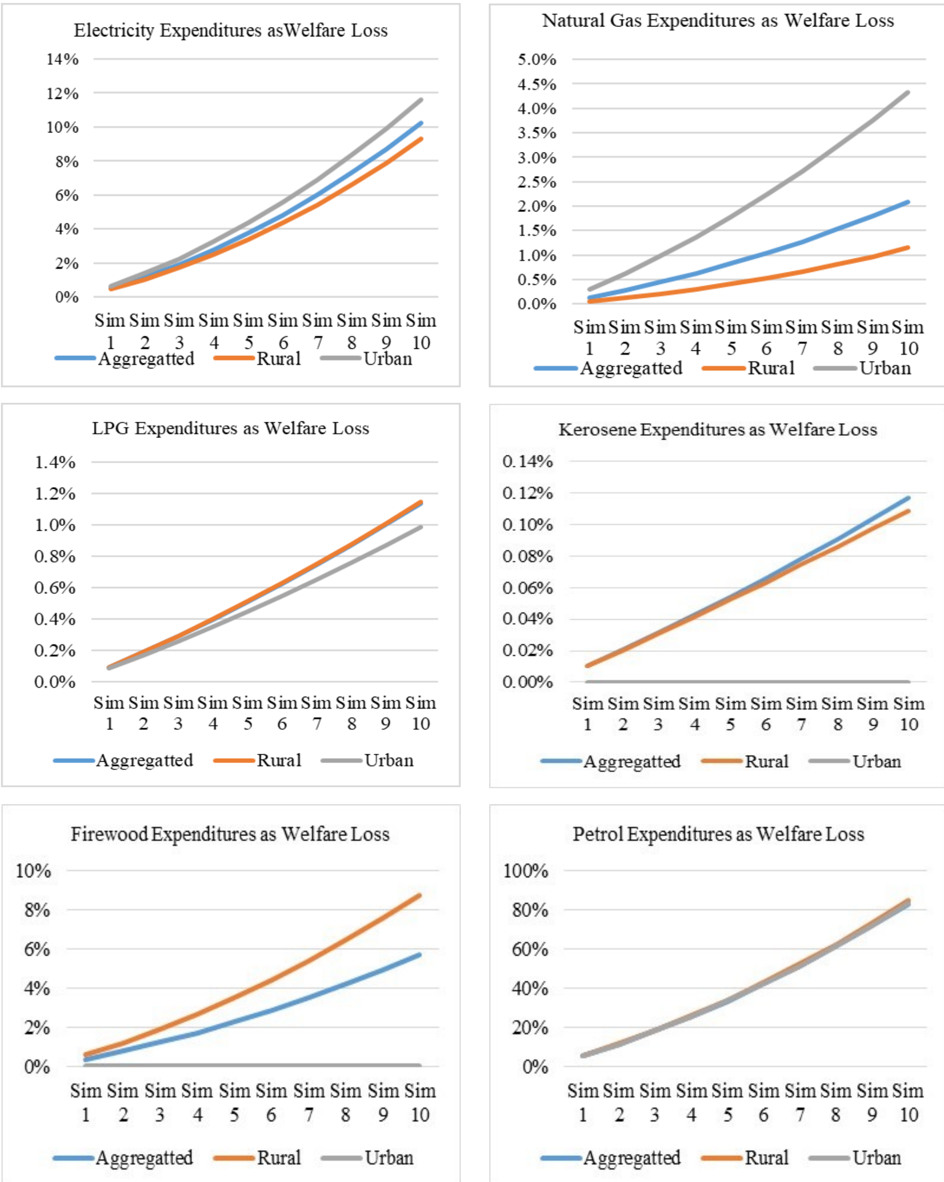
Authors' Calculations

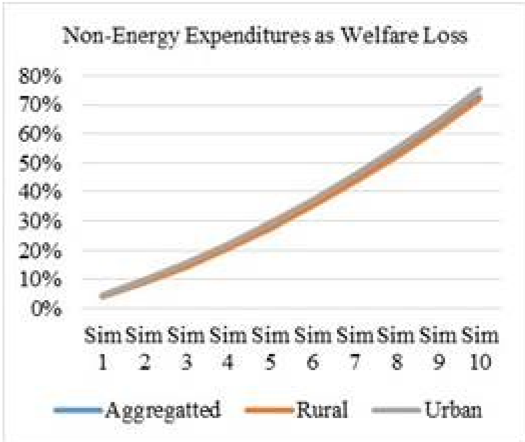
10 percent increase in the price of electricity requires 0.5 percent of total household expenditures to compensate the welfare loss (Table 5). This loss increases to 10.2 percent of the total household expenditure if price of electricity is increased by 100 percent, in this case, as per the estimates, the amount needed to compensate the welfare loss is equal to Rs. 2888 for an average household per month. The welfare loss is 0.1 percent of total expenditures in case of a 10 percent increase in the price of natural gas (see Table 5).

This loss increases to 2.1 percent of total household expenditure in simulation 10, a 100 percent increase in price of natural gas. Since 2018, the gas prices have increased by 267 percent in Pakistan. LPG and kerosene oil price change has less significant impact in terms of welfare loss. Firewood mounts 5.7 percent of total household expenditure in the case of 100 percent increase in price of firewood. The major welfare implication comes in terms of petrol prices. 10 percent increase in petrol price estimated to generate a loss of 5.4 percent of total household expenditures. A 100 percent increase in the price of petrol mounts 83 percent of expenditure increase faced by an average household which is in monetary terms equals to amount of RS. 23,506 per month. The price of petrol has been increased by 238 percent since 2018.

FIGURE 1

Percentage of Expenditures as Welfare Loss in
Rural and Urban areas for Different Fuels

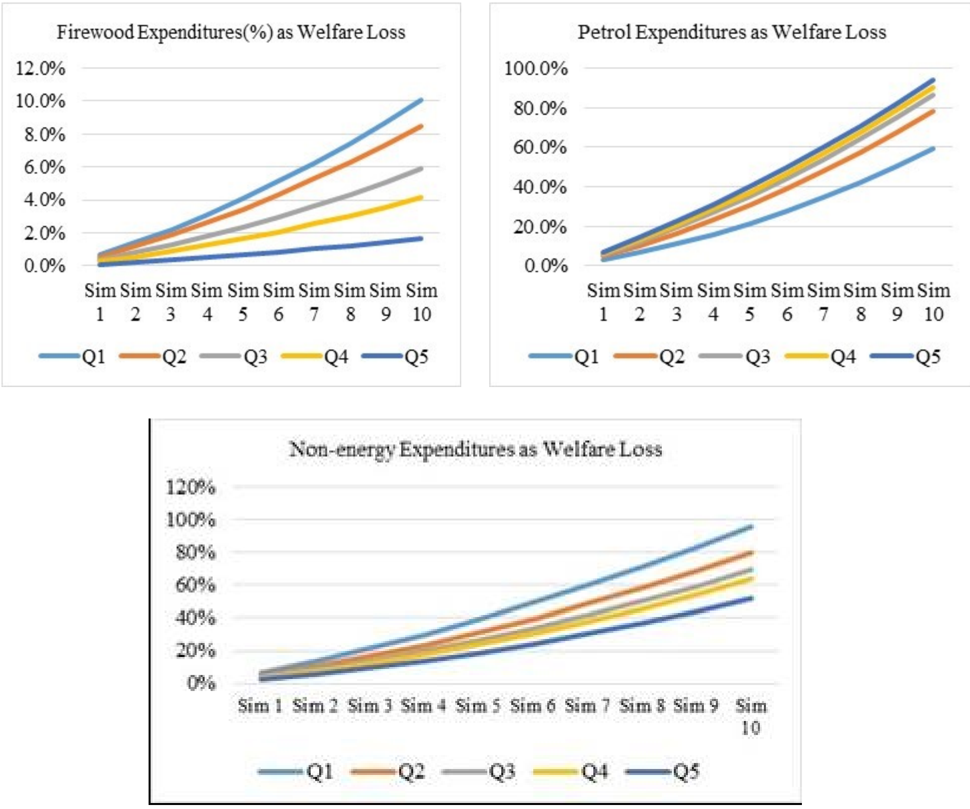




Note: 'Sim' refers to Simulation
Source: Authors' calculations

FIGURE 2

Percentage of Expenditures as Welfare Loss Across Different Quintiles



Note: 'Qi' refers to Quintiles
Source: Authors' calculations

Charts in Figure 1 compare the welfare loss as percentage of average household expenditure of rural and urban areas. When price of modern fuels such as electricity, natural gas and LPG increases, the urban households face more welfare loss as compared to rural households. On the contrary, increase in price of primitive fuels such as firewood, rural households bear the higher degree of welfare loss compared to their urban counterparts. Another significant finding is the same level of welfare loss for rural and urban households in the event of petrol prices. This intuition explains the homogeneous implication of petrol prices for rural and urban households. In the context of non-energy price hike, the welfare of households in rural and urban areas is equally impacted. An increase of 10 percent in the price of non-energy commodities incurs a welfare loss of 4.2 percent. This loss is increased to 73 percent of household expenditures if prices are increased by 100 percent in case of non-energy commodities.

The welfare loss in terms of price hike of electricity is likely to remain same for all the consumption quintiles. The higher consumption quintile has a slightly higher welfare loss as compared to lower quintiles. Moreover, it is evident from Figure 2 that lower consumption quintiles face more welfare loss when price of primitive fuels such as firewood increases. Likewise, the higher income quintiles are more affected by increase in modern fuel prices.

VI. CONCLUSION

This study estimates the welfare implications of subsidy removal and resulting price hike in energy commodities at household level in the case of Pakistan. Most of the existing studies in this context rely on the aggregated time series data, which can lead to misleading results owing to aggregation bias. This study employs household level micro data of Household Integrated Expenditure Survey (HIES) to estimate the Quadratic Approximation of Almost Ideal Demand System (QUAIDS) to compute micro estimates of own and cross price elasticities for energy products in Pakistan. These elasticities are then employed to compute the welfare implication of price hike in terms of subsidy removal by IMF program. The estimates provide insightful trends for the energy sector of Pakistan, which faces a higher degree of government interventions on account of price determination and subsidy framework. Therefore, the point estimates of this study are useful in understanding the welfare implication of subsidy removal and resulting price hike of energy commodities.

The statistically significant estimates of QUAIDS confirm the role of socioeconomic factors in determining the share of fuels in household budget at micro level. The prices of fuels along with the income of households matter for such decision-making. Further, the role of household specific characteristics such as region, gender, age and economic status of household head also play a significant role in determining the fuel choices at household level. The cross-price elasticities indicate that the modern fuels are relatively inelastic as compared to primitive fuels in urban areas. On the contrary, in rural areas, demand for primitive fuels is steeper than the modern fuels. In this context, Oil and Gas Regulatory Authority (OGRA) is advised to take into account demographic, geographical and household specific behavioral factors in making decisions regarding subsidy. Regarding the welfare consequences, this study formulated 10 different simulations ranging from 10 percent increase in price to 100 percent increase in price of energy items. We find that significant differences exist in welfare changes across the fuel categories in terms of income quintiles and rural/urban classification. The loss of welfare is higher in rural areas due to increase in price of primitive fuels as compared to urban areas. Therefore, region specific development strategy is suggested to rationalize the impact of subsidy removal at household level. Furthermore, lower income quintiles also consume more primitive fuels and the price hike for these fuels multiplies the financial woes of already worsen lower economic class. The estimates suggest that welfare implications of petrol price increase are uniform across the regions and over the income quintiles. Consequently, considering petrol as a fuel of riches is a false notion as it has similar adverse direct impacts on the poor households in Pakistan. Government should consider eliminating the blanket subsidies on energy commodities, however, the targeted subsidies and lump sum cash grant should be provided through the State Bank and BISP program.

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APPENDIX A

TABLE
Estimates of QUAIDS

	Share of Fuel in expenditures						
VARIABLES	Electricity share (w_1)	Natural Gas share(w_2)	LPG share (w_3)	Kerosene share (w_4)	Firewood share (w_5)	Petrol share (w_6)	Non-energy share (w_7)
Electricity Price (Log)	-0.075*** (0.0029)	-0.020*** (0.0047)	-0.0028*** (0.00105)	-0.0026*** (0.0005)	-0.029*** (0.003)	0.15*** (0.0290)	-0.024 (0.0289)
Gas Price (log)	-0.020*** (0.0051)	-0.0246** (0.0097)	0.0153*** (0.00205)	0.00198** (0.001)	-0.0300*** (0.006)	0.112** (0.0569)	-0.054 (0.0570)
LPG Price (log)	-0.0028 (0.0042)	0.0153** (0.0078)	0.00320* (0.00173)	0.00289*** (0.00087)	0.0113** (0.00447)	-0.0353 (0.0485)	0.0053 (0.0494)
Kerosene Price (log)	-0.003 (0.0019)	0.00198 (0.0035)	0.00289*** (0.000777)	0.00093** (0.000385)	-0.000476 (0.00208)	0.00219 (0.0217)	-0.0049 (0.0221)
Firewood price (log)	-0.029*** (0.003)	-0.030*** (0.0052)	0.0113*** (0.00120)	-0.00048 (0.000563)	-0.0815*** (0.0041)	0.188*** (0.0305)	-0.059* (0.0316)
Petrol price (log)	0.153*** (0.014)	0.112*** (0.022)	-0.0353*** (0.00487)	0.00219 (0.00221)	0.188*** (0.022)	-1.207*** (0.169)	0.797*** (0.144)
Non-energy price (log)	-0.024 (0.015)	-0.0540** (0.024)	0.00526 (0.00529)	-0.00496** (0.00237)	-0.059** (0.025)	0.787*** (0.160)	-0.651*** (0.141)
Total HH expenditures	-0.071*** (0.005)	-0.083*** (0.009)	0.0182*** (0.00201)	-0.00265*** (0.00100)	-0.163*** (0.005)	0.546*** (0.0542)	-0.244*** (0.0570)
Squared Total HH expenditures	0.00504*** (0.00047)	0.0098*** (0.0008)	-0.00123*** (0.000179)	0.000145 (0.000088)	0.011*** (0.00038)	-0.0326*** (0.00468)	0.0076 (0.00499)
Household size	-0.00108*** (0.00012)	-0.0017*** (0.0002)	-0.000992*** (0.0000480)	0.0000421* (0.0000239)	0.0014*** (0.00012)	-0.0183*** (0.00132)	0.021*** (0.00135)
Gender of HH head	-0.00023 (0.00131)	-0.00396* (0.0024)	0.00303*** (0.000538)	0.000690*** (0.000267)	0.00488*** (0.0013)	-0.145*** (0.0147)	0.141*** (0.0151)
Age of HH head	0.00019*** (0.0000236)	0.000007 (0.0000433)	-0.0000173* (0.0000097)	0.0000095** (0.0000048)	0.000130*** (0.0000236)	-0.000718*** (0.000265)	0.0004 (0.00027)
Monthly income of HH (log)	-0.00066*** (0.000185)	0.00098*** (0.000339)	-0.000394*** (0.0000759)	-0.000000281 (0.0000377)	0.000385** (0.000183)	0.00756*** (0.00207)	-0.0079*** (0.0021)
Gas connection	0.0106*** (0.000862)	0.0195*** (0.0016)	-0.0182*** (0.000355)	-0.000649*** (0.000177)	-0.0422*** (0.000872)	-0.0785*** (0.00976)	0.110*** (0.0099)
Consumption Q1	-0.0149*** (0.00168)	0.0027 (0.0031)	-0.00608*** (0.000692)	-0.000772** (0.000344)	-0.00424** (0.00169)	-0.246*** (0.0189)	0.269*** (0.019)
Consumption Q2	-0.00824*** (0.00136)	-0.00119 (0.0025)	-0.00520*** (0.000559)	-0.000413 (0.000278)	-0.00419*** (0.00137)	-0.157*** (0.0153)	0.177*** (0.016)
Consumption Q3	-0.00455*** (0.00121)	-0.00648*** (0.0022)	-0.00256*** (0.000498)	-0.000476* (0.000248)	-0.00371*** (0.00123)	-0.0766*** (0.0137)	0.094*** (0.014)
Consumption Q4	-0.0022** (0.00108)	-0.0110*** (0.0020)	-0.00141*** (0.000448)	-0.000418* (0.000223)	-0.00216* (0.00111)	-0.0347*** (0.0123)	0.052*** (0.013)
Rural Area	-0.011*** (0.00082)	0.00385** (0.0015)	-0.00579*** (0.000337)	0.000537*** (0.000167)	0.00894*** (0.000825)	0.120*** (0.00924)	-0.117*** (0.009)
KP	-0.0065*** (0.0018)	0.0312*** (0.0034)	0.00315*** (0.000751)	0.000796** (0.000374)	0.0244*** (0.00183)	-0.382*** (0.021)	0.328*** (0.021)
Sindh	-0.0142*** (0.00137)	0.00987*** (0.0025)	-0.00538*** (0.000562)	0.000146 (0.000279)	-0.0161*** (0.00138)	-0.248*** (0.0154)	0.274*** (0.016)
Balochistan	-0.0316*** (0.0018)	0.00989*** (0.0034)	0.000157 (0.000750)	0.00103*** (0.000373)	-0.00456** (0.00183)	-0.196*** (0.0206)	0.221*** (0.021)
BISP HH	-0.00592*** (0.0011)	-0.00369* (0.0021)	-0.00335*** (0.00047)	-0.000271 (0.00023)	0.00253** (0.00114)	-0.040*** (0.013)	0.051*** (0.013)
Remittances HH	-0.00513*** (0.0013)	0.0083*** (0.00248)	-0.0046*** (0.0006)	0.00017 (0.00028)	0.00483*** (0.00137)	0.008 (0.015)	-0.011 (0.016)
Constant	0.215*** (0.0188)	0.108*** (0.0347)	-0.0494*** (0.00768)	-0.0028 (0.00383)	0.565*** (0.0184)	-0.888*** (0.212)	1.052*** (0.218)

w_1= share of Electricity; w_2= share of Natural Gas; w_3= share of LPG; w_4= share of Kerosene; w_5= share of Firewood; w_6= share of Petrol; w_7= share of Non-Energy