JOURNAL OF CURRENT RESEARCH IN SCIENCE (ISSN 2322-5009)
CODEN (USA): JCRSDJ
2014, Vol. 2, No. 6, pp: 702-707
Available at www.jcrs010.com

ORIGINAL ARTICLE

THE IMPACT OF INCREASE HOUSEHOLD ELECTRICITY PRICE ON NET WELFARE OF ACROSS INCOME GROUPS IN IRAN

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ABSTRACT: A policy of subsidizing energy has been pursued in IRAN to help the poor and to utilize the relative advantages of the country. Regarding to this policy the effect of increasing electricity price on compensated variation (CV) and deadweight loss (DWL) of different income groups in IRAN was done. To do so, an auto-regressive distributed lag (ARDL) model was used and five electricity demand functions were estimated in different income groups. The result shows CV and DWL increases from poor groups to rich ones. Also by increasing electricity price and use direct subsidy, the welfare of low and middle income groups will increase while the welfare of high income groups will decrease.

Key words: Dead Weight Loss, Compensated Variation, Different Income Groups, Subsidy, Price Change Electricity

INTRODUCTION

Program for targeted subsidies in 2010, great progress was made in the Iranian economy, in both of macro and micro variables. Regarding to microeconomics, what is the most discussed, increases in household spending, and the decline in welfare, especially in low-income groups of society. In this context, the energy expenditure of households, as most of the expenses, which accounted for 30 percent subsidy was given as the main reason for implementing the policy was considered meaningful. "In Iran, the residential sector consumed 65,832 million kW/h of energy in 2013, about 32 percent of total electricity consumption in the country is constituted, and as compared to the previous year has an estimated 7.3 percent growth. The energy consumption in the residential sector has been increasing in the past few years, and during the years 2002-2013, the average annual growth of 7.3% respectively. The number of residential customers, over the years, with an annual average growth equal to 6 percent in 2013 to 24 680 thousand subscribers globally. (Detailed statistics of Electric Power Industry, 2013)

On the other hand, according to government subsidies, the enjoyment of the highest income deciles of the electricity subsidy 3.7 times has stated as has the lowest income deciles (Management and Planning Organization, 2001). Based on community groups, the subsidy will benefit from the higher level, therefore the search for a better solution for the distribution of subsidies among different income groups are necessary. If the government reduced subsidies in the domestic sector, it is essential to understand that the price of electricity, which affects the income effects on different groups.

According to the central bank of Iran, in 2005 a one percent increase in electricity prices, will increase the general level of prices of 0.15percent, is that of the 0.12 of the direct effect, and 0.03 of the indirect effect. However it should be noted that the effect of income on which group is more.

Many studies in this field have been carried out, shows that with the removal of energy subsidies, the welfare of the poor in the short term and long term increases (Dodonov, Optiz and Pfaffenberger, (2004), Tiezzi, (2005), Ibrahimi and Dehghan Abadi (2012), Sadeghi et al (2013))

STATISTICAL INFERENCE AND THE RESULTS OF THE ESTIMATED MODEL

In this study, the used variables include household size, total population, per capita income in different income groups, and the per capita consumption of electricity in different income groups, price of electricity sold to the residential sector over a period of 46 years (1967-2013).

To investigate the welfare of different income deciles, five groups therefore it is intended that the first and second deciles are in the first, third and fourth deciles are in the second, fifth and sixth deciles are in the third, seventh deciles and eighth are in the fourth and the ninth and tenth deciles are in fifth place.

The variables used in this study for each group are as follows:

q_i : Per capita consumption of electricity in group i. This statistic is based on kilowatt-hour. Because of five demand, each group has its q, for example, q_1 indicates the amount of power in the first group.

rp : The average true price of power indicates that the price of the share, the nominal price of electricity to the consumer price index is obtained and y_i: real income, per capita disposable in group i.

Long-term model for the five groups in general are as follows:

$$Lq_t = \sum_{j=1}^{S} \beta_j Lq_{t-j} + \sum_{j=0}^{n_1} \theta_{1j} Ly_{t-j} + \sum_{j=0}^{n_2} \theta_{2j} Lrp_{t-j} + \gamma_0 d_1 + u_t \quad (1)$$

Table (1) -coefficients for the pattern long-term demand for electricity in different income groups

	explanatory variables	Estimated coefficients	t-statistics
First Group	Ly_1	0.57	15.65
	Lrp	-0.52	- 4.5
	D_1	-0.75	- 0.68
Second Group	Ly2	0.67	14.65
	Lrp	- 0.84	- 3.95
	D1	- 0.61	- 0.35
Third Group	Ly_3	0.61	18.36
	Lrp	- 0.94	- 5.16
	D_1	- 0.36	-1.05
Fourth Group	Ly_4	0.67	27.4
	Lrp	- 0.98	-7.8
	D_1	- 0.22	-0.84
fifth Group	Ly_5	0.59	15.3
	Lrp	-0.77	-3.59
	D_1	0.82	0.51

2-1: Error correction model

The error correction model in order to the relationship between short-term volatility variables are used for long-term fluctuations. The results obtained are as follows.

Table (2) - coefficients for error correction model of demand for electricity in different income groups

	explanatory variables	Estimated coefficients	t-statistics
First Group	dLq_{11}	-0.33	-3.1
	dLy_1	0.59	4.5
	dLrp	- 0.33	-1.7
	D_1	- 0.01	0.51
	ecm(-1)	-0.38	-2.01

		R-Square = 0.56	F(4,30)= 9.1
Second Group	DLy_2	0.31	1.95
	dLrp	-0.58	-1.8
	D_1	0.004	-0.41
	ecm(-1)	-0.26	-2.07
		R-Square = 0.25	F(4,30)= 15.3
Third Group	DLy_3	0.36	3.7
	dLrp	- 0.66	- 3.06
	D_1	- 0.032	1.04
	ecm(-1)	- 0.37	- 3.8
		R-Square = 0.37	F(4,30)= 14
Fourth Group	DLy_4	0.05	0.025
	DLy_{41}	- 0.025	- 0.27
	DLy_{42}	0.35	4.6
	dLrp	- 0.54	5.1
	D_1	-0.03	-0.41
	ecm(-1)	- 0.33	-3.4
		R-Square = 0.68	F(4,30)= 12.7
fifth Group	DLq_{51}	-0.45	-3.8
	DLy_5	0.16	2.5
	dLrp	-0.36	-1.1
	D_1	-0.1	1.07
	ecm(-1)	-0.24	-2.6
		R-Square = 0.36	F(4,30)= 13.3

CALCULATION OF COMPENSATED VARIATION IN EACH GROUP

To calculate the compensating variation is assumed in the year 2015, the average real price of electricity, twenty percent increase from the year before, but the per capita real income does not change. Real price and real income per capita is equal to the average income of the years 2000-2013, when considered as income in the year 2015 will not change, therefore these claims for real income and prices in 2013, the average years 2000-2013. Then suppose that, in 2015, prices have increased twenty percent, and fixed income. To obtain compensatory changes, long-term income and price elasticity of price, before and after the price change and per capita income is required.

Table (3) - Evaluation compensatory changes in different income groups in Rails

income group	earnings ratio	price index	yr_i^0	rp^0	rp^1	CV	$\frac{CV}{yr_i} \times 100$

1	0.52	-0.76	17538	0.55	4.3	28.4	0.18
2	0.63	-0.78	23875	4.8	4.9	32.5	0.15
3	0.68	-0.85	33286	4.8	4.7	88.2	0.14
4	0.68	-0.84	44287	4.4	4.9	38	0.08
5	0.55	-0.79	85964	4.9	8.7	492	0.008

rp^1: Price after increasing, CV: compensatory changes

According to the results, it is seen that the maximum compensatory changes in fifth Group and the lowest was in the first group. The results showed that increasing the amount of compensatory changes from the first group to fifth. It is considered that this is an absolute value. Since income groups are different, so the price is also different effects on individuals' income. The $\frac{CV}{yr_i}$ Reflects a compensatory change in the income share of different income groups, respectively. (Halvorsen and Nesbakka, 2002, p. 35) The results show that the percentage is higher in lower income groups. In other words, the share of compensatory changes in the income group, the fifth group is more than double. That price change, the first group has the effect of further distribution.

In this paper, investigate the effect of increasing the price of electricity on different income groups. In electricity subsidy is indirect, ie, less than the real price of electricity, the consumer is offered. Consequently, the increase in electricity prices, a reduction in the cost to the government. Therefore, to calculate net welfare loss, use the following equation:

EBCV = CV – Rate of cost reduction due to the increase in price

To obtain rate of cost reductions due to price increases, use the following equation:

$Hq_i(rp, u^0) * drp$ = Rate of cost reduction due to the increase in price

With take derivative of the cost function will reach the function Hicks follows:

$$Hq_i = \frac{\partial e(rp_1)}{\partial rp_1} = [(1-B_1)(u^0 + \frac{e^{B_3 d_1}}{1+B_2} rp_1^{1+B_2})]^{\frac{1}{1-}}$$

Using an equivalent amount of the earned pieces is replaced and the demand Hicks is obtained. The amount of the demand function, the difference in price multiplied, and the revenue obtained from the price. The difference between the compensatory change and reduction of cost due to price increases shows net welfare loss in each group.

Table (4) - The net welfare loss in different income groups in Rails

income group	compensatory change	Rate of cost reduction due to the increase in price	Net welfare loss
1	2741	2654	87
2	3546	2981	565
3	3687	3021	666
4	3870	3385	485
5	5641	4855	786

Total	19485	16896	2589

As can be seen, the effect of increasing the price of electricity in the fifth group, the highest reduction in costs due to the price increases will accrue to the government. The greatest net welfare loss is in the fifth group and the lowest is in the first group. Price increases at the rate of twenty percent compared to 2013, mostly due to reduced well-being in the fifth group, and the least effect on the first group.

Given that, the total cost reduction due to the price increases, evenly divided between households, it can be concluded that the low income groups, most of which benefit from this allocation, and since the community groups, the most often used electrical goods, thus increasing the cost price, the greater the burden on community groups. However, due to the low share of energy costs in the top group has no perceptible change in their income. This will ultimately lead to a redistribution of income, compared to a state grant, subsidy or indirectly, benefit is the most.

As the Table (5) is evident each group an equal share of the total reduction in costs resulting from the change in the price was 3465 Rials. This value represents a direct subsidy of the government. If the amount of subsidy of CV minus, the resulting is additional revenue each group after compensating for price increases (CV).

According to Table 5, the income is positive for the first and third groups, and for the groups of the top of the society is negative. In other words, direct subsidies, not only compensatory changes for the first three groups have compensation income, but additional income for the three groups as well. Due to the redistribution of income, it is evident that the lowest income group, the greatest beneficiaries of redistribution of resources to great advantages. Also seen the low income groups, price increases and redistribution of subsidies benefit, and the fourth and fifth groups are affected. Since the cost of electricity increases, a negligible effect on the funding of community groups leave, therefore, the distribution of subsidies, indirect subsidies distribution is better, because, in the case of indirect subsidies, household type are not considered.

Table 5 - Effect of direct subsidies allocated to different income groups in Rails

income group	direct subsidies	Additional revenue after compensate for price rise
1	3465	684
2	3465	261
3	3465	145
4	3465	-214
5	3465	-1843

RESULTS

The results show that compensatory changes, and net welfare loss, in order from first to fifth ascending through it. It should be noted that the share of energy costs in low income groups, rather than those of society. Therefore, the relative price change has the more effective on the lower groups of society.

In conclusion, it seems to be an increase in electricity prices has the absolute reduction in more prosperity in the community groups, however, due to high income groups of the population, the ratio of compensation to lower income groups higher than those of the community. Since the increase in electricity prices will generate income for the government, it could be expected, direct and equal allocation of income, income groups, low income groups are of greater interest. This type of subsidy, because of the problem identification of low-income households is the most concern.

Common characteristics were estimated for each group, as follows:

The absolute value of the income elasticity and price of electricity demand in each group is

smaller than unity, and the difference was statistically significant. Low price elasticity of demand, on the other hand represents the partial effect of price changes on the demand for electricity in the period studied, and on the other hand, indicates a lack of suitable substitutes for electricity in the residential sector. The main reason for being small price elasticity is the share of household electricity cost of the total budget. Income elasticity is less than unity, indicates that in the long run, the household consumption basket, a good power supply is necessary. Therefore, changes in demand relative to income do not have a lot of responses.

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