WELFARE EFFECTS OF ELETRICITY AND PETROL PRICE HIKE ON URBAN HOUSEHOLDS IN BENUE STATE

[1]Godwin Asemaver ONOV, [2]Ayila NGUTSAV, [3]Victor Ushahemba IJIRSHAR
[4]Jorji Akudo NWOGU
[2,3]Department of Economics, Benue State University, Makurdi-Nigeria
[1]Department of Business Administration Management, Akperan-Orshi Polytechnic, Yandev
[4]Federal College of Education (Technical), Gusau-Zamfara State-Nigeria
[1]onovgodwin@yahoo.com (+2347034884793) [2]ngutsavayila@gmail.com (+2348065716118)
[3]ijirsharvictor@gmail.com (+2348134705084) [4]dajorji@gmail.com (+2348038967778)

ABSTRACT
This study examines the welfare effects of electricity and petrol price hike on urban households in Benue state. The Marshallian demand theory and the theory of utility were utilized. A three-stage sampling approach was used to obtain data from 384 urban households using a survey research design. For data analysis, the researchers employed Seemingly Unrelated Regression (SUR) and Compensating Variation (CV). The study found that both economic and social factors influence demand for electricity and petrol, and that increases in the prices of the energy goods (electricity and petrol) had negative impact on urban households' welfare in Benue State. The study recommends better supply distribution channel of electricity and petrol through public-private partnership and that government should ensure stable prices and supply of the two energy products over a long period of time.
Keywords: Energy Demand, Energy Products, Electricity, Household Welfare, Petrol, and Prices.
JEL Classification: O13, Q41, Q42, L94, R2, L95

1. INTRODUCTION
Energy is an integral part of growth and development. The demand, supply and pricing of energy exerts great impact on social and economic development as well as the living standard and overall quality of life of the population (Iwayemi, 1998; Molem & Ndifor, 2016). Theoretically, household welfare depends on combination of different energy products irrespective of the level of income (Masera, Saatkamp & Kammen, 2000). Empirically, several studies have shown that there is a relationship between energy demand and household welfare (Romero-Jordan, Pablodelrio, & Penasco, 2016: Hossain, Esfandiar & Mohammed, 2017; Agboje, 2018). It is therefore impossible to overemphasize the wide-ranging role of energy demand in social and economic development as well as the living standards of energy consumers in Benue State. Based on the above theoretical and empirical position on energy demand/consumption, it is clear that the adequacy of energy available to a household for its energy requirements is an indication of the household welfare. Positive changes in the amount of energy available to a household relate to positive changes in the welfare (Chambwera, 2004).

The energy products considered in this study are electricity and petrol. Basic economic factors that influence households' consumption of these energy products in developing countries like Nigeria are income of consumers and relative energy prices (Barnes, krutilla & Hyde, 2005). Therefore, changes in the prices of energy products are capable of affecting household welfare through energy demand. Prices of these energy products, in the last decade, have exhibited an upward trending pattern in Benue state. This continuous change in the prices of energy products and the relatively stable income in Benue state have called for a serious concern.

Also, the direct link that exists between prices of energy products and energy demand as highlighted by the Marshallian demand function (Zaratiegui, 2002) and the indirect link (Levin & Milgrom, 2004), that exists between household welfare and energy prices have been left unattended to, especially. In view of this, this study intends to fill the gap by assessing how the electricity and petrol price-hike have affected the households' welfare in the urban areas of Benue state.

2. LITERATURE REVIEW

2.1 Conceptual Clarification

Welfare: Adam Smith defined welfare as the increase in the gross national product (Koutsoyiannis, 1975). However, in order to maximize welfare, efficiency in the distribution of products and services created is required. As a result of this definition, welfare has come to be defined as Per Capita Income (PCI). The cardinalist approach to welfare, which is based only on diminishing marginal value, is another thread in the literature. The argument here is that welfare is maximised if income is equitably distributed in the society. This welfare measure has been criticised on the grounds that individuals do not have equal marginal utility of money (Koutsoyiannis, 1975). The Pareto welfare measure has also gained popularity and asserts that welfare is improved if it is possible to make at least one person better off without making any one worse-off. This criterion of welfare does not seem plausible because government policies often alter the consumption pattern of households negatively and positively. The Kaldor-Hick Compensation criterion states that a change constitutes an improvement in social welfare if those who benefit (gainers) from it could compensate those who are hurt (losers) and still be left with some gain. This welfare criterion became known as the Compensating and Equivalent Variations (CV and EV) welfare approaches, and has dominated the welfare literature in recent times. A major advantage of the CV and EV is that they measure changes in utility and do so in monetary units. The CV is the amount of money that would be given to or taken away from a consumer after a policy change, to make him just as well off as he was before the change in policy. EV on the other hand measures how much money would have to be taken away from a consumer before the policy change to leave him as well-off as he would after the policy change.

Price Hike: This is a percentage increase in the price of a good or service, such as electricity or petrol. It is an increase in the price of a single product or service. A 10% price rise signifies that the cost of that particular item has increased by 10%. Inflation occurs when the majority of prices rise, as long as the other prices do not fall too sharply. People become poorer if inflation is not offset by nominal increases in income. Households and decision-makers pay varying attention to low, medium, and high rates of price increases. People's income is another influencing element in how households react to various amounts of price increases. The study examines the price hike in the electricity and petrol products.

2.2 Theoretical Literature

The theoretical basis of this research is the Marshallian demand theory and the theory of utility. The ordinary theory of demand, otherwise known as the Marshallian theory of demand was developed by Alfred Marshal in 1890, to describe the behavior of consumers. The law of demand depicts downward slopping curve. It shows that when the price of a commodity is raised (other things held constant), buyers tend to buy less of the commodity. Similarly, when the price of the commodity is lowered, the quantity demanded increases. This situation is known as the law of demand.

There are two reasons for this law. First is the substitution effect, that is, when the price of a good rises, consumers substitute it with alternative goods. The second reason is the income effect. This comes into play when the price of a good increases, the purchasing power of the consumer's real income falls. That is, the consumer will have less real income to spend on consumption activities. The income and substitution effects are useful concepts because they help to explain why people react to a price change. The size of these effects depends on a range of factors. These factors determine the shape

of the demand curve. Consumer demand refers to the variation in the quantities of a commodity that a consumer is willing and able to buy at specified prices and time periods, assuming that the consumer's income, price of other substitutes, tastes and preferences and all other determinants of demand remain unchanged. A simple hypothetical demand function is of the form;

$$Qd = f(P, Y, P^*, t, e) \quad (1)$$

where, Qd= Quantity demanded of the commodity, P = Price of own commodity, Y = Income of the consumer, P* = Price of related commodities (substitutes and complements), t = tastes, e = expectations of future price changes. The demand equation (1) means that quantity demanded of a commodity is a function of (or is determined by) consumers' income, price of own commodity, price of related commodity, tastes and expectations about future price of the commodity. The ordinary demand theory, also called the Marshallian demand theory shows an inverse relationship between the quantities demanded of a product and its own price, all other things being equal. This relationship is called the direct price effect which means that as the price of a commodity falls the quantity demanded increases and as the price increases the quantity demanded falls while holding constant all other factors that affect demand. Hence equation (1) can be re-written as (where, the Quantity Demanded-Qd of a commodity is a function of its own price-P):

$$Qd = f(P) \quad (2)$$

The Utility Theory was propounded by Daniel Bounoulli in the 18th century, to define the level of satisfaction or welfare that a consumer derives from a specific allocation of income among different products. The consumer selects a bundle of goods and services which maximizes utility given the level of income. The consumer problem therefore, is that of how to maximize utility subject to a given level of income, also known as the budget constraint. The indirect utility theory is a function that gives the consumers maximal attainable utility or welfare when faced with a vector of goods prices and an amount of income. It reflects both the consumer's preferences and the market conditions. This is because consumers usually think about their preferences in terms of what they consume rather than prices. A consumer's indirect utility $V(p, w)$ can be computed from his or her utility function $u(x)$, defined over vectors x of quantities of consumable goods, by first computing the most preferred affordable bundle represented by the vector $x(p, w)$ by solving the utility maximization problem and, second, computing the utility $u(x(p, w))$ the consumer derives from the bundle. The resulting indirect utility is:

$$V(p, w) = u(x(p, w)) \quad - \quad (3)$$

Equation (3) expresses that utility of a consumer depends on the quantity of goods demanded which are in turn determined by prices and income. The prices of energy products may affect the demand of the energy goods directly and this may also affect the welfare or utility of the households directly.

2.3 Determinants of Household Welfare

Using an updated dataset from the 2016 VHLSS, Nguyen, Nguyen, and Read (2019) investigated the socio-economic determinants of household welfare among households in Vietnam's Central Highlands. They found that household size, ethnicity, communist party membership, education, and other socioeconomic factors have a significant positive impact on the household welfare. However, Glewwe (1990) discovered that education has a large impact on household welfare in urban regions but it is weak in rural ones. In addition, the study found that providing medical facilities in rural areas has a significant positive influence on household welfare. Using data from the 2002/2003 Household Income and Expenditure Survey and the 2009/2010 Botswana Core Wellbeing Indicator Survey, Lekobane and Seleka (2016) investigated household determinants of welfare and

poverty in Botswana. They found that the household head's educational degree and employment position are important drivers of household welfare and poverty.

2.4 Empirical Review

The study presents the previous studies on the relationship between changes in the prices of energy products and energy demand and the influence of the price changes on household welfare. The studies reviewed as follows:

Janthanee (2006) estimated the impacts of gasohol substitution to unleaded gasoline towards consumer welfare (EV) in Thailand by using the linear Approximated Almost Ideal Demand System (LA/AIDS) with time series data between Oct 2003 and Feb 2007. Janthanee (2006) indicated that the own-price elasticity of gasohol is negative and elastic. In addition, cross-price elasticity of demand for gasohol with respect to gasoline price is high. Moreover, the impacts on substitution of gasohol increases net consumer welfare, even after considering the government and private loss of subsidy to subsidize gasohol price. In assessing several energy products, Mehdizadeh (2011) used the data for urban households' expenses and earnings from 1996 to 2008 and LES and AIDS to measured welfare impacts of higher prices of oil, natural gas and petrol energy carriers by compensation variation, equivalent variation, equivalent income and the true cost of living index. The study found that governmental payment for the loss of consumers' welfare for energy carriers could compensate the direct impact of higher prices of energy carriers.

In assessing the effects of price changes on household welfare, Loughrey and O'Donoghue (2011) examined the effects of consumer price changes upon households in Ireland between 1999 and 2010, using a Linear Expenditure System (LES) and an equity component using the Atkinson Social Welfare Function. The results showed that changes in the cost of living differed substantially between households both in terms of demographics and the position of the household in the income distribution and that behavioural response can potentially improve the welfare position of households in response to price changes in most years. Wilaiwan (2012) also investigated in Thailand, the influence of households' socio-economic characteristics and other factors on vehicle fuel consumption and the impacts of the existing pricing policy were examined so that an alternative pricing policy that should lead to the highest efficiency of both fuels and increase gasohol consumption with the least cost could be proposed in the study. A micro-analytic empirical approach was used to investigate vehicle fuel demand patterns of households, which cannot be revealed by macro-data while the demand elasticities, both uncompensated and compensated, were used to determine the alternative pricing policy to support the use of gasohol as a gasoline substitute. The welfare measure used to examine the highest efficiency of pricing policy is the compensating valuation. The results found that the consumption pattern of households for vehicle fuels is determined by their total vehicle fuel expenditure, the prices they pay for the fuels, and by the gender, age and educational attainment of the household head.

Oriakhi and Iyoha (2013) also examined the consequences of oil price volatility on the growth of the Nigerian economy within the period 1970 to 2010. Stochastic general equilibrium (SGE) was used in the analysis. The study find out that out of the six variables employed, oil price volatility impacted directly on real government expenditure, real exchange rate and real import, while impacting on real GDP, real money supply and inflation through other variables, notably real government expenditure. Bondzie, Bartolomeo and Fosu (2014*)* also investigated the oil price fluctuations and it impact on economic growth: A Dynamic Stochastic General Equilibrium (DSGE) approach. The study realized that a shock on interest rate leads to a sharp fall in prices which reflects the impact of the decrease in interest rate on the marginal cost. There was a paradoxical effect of a negative interest rate on total money supply. The study also showed that a positive output shock has the same effect on consumption, investment, prices and wages as in the case of interest rate shock.

Hossain, Esfandiar and Mohammad (2017) investigated the effect of soaring residential electr icity price on the welfare of rural individuals in Guilan Province by Almost Ideal Demand System

(AIDS) in which the elasticity's and welfare variations were calculated by Compensation Variations (CV) and Equivalent Variations (EV) for the time period of 1991-2012. It was shown that the direct effect of residential electricity price modification (increase) has not been compensated. In fact, the welfare loss of the households, due to more expensive electricity, is more than the acquired welfare. Yet, in a gradual increase scenario, the calculated CV is less than the payments to the families, and hence it is the only price policy that does not impose a loss on families and improves their welfare.

In a close related study in assessing the welfare effects of change in prices of energy products, Adagunodo (2013) also examined welfare effects of energy reform particularly petroleum products pricing reform in Nigeria. The data for 5000 households were collected to estimate a demand system for Premium Motor Spirits (PMS), AGO and DPK. The survey contained information on the occupation and income of the household members, as well as on household expenditure and consumption as well as on a wide range of demographic and socio-economic characteristics. The study used marginal social cost approach to evaluate equity and efficiency implications of petroleum products subsidy reform in Nigeria. Findings of the study revealed that equity argument for continuous subsidization of household kerosene can no longer be justified since marginal social cost is low. The reality is that apart from the Nigeria National Petroleum Corporation outlets, there is no other outlet anywhere in Nigeria where kerosene is sold at the subsidized price. The study recommended reduction or removal of subsidy on PMS to save largest amount from government budget.

In a study, particularly on electricity, Romero-Jordan, PablodelRio and Penasco (2016) analyzed household electricity demand and its welfare consequences related to severe economic crisis and the intensive rise of electricity price in 2006-2012 periods by the quantile regression method. They revealed that economic crisis and higher electricity prices had damaging effect of the welfare, particularly among low-income part of the population. More so, Shamaila, Muhammad and Sofia (2016) investigated the impact of higher energy prices on consumer's welfare for the Pakistan from 1987 to 2012. The central objective of the study was to quantify the consumer-welfare through Compensating Variation (CV). They estimated the demand elasticities by applying the Linear Almost Ideal Demand System (LA/AIDS) for main energy sources. Welfare change was measured in four scenarios (two price shocks) for Pakistan in order to analyse the impact of energy price change in different time period. Coal, gasoline and High Speed Diesel (HSD) oil were relatively less elastic, where High Octane Blended Component (HOBC), kerosene and Compressed Natural Gas (CNG) were relatively more elastic, while electricity and natural gas was unit elastic. Additionally, the results of Compensating Variation showed that due to higher energy prices, more income compensation is required to pay for consumer in order to achieve the initial energy utility. Another study, focusing on only PMS, Agboje (2018) used a static computable general equilibrium model to assess the impact of phased and withdrawal of PMS consumption subsidy as well as their alternative curtailing policies on the welfare of farm and non-farm households in Nigeria. Results showed that partial and total PMS subsidy reform with the subsidy gains conserved reduced households consumption level, increased their expenditures on all commodities and reduced social welfare. However, an alternative policy of reallocating fuel subsidy into the crop and service sectors contributed largely to increased household consumption basket.

3. METHODOLOGY

3.1 Research Design

The type of research design utilized for this work is a survey research design. The design is selected due to the large number of households in the selected urban areas of the state which could be too cumbersome to investigate, and also as a result of lack of existing data on household energy demand. Data or information was collected and analysed quantitatively.

3.2 Kinds and Sources of Data

Data collected for this study were identification of respondents, background information about the respondents, socio-economic and demographic characteristics of respondents and energy use profile. These primary data mainly describe household energy and general expenditure in a cross-section together with other household attributes. The survey included data on the consumption of 2 different energy types for various activities such as cooking and lighting. The two energy products are electricity and petrol. Information on them was recorded in different measurement units. Kilowatt hour (kwh) is for electricity and liter (Lit) is for petrol. Data on prices of energy products were required to determine the actual quantities of each energy product consumed given its budget share and expenditure. Therefore, data on household energy consumption expenditure pattern per month was collected. The study considered price, income, and household size, occupation of households' heads, geographical location of households, educational level of household heads and ownership of a house as main determinants of energy substitution. Instead of income total household expenditure has been used as a proxy. The sampled population or respondents were sources of the primary information required, through questionnaires. The sampled population of the study was highly literate, mostly civil servants and mixed income earners that would fill the questionnaire without assistance.

3.3 Sample Size and Sampling Technique

The population of the study therefore consists of all households from Makurdi, Gboko and Otukpo townships. These local governments' headquarters are selected because of their status as urban centres of the state (Benue State Urban Development Board, 2017). They are also among the high energy consuming local governments of Benue state (Akighir & Nomor, 2013). According to National Bureau of statistics (2018), the average number of persons per household in Benue state is 5.3. The expected number of households in each of the selected urban centres of Benue state is equal to the total population of the urban centre divide by 5.3 persons, (NBS, 2018). Also, based on World Data Atlas (2018), the household size for Benue State is 5.3. The estimated populations of Makurdi, Gboko and Otukpo towns as of 2018 are 600,635, 478,241 and 280,830 respectively (World Data Atlas, 2019). Total number of households in the three urban areas is therefore 271,941 households. The Krejcie and Morgan (1970) formula for sample size determination was used

$$S = \frac{X^2NP(1-P)}{d^2(N-1)+X^2P(1-P)} \quad \text{...(4)}$$

Where

S= Required Sample Size

X= Z Value (that is 1.96 for 95% confidence level)

N= Population Size

P= Population proportion expressed as decimal (assumed to be 0.5 (50%), since this would provide the maximum sample size.

d= Degree of accuracy expressed as proportion (0.05)

Thus, imputing the values, we have:

$$S = \frac{1.96^2 * 271941 * 0.5(1-0.5)}{0.05^2(271941-1)+1.96^2 * 0.5(1-0.5)} = \frac{261172.1364}{680.8104} = 383.6195 \approx 384$$

This sample size of 384 was proportionately distributed across the selected towns in Benue state, 170 to Makurdi, 135 to Gboko and 79 to Otukpo. The questionnaires for this study were distributed and collected with the research assistants employed for the purpose. A total of 384 copies of the questionnaire were administered in three selected urban areas of Benue State. All the 384 copies of the questionnaires were retrieved, giving a return rate of 100% as spoilt copies were replaced in order to have a total sample of 384. A three-stage sampling process was used in selecting the respondents. Identification of urban areas of the state was carried out in the first stage. In the second

stage, settlement areas or wards in each of the urban areas was identified while random selection of households within the wards was the third stage of the procedure.

3.4 Method of Data Collection

The major instrument used for this research was a structured questionnaire. Research assistants or interviewers for the survey were recruited and given necessary training. The recruitment of research assistants was to ensure that questionnaires distributed were all recovered, and also to assist respondents in completing the questionnaires where necessary.

3.5 Validation / Reliability of the Instrument

The questionnaire was validated by experts to ensure that they capture all the objectives of the study. To ensure the reliability of the instrument, the instrument was pilot-tested on 50 households (Makurdi -20, Gboko – 17 and Otukpo - 13) which were part of the population of the study. The reliability estimates were obtained after administering, collecting and analyzing the data. Cronbach Alpha Coefficient which is a measure of internal consistency of instruments was used in the pilot study. The analysis yielded an alpha coefficient of 0.8941. This indicated the high reliability of the instrument since the coefficient was more than 0.5. Thus the instrument was validated as a reliable instrument for data collection and empirical analysis.

3.6 Model Specification

The model specified was the Almost Ideal Demand System (AIDS) developed by Deaton and Muellbauer (1980). According to this model, the budget share of an energy product is a function of energy prices and consumers' income (total energy expenditure). The final specification including socio-demographic variables (level of education, household size, nature of occupation, ownership of a house and geographical location) becomes:

$$w_i = \alpha_i + \sum_{j=1} \gamma_{ij} \ln p_j + \beta_i \ln(X / P) + Demographics + \varepsilon_t \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5)$$

Where:

w_i = shares of household expenditure on fuel *i* in total energy expenditure

p_j = price of fuel *j*.

α, β, γ = parameters to be estimated

X= the total expenditure in all categories of energy

In the model, it is expected that since total energy expenditure and the socio-demographic variables are important factors in energy consumption, they would have a positive and significant effect on the demand for particular types of energy (Nguyen, Nguyen & Read, 2019; Glewwe, 1990; Lekobane & Seleka, 2016). Expenditure shares in each of the two energy goods were the dependent variables. Total energy expenditure, energy prices and the demographic variables were the independent variables. Since there are two energy sources, the model equation became a system of two equations which had to be estimated simultaneously. However, given that the dependent variables (share of goods in total expenditure) are dependent, the error terms (ε) were also expected to be correlated across the equations.

3.7 Methods of Data Analysis

The Seemingly Unrelated Regression [SUR] was used to estimate the demand functions. SUR technique is a generalization of a linear regression model that consists of several equations. Each equation is a valid linear regression on its own and can be examined separately. It helps to estimate equation by equation using standard ordinary least squares with a specific form for the variance covariance matrix.

The purpose of this study is to calculate the welfare cost resulted from rising energy prices. In order to study the welfare cost, Compensating Variation (CV) measure was employed to assess the change in welfare resulted from the variations in energy product prices. The function of Compensating Variations (CV) can be expressed as follows according to Laraki (1989):

$CV=c(u^0, p^1) – c(u^0, p^0)$

Where, u^0 and p^0 are original utility and prices, respectively, p^1 is new prices, $C=\sum_i p_i\, qi$ is expenditure function and q_i is the demand for the commodity *i*.

A positive *CV* implies a requirement of more spending to achieve the same utility level as before the price changes, and thus there is a decrease in consumer welfare. By contrast, a negative *CV* implies a drop in spending, and thus a gain in consumer welfare.

4. RESULTS AND DISCUSSION

This section deals with the analysis of data, interpretation and discussion of results. The first stage of this analysis was descriptive analysis of the bio-data and general questions. Stage two involved the presentation and analysis of the significance of factors influencing demand for petrol and electricity using SUR model. The last stage was computation of welfare effect of increase in the prices of petrol and electricity. The discussion of the findings was made at the end of the analysis.

4.1 Descriptive Analysis

This section undertakes vivid analysis of the social, economic and demographic features of the respondents. The following table show how the three hundred and eighty four respondents were distributed based on the socio economic characteristics such as gender, household head status, age of the respondents, respondents' urban area, educational level of respondents, household size and occupation of the respondents.

Table 1: Analysis of Bio-data and General Questions

Category	Respondents	Percentage	Category	Respondents	Percentage
Gender of Head			**Household Size**		
Male	327	85.16	< 5	74	19.27
Female	57	14.84	5-7	271	70.57
Total	384	100	8-10	34	8.85
Age of Respondents			11 and above	5	1.3
20-29	25	6.51	Total	384	100
30-39	51	13.28	**Occupation**		
40-49	88	22.92	Farming	64	16.67
50-59	149	38.8	Trading	52	13.54
60 and above	71	18.49	Artisan	55	14.32
Total	384	100	Civil Service	97	25.26
Urban Areas			Others	116	30.21
Otukpo	79	20.57	Total	384	100
Gboko	135	35.16	**Ownership of dwelling place**		
Makurdi	170	44.27	Family	91	23.7
Total	384	100	Personal	107	27.86
Income			Rented	128	33.33
Less than 75,000	160	41.67	Free	32	8.33
75,000 -100,000	125	32.55	Subsidized	26	6.77

Above 100,000	99	25.78	Total	384	100
Total	384	100			
Educational Level					
No Formal	54	14.06			
Primary	69	17.97			
Secondary	119	30.99			
Tertiary	142	36.98			
Total	384	100			

Source: Field Survey, 2020

Table 1 shows that 327 (85.16%) of the respondent households are males while 57 (14.84%) of the respondents are females. This probably reflects that males are more involved in fuel procurement for cooking in a household. The table also shows that most of the respondents are between the ages of 50 and 59 years. Out of the 384 respondents, 25 (6.51%) of the respondents are in age bracket of 20-29 years. 88 (22.92%) of the respondent households are within the age bracket of 40-49 years. 51 (13.28%) of the respondents are between the ages of 30-39 years while 71 (18.49%) of the respondents are in the age bracket of 60 years and above. This indicates that the decisions over which fuel to use for cooking and lighting in a household are taken by adults.

Geographical Location of households above shows that 170(44.27), 135 (35.16) and 79 (20.57) households are located in Makurdi, Gboko and Otukpo respectively. This clearly shows that among the three urban areas Makurdi is the most populated town, followed by Gboko and then Otukpo.

Educational status of the respondents shows that majority of them attended tertiary school. 30.99 percent of the respondents have secondary education, 17.97 percent of the respondents have primary education, and 14.06 percent of the respondents have no formal education. This indicates that over 60 percent of the respondents have average education and thus may have knowledge of the use of household cooking and lighting energy appliances. According to Table 1, the family size of 271(70.57%) of the respondents fall within the range of 5 - 7. 74(19.27%) of the respondents family size fall within the range of less than 5. 34(8.85%) of the respondents had family size that fall within the range of 8-10, while 5(1.30%) of the respondents had family size of 11 and above. This is in line with the official household size of 5.0 given by NBS (2006) and World Data Atlas (2018).

The Table 1 also reveals that 160 (41.67%) of the respondents fall within the income category of less than 75,000.00. 125 (32.55%) of the respondents fall within the income category of 75,000 and 100,000. This shows that majority of the respondent households are relatively poor people with large family size who may not afford to buy expensive energy source for cooking. The table shows that majority the respondents are under other occupations, followed by civil servants. An occupation with the least number of respondents is trading. This is an indication that the main occupation of the inhabitants of our urban areas is civil service, followed by farming. From the same table, 128 (33.33%) of the respondents are tenants while 107 (27.86%) own their dwelling house. Respondents with their own dwelling place would have enough space to use fuel wood in their homes for cooking purposes.

4.2 Empirical Analysis

The results of the descriptive statistics and the estimations for petrol and electricity demand for Benue urban areas are presented on Tables 2 and 3 respectively.

Table 2: Descriptive Statistics

Variables	Obs	Mean	Standard deviation	Minimum	Maximum	VIF	% Change
Price of Electricity in 2020	384	48.8	1.42	47.21	50.73	2.91	107.04
Price of Electricity in 2012	384	23.57	0.51	22.9	24.1	2.16	
Price of Petrol in 2020	384	163.04	0.83	162	164	0.51	67.05
Price of Petrol in 2012	384	97.6	1	97	100	1.02	
Quantity of Electricity Consumed 2020	384	237.53	58.93	175	330	24.81	0.82
Quantity of Electricity Consumed 2012	384	235.59	67.64	151	336	28.71	
Quantity of Petrol Consumed in 2020	384	61.48	44.79	13	151	72.85	-8.12
Quantity of Petrol Consumed in 2012	384	66.92	47.40	15	160	70.84	

Source: Author's Computation using STATA 15 Output

From the results in Table 2, the average prices of electricity and petrol increased from ₦23.57/per kilowatt and ₦97.6 per litre in 2012 to ₦48.8/per kilowatt and ₦163.04 per litre in 2020 recording a percentage change of 107.04% and 67.05% in the prices of electricity and petrol in Benue state. The variations in the prices as measured by the coefficient of variation was very minimal given the regulation of the market price by the federal government. Consequently, the average quantity of electricity consumed increased slightly by 0.82% while the households in Benue state demanded less of the petrol on average in 2020 as compared to the quantity consumed in 2012. This may be attributed to the restriction of movement in 2020 occasioned by COVID-19 pandemic and the effect of the price changes. However, given that electricity is very essential, the change in quantity demanded was very minimal but with high coefficient of variance. This shows that the changes in prices of the energy products affect the household welfare in Benue state.

The structural parametric coefficients of two equations along with their standard errors (in parenthesis) as well as significant levels are presented in the Table 3.

Table 3: Estimates of the SUR Model for Electricity and Petrol

Parameter	Electricity	Petrol
Price of Electricity	-0.1837	-0.1499
	(1.1007)	(1.0615)
	[0.867]	[0.888]
Price of petrol	5.5855	5.7466
	(6.2588)	(6.0364)
	[0.372]	[0.341]
Expenditure	-0.9123	-0.7728
	(0.0556)	(0.0536)
	[0.000]*	[0.000]*
Education	0.2016	0.2152
	(0.0939)	(0.0906)
	[0.032]*	[0.018]*
Household Size	-0.0322	-0.0262
	(0.0905)	(0.0873)
	[0.722]	[0.764]
Occupation	0.0182	0.0734

	(0.0628)	(0.0605)
	[0.772]	[0.226]
Household ownership	0.0652	0.0738
	(0.0625)	(0.0603)
	[0.297]	[0.221]
Geographical location	0.0010	0.0857
	(0.1024)	(0.0988)
	[0.993]	[0.386]
Constant	-3.7626	-6.2402
	(32.581)	(31.4228)
	[0.908]	[0.843]
R^2	0.5080	0.5289
Chi-Square	396.41	288.19
Prob.	0.0000*	0.0000*
RMSE	0.6212109	0.5991288

Source: Own calculations from field survey, 2020; * means significant at 5% level of significance; standard errors in parentheses and probability values in brackets.

Electricity equation and petrol equation have R-Square values of 0.508 and 0.5289 respectively. This means that the variations in the values of the explanatory variables of the electricity share equation is responsible for 50.8% of the variations of the quantity of electricity demanded or utilized by the consumers sampled in the study area while the variations in the values of the explanatory variables of the petrol share equation is responsible for 52.89% of the variations of the quantity of petrol demanded or utilized by the consumers sampled in the study area. With the significance chi-square of each equation at 5% critical level, it implies that the model equations have good fit. The negative coefficient of the intercept, which recorded a value of -3.7626, was insignificant with a p-value of 0.908, signifying that even when all the included explanatory variables remain at zero, there will be an insignificant electricity demand change at 5% level of significance. Similarly, there is negative and insignificant coefficient of a constant from the petrol equation. It also implies that even when all the included explanatory variables remain at zero, there will be an insignificant petrol demand change at 5% level of significance.

The estimated coefficient of price of electricity is -0.1837. This implies that for every unit change in price of electricity, the quantity demanded of it in the study area decreases by 18%. This is in line with the theory of demand which held that as price of the commodity increase, *ceteris paribus*, the quantity demanded decreases. On the other hand, the estimated coefficient of price of petrol is 5.7466. The coefficient is not statistically significant in influencing the demand for petrol by the respondents. This explains the importance of the commodity making its demand insensitive to change in price. This is in contrast to the theory of demand which held that as price of the commodity rises, *ceteris paribus*, the quantity demanded falls. However, it may be attributed to the nature of the good (essential commodity) and its supply in the state which is generally unstable. Therefore, increase in the price of petrol may increase the budget share allocation to it by households as well as increase the quantity bought.

The estimated coefficient of monthly expenditure on energy has a significant negative effect (p-value of 0.000 at 5 percent level of significance) on quantity of electricity and petrol consumed or demanded in the urban areas. This means that for every 1 unit of expenditure increase, the people decrease their demand for electricity and petrol by 91% and 77%. This further explains that higher incomes can lead to less consumption of electricity and petrol as those whose incomes are increasing could increase their expenditure on alternative energy sources to electricity and petrol such as solar

energy due to the epileptic power supply in the state and the concomitant effect of using generator in terms of pollution.

The positive sign of geographical location coefficient implies that moving from the outskirt of the town to the main township increases the consumption of electricity, *ceteris paribus*. This may be attributed to the high cost of electricity in townships. For household size, demand for elasticity and petrol are statistically insignificant with coefficient -0.0322 and 0.0262. However, it shows negative relationship. More so, the estimated coefficient of household ownership of housing unit is statistically insignificant in relating to electricity demand and petrol demand with the positive coefficient values of 0.0652 and 0.0738 implying that becoming the owner of a dwelling unit in the urban areas of Benue State, it increases expenditure on electricity and petrol but not significantly.

The estimated coefficient of educational level is positively related to electricity demand and statistically significant at 5% level of significance. A possible reason for these findings is that education enhances individuals' awareness of the detrimental consequences of using petrol and kerosene on people's health and the environment. More so, as economic status has improved people may decide to go for better as well as cleaner energy products or even fuel than petrol. Petrol is very inconvenient when used for cooking and lighting. From the results, the estimated coefficient of geographical location, occupation and household ownership have positive influence on the demand for electricity and petrol. However, the estimated relationships are not statistically significant at 5% level of significance. More so, the cross price elasticity between the demand for electricity and petrol are positive implying that the energy products are substitutes. The insignificant relationship implies that not very close substitutes. The LA/AIDS results of the SURE technique give chi-square values of 396.41 and 288.19 with the probability values of 0.0000. This explains the overall significance of the model.

4.3: Impact of Price Change in Electricity and Petrol

Table 4 represents compensation variation which is the amount of money that will be given to consumers of electricity and petrol to allow them stay on the same indifference curve or utility level they were before the price change. In this study, mean prices, mean quantities of electricity and petrol consumed and mean expenditures on each of them for 2012 and 2020, estimated from SUR model is used to compute the compensating variations.

Table 4: Welfare Impact of Price Change

Energy Type	p^0 (₦)	P^1 (₦)	q^0	$E(p^0, u^0)$ (₦)	$E(p^1, u^0)$ (₦)	CV (₦)	CV (%)
Electricity	23.57	48.80	235.59	5552.86	11496.79	5943.93	107.04
Petrol	97.60	163.04	66.92	6531.39	10910.64	4379.25	67.05

Source: Author's Calculation, 2020

Table 4 the welfare sensitivity analysis of increase in the prices of the energy products. The results showed a per capita base consumption per month of 235.59 kwh for electricity and 66.92 litres of petrol. The compensating variations for electricity and petrol are ₦5,943.93 and ₦4,379.25 respectively. The implication of this fall in utility due to price change is that it reduces the purchasing power of the consumers. However, the impact of this welfare loss is greater for low income households who can afford it least.

5. CONCLUSION AND RECOMMENDATIONS

Based on the results of this study, it is concluded that (i) demand for electricity and petrol in Benue State are affected by both economic and social factors, and (ii) the impact of increase in the

prices of energy products (electricity and petrol) on Benue State urban households' welfare are negative.

The study therefore recommends that better supply distribution channel of electricity and petrol is needed. This will help to reduce the hardship faced by consumers. In addition, government needs to ensure that the price of the two energy products are stable over a long period of time. Electricity should be seen as a basic need of households and as such it should be made available on a regular basis. In addition to ensuring that there is regular power supply, there is the need to diversify to other sources of energy to generate electricity. Private organizations, banks and government should partner to provide other sources of energy such as solar and wind energy at reduced costs. Finally, whatever policy measure is put in place should be made to reflect the true cost of energy if any meaningful result is to be achieved.

REFERENCES

Adagunodo M. (2013), Petroleum product pricing reform in Nigeria: Welfare analysis from household budget survey. *International Journal of Energy Economics and Policy 3(4), 459-472.* Retrieved from www.econjournals.com

Agboje A. (2018). *Implications of Switching Fuel Subsidy in Households Welfare in Nigeria.* A paper presented at International Conference of Agricultural Economists, July 28 to August 2, 2018. University of Ibadan Nigeria.

Akighir D.T. & Nomor D.T. (2013), Empirical investigation of the poverty – fuelwood consumption nexus in Makurdi Metropolis. *Journal of Economic and Social Research,* 5(1): 40-156.

Barnes, D., Krutilla, K., & Hyde, W. (2005). *The Urban Energy Household Transition: Social and Environmental Impacts in the Developing World.* Washington, DC: Resources for the Future Press.

Chambwera, M. (2004). *Economic Analysis of Urban Fuelwood Demand the Case of Harare in Zimbabwe*. Doctoral Degree, Wageningen University.

Deaton, A. & Muellbauer J. (1980), An almost ideal demand system, *American Economic Review, 70,* 312-326.

Glewwe, P. (1990). Investigating the determinants of household welfare in Cote d'Ivoire. Living Standards Measurement Study Working Paper No. 71.

Hossain S., Esfandiar D. & Mohammad S.(2017). Effects of raising electricity price on welfare of the household sector in rural areas of Guilen Province, Iran. *International Journal of Agricultural Management and Development (IJAMAD*).

Iwayemi, A. (1998), *Energy Sector Development in Africa*. A background paper prepared for the African Development Report.

Janthanee H. (2006). *Analysis of impacts of gasohol substitution for unleaded gasoline on consumer welfare.* Master Degree, Chulalongkorn University.

Koutsoyiannis, A. (1975). *Modern microeconomics.* Second edition. Macmillian Press Limited. Houndmills, Baasingstoke, Hampshire.

Laraki, K. (1989). Food subsidies: A case study of price reform in Morocco. Washington, DC:

Lekobane, K. R., & Seleka, T. B. (2016). Determinants of household welfare and poverty in Botswana, 2002/2003 and 2009/2010. *Journal of Poverty,* 21(1), 42–60.

Levin, J. & Milgrom, P. (2004). Consumer Theory. Retrieved from https://web.stanford.edu/~jdlevin/Econ%20202/Consumer%20Theory.pdf

Loughrey J. & O'Donoghue C. (2011), Welfare Impact of Price Changes on Household Welfare and Inequality, *Discussion Paper 5717,* Bonn-Germany.

Masera, O.R., Saatkamp B.D. & Kammen D.M. (2000), From linear fuel switching to multiple cooking ctrategies: A critque and alternative to the energy ladder model. *World Development, 28,* 2083-2103.

Mehdizadeh, Y. (2011). *Measurement of welfare variations resulted from the fulfillment of Iran subsidy reform plan by AIDS and LES demand systems*. Department of Economics, Faculty of Humanities, Tabriz University.

Molem C.S. & Ndifor R.T. (2016). The effects of energy consumption on economic growth in Cameroon. *Asian Economic and Social Society*, *6(9),* 510-521.

Nguyen, H. M., Nguyen, T. A., & Read, R. (2019). Investigating the determinants of household welfare in the Central Highland, Vietnam. *Cogent Economics & Finance*, 7(1), 1684179.

Romero-Jordan, A., PablodelRio, B., & Cristina, P. N. (2016). An analysis of the welfare and distributive implications of factors influencing household electricity consumption. *Energy Policy, 88*, 361–370.

Shamaila A., Muhammad R. & Sofia A. (2016), Impact of Rising Energy Prices in Consumers' Welfare. A Case Study of Pakistan. *The Pakistan Development Review 55(4)*, 605-618. The World Bank LSMS Working Paper, 50.

United Nations (1998). *Guidelines for population and housing censuses*, quoted in Guidelines for the World Programme of Agricultural Censuses.

United Nations (1993). *System of national accounts*, Commission of the European Communities - Eurostat, International Monetary Fund, Organisation for Economic Co-operation an Development, United Nations, World Bank, Brussels/Luxembourg, New York, Paris, Washington, D.C., ISBN 92 116, 352- 3.

Wilaiwan S. (2012), *Welfare analysis of household demand for vehicle fuel*, Department of Economics, National Institute of Development Administration, Thailand.

Zaratiegui, J. M. (2002). Marshallian Demand Function and the Adjustment of Competitive Markets. *International Journal of Applied Economics and Econometrics*, 10(3), 369-380.