European Online Journal of Natural and Social Sciences 2015; www.european-science.com
Vol.4, No.1 Special Issue on New Dimensions in Economics, Accounting and Management
ISSN 1805-3602

Modelling and Estimating Gasoline Demand Using AIDS for Urban Low-Income Groups

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Abstract

One of the biggest problems facing humanity today is the shortage of non-renewable groundwater resources. Since these resources have fewer alternatives, the only way to survive these resources is optimal utilization of them. The purpose of this study is to estimate the gasoline demand in urban low-income groups. Instead of a single equation of gasoline demand, demand is modelled as a multi-equation demand system. For this purpose, a low-income group is considered for which the AIDS is estimated and assumptions are reviewed. In this research, the demand for commodities of low-income group is investigated within urban households in Iran. Using time series data relating to 1991-2009 and AIDS equations, equations of commodity consumption expenditure were estimated using seemingly unrelated regressions. The results indicate that the gasoline is a luxury commodity for low-income groups. In addition, gasoline is a low attractive commodity for this group.

Keywords: Gasoline, Low-Income Groups, Almost Ideal Demand System

Introduction

One of the biggest problems facing humanity is the shortage of non-renewable groundwater resources. Since alternatives of these resources are available in a long term, if any exist, the only way to survive these resources is optimal utilization of them (Abunouri & shive, 2006). In Iran, billions Rials are spent annually for fuel subsidy; this indicates that a high amount of budget is spent a year, on average, on subsidizing this oil substance. The existence of subsidies and cheap oil resources has led to unrealistic prices and excessive consumption of this product followed by excessive volume of imports into the country (Abunouri & shive, 2006). The analysis of energy demand uses various models, some of which are developed only for the study of energy and some other study its relationship with other factors. The studies conducted to estimate gasoline demand have been mostly econometric with linear functions. In this study, the gasoline demand function is examined using the Almost Ideal Demand System (AIDS), a conventional method to estimate demand functions.

It is noteworthy that petrol price hike for people who are forced to pay the price may lead to a reduction in spending in other commodity groups (due to rising fuel costs). Because low-income group is the most vulnerable group of society to policies, this study examines the effect of gasoline demand for low-income groups and the effect of other commodity groups. To review this research and in order to achieve the research objectives, AIDS is a useful tool to estimate demand functions in recent years. Thus, this study estimates gasoline demand for low-income group of Iranian economy using annual data (1991-2009) by AIDS. Moreover, this study will evaluate price-income elasticity.

In this research effort are made to examine two hypotheses; first, the relationship between gasoline prices and gasoline demand is negative and significant. Second, the relationship between petrol price changes and changes in costs of other commodity groups is positive and significant. After the introduction, several studies conducted in this regard are reviewed. In second section, we will explain the AIDS. The next section examines the research data and computational requirements are expressed in section 4. In section 5, we estimate the model and test constraints. In section 6, we calculate and analyse elasticity and the research results are expressed in section 7.

Literature Review

Deaton and Muellbauer (1980) proposed and estimated AIDS for annual data of England during 1954 and 1974. According to their results, food and housing were essential and other goods and services were luxury. Except for food, other commodities had negative price elasticity; thus, homogeneity hypothesis was rejected.

The first attempt to consider the dynamic behaviour of consumers was made by Roy (1980) inserting the variable household in linear approximation model (AIDS). He conducted his study in India for the period 1952-1996. In both studied rural and urban areas, food, fuel, and brightness were essential commodities; clothing, and other non-edible goods were considered luxury goods. Thus, the homogeneity hypothesis in urban and rural areas was not rejected.

with regard to cost information of six commodity groups including 1) food, beverages, tobacco, 2) clothing, shoes 3) housing, fuel and light, 4) luggage, goods and services used in home, 5) transportation and communication, 6) other goods and services (including health care, recreation, entertainment and cultural services and other goods and services) in urban areas of Iran during 1965-1993, Panahi (1996) attempted to estimate unconstraint equation by weighted least squares (WLS) and constraint models by seemingly unrelated regressions. The related constraints were also tested.

Christopher Nicole (2000) estimated equations of demand system, including demand for gasoline in Canada and United States. Instead of estimating a single equation of gasoline demand, this study modelled demand as a multi-equation demand system.

Gasoline demand gives generally greater responsiveness to changes in price and income, but not for all types of households. When regional differences are observed in elasticity of Canada and America, family size and housing tenure status of households will have more effect on the differences in elasticity.

Davodi and Salem (2006) evaluated the effect of gasoline prices on household welfare in different income deciles. Through a system of demand equations, AIDS, they estimated gasoline demand equation using data from the household budget. They formed a panel data from 1996 to 2004. Their calculations showed that the price elasticity of gasoline was low for all deciles. The income elasticity of gasoline was less than one for all households. That means gasoline was an essential commodity.

Khaksari and Ardebili (2006) estimated fuel demand function in ground transportation using available statistics during 1971-2003 by AIDS. Among the studied areas, the income elasticity of gasoline demand was highest in the road transport sector; this suggested that consumers became more sensitive to changes in this sector compared to other sectors. A slight change in income will increase demand further.

AIDS

Deaton and Muellbauer (1980) introduced AIDS into the economics literature. They did the following steps to extract the above demand system.

1. They stipulated cast, which represents preferences.
2. To extract compensation demand function, they derived cost function specified in the previous step to prices.
3. To extract the indirect utility function, they reversed cost function.
4. Using the indirect utility function, they obtained non-compensatory demand function. To extract AIDS function, they also considered the following cost function.

This system of cost function is in fact the logarithmic form of price-independent generalized linearity (PIGLOG). Usually, costs are considered as a function of utility and prices; here, preference function is defined as the utility and price are separated for failing to comply.

The general form of this function is:

$$Ln\, C(U, P) = (1-U)\, Ln\{a(p)\} + U\; Ln\{b(p)\}$$

where, U and P represent utility and price vector, respectively; a and b are a function of prices that is linear homogeneous concave. These functions are defined as:

$$Ln\, a(p) = \alpha_0 + \sum_{i=1}^{n} \alpha_i Ln\, p_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} Ln\, p_i . Ln\, p_j$$

$$Ln\, b(p) = Ln\, a(p) + \beta_0 \prod_{i=1}^{n} P_i^{\beta_i}$$

Utility is zero for poor and one for wealthy people. Let the utility be equal to zero; Ln a(p) is minimal cost of living. Integrating equations (1) and (2), we have:

$$Ln\, C(U, P) = \alpha_0 + \sum_{i=1}^{n} \alpha_i Ln\, p_i + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} Ln\, p_i . Ln\, p_j + U\beta_0 \prod_{i=1}^{n} P_i^{\beta_i}$$

The cost function is linear homogeneous with respect to prices; therefore, the following constraints hold.

$$\sum_{i=1}^{n} \gamma_{ij} = \sum_{i=1}^{n} \gamma_{ji} = \sum_{i=1}^{n} \beta_i = 0 \qquad , \qquad \sum_{i=1}^{n} \alpha_i = 1$$

Using Shephard's Lemma, the demand function is obtained from equation (3):

$$q_i = \frac{\partial C(U, P)}{\partial p_i} \Rightarrow W_i = \frac{p_i q_i}{C} = \frac{\partial C(U, P)}{\partial p_i} . \frac{P_i}{C} = \frac{\partial Ln\, C}{\partial Ln\, p_i}$$

Thus, contribution of ith commodity in the household budget is equal to partial derivative of cost log to logarithm of the i-th commodity. Let us derivate (3); we have:

$$W_i = \frac{\partial Ln\, C}{\partial\, Ln\, p_i} = \alpha_0 + \sum_{j=1}^{n} \gamma_{ij} Ln\, p_j + \beta_i U \beta_0 \prod_{i=1}^{n} P_i^{\beta_i} \qquad (6)$$

Based on this relation, the contribution of expenditure on each commodity is a function of prices and utility.

Obtaining utility from equation (3) and substituting in equation (6), the contribution of each commodity in the entire budget is obtained in terms of P and M, as:

$$w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} Logp_i + \beta_i Log(\frac{M}{p^*})$$

In this method, all equations are estimated together and continuously. The model is modified as equation (7) where wi is the cost of ith commodity group to the total household expenditure. Pi represents price of ith commodity group, M is the household expenditures and p* is Stone price index which is calculated as follows:

$$W_{it} = \alpha_i^* + \sum \gamma_{ij} Log\; P_{it} + \beta_i Log\; \left(x / p\right) + U_i$$

A proper form to estimate demand functions is the linear form of AIDS. Linear approximation of AIDS model can be static or dynamic. The most proper functional form of static AIDS is as follows:

$$W_{it} = \alpha_i^{*} + \sum \gamma_{ij} Log\ P_{it} + \beta_i Log\ (x / p) + U_i$$

where, the term Ui is the disturbancce term and $\alpha_i = \alpha_i - \beta_i \alpha_i$.

Deaton and Muellbauer claimed that the static form might not provide a quite satisfactory description of consumer behaviour, because the dynamic aspects of consumer behaviour are ignored. Functional form of dynamic AIDS can be written as follows.

$$W_{it} = \alpha_i^{*} + \sum \gamma_{ij} Log\ P_{it} + \beta_i Log\ (x / p) + ØW_{it-1} U_i$$

Empirical estimation of different AIDSs showed that the dynamic form in which the costs of each commodity group appears with a pause as an explanatory variable (as above) is more suitable. This explanatory variable shows the effect of consumer habits during years before the current consumption.

Data

To evaluate the effects of changes in gasoline prices on allocation of essential commodities to urban low-income groups, this study requires individual information and data from household budget. The purpose of the present study is to review these statistics using time series data from 1991-2009.

Statistic body of household budget includes statistical information on household income and expenditure relating to eight groups, which makes it very convenient to estimate demand functions. Commodity groups include food, clothing and footwear, housing, furniture, health, transportation and communication, study and entertainment and other commodities.

Other data needed to estimate the demand function is price index, extracted from Central Bank for 1991-2009. In this study, the base year is 1997.

Since the basic approach in this study is the household commodities, the first step is to determine the commodities. To do this, the household commodities are organized based on average expenses of income groups for a single commodity. The group of commodity assigned the most contribution of total household expenditure is selected as the essential commodity. These groups include food, clothing, housing, gasoline and other commodity groups. Considering the importance of third and sixth groups in which gasoline expenditures exists, thus gasoline expenditures are separated and independently evaluated. Other groups in addition to those two groups, except for gasoline expenditures, are integrated as other commodities.

As noted earlier, this information is related to separate income deciles. To determine low-income groups, the geometric mean of the first third of income decile is classified as lower income group. Price index for other commodities is obtained from geometric mean of price indices related to this group.

Durability of Variables

Durability of variables has a special place in the analysis of time series and includes an extensive literature. Employing traditional methods and typical econometrics in estimating model coefficients using time series data, based on the assumption that the variables are durable. A variable time series is durable if mean, variance and autocorrelation coefficients remain constant over time. If the time series variables used in the estimation of model coefficients are durable, while there may be no significant relationship in the model, the coefficient of determination R2 will be very high, and it can lead to incorrect inferences about the relationship between variables. ADF test is strongly influenced by intercept and the trend and it provides deviated results in many cases; thus, this study tested variables by KPSS test. H0 and its alternative hypothesis are defined in the KPSS test as follows:

$$H_1: \delta^2{}_4 > 0 \rightarrow y_t \approx I(1)$$

$$H_0: \delta^2{}_4 = 0 \rightarrow y_t \approx I(0)$$

KPSS (1992) is different from other unit root tests in the assumption that variable yt is static. KPSS statistic is based on errors. LM statistic is defined as follows:

$$LM = \frac{\sum_t S(t)^2}{T^2 F0}$$

, F0 is an estimator of error spectrum under zero frequency and S(t) is the cumulative error function.

$$U_r S \ (t) = \sum\nolimits^t_{\gamma=1}$$

where, Ut is the regression residual of λ2yt defined as λ2=T2F0. The consistent estimator of the long-term variance is Ut. The result of this test is shown in Table (1) in which M1 represents costs (income) of the low-income group, P11 to P41, respectively, are price indices for food, clothing, housing, and gasoline and W110 and W410, respectively, represent contribution of expenditure on the commodity groups in the total household expenditure.

Table 1: durability of variables using KPSS test

Results	10%	5%	1%	KPSS	Durability
Non-durable	0.347	0.463	0.739	0.6402	W110
Durable	0.347	0.463	0.739	0.177	W210
Durable	0.347	0.463	0.739	0.444	W310
Non-durable	0.119	0.146	0.216	0.1742	W410
Non-durable	0.347	0.463	0.739	0.565	P11
Non-durable	0.347	0.463	0.739	0.576	P21
Non-durable	0.347	0.463	0.739	0.549	P31
Non-durable	0.347	0.463	0.739	0.5397	P41
Non-durable	0.347	0.463	0.739	0.5682	P51
Non-durable	0.347	0.463	0.739	0.5584	M1

As shown in Table 1, all variables are non-durable, except for clothing and housing. Given that, almost all variables are non-durable, durability of variables needs to be tested to create an appropriate model. Table 2 shows the results.

Table 2: durability of the first-order differential variables using KPSS test

Result	10%	5%	1%	KPSS	Variable
Durable	0.347	0.463	0.739	0.408024	D(W110)
Durable	0.347	0.463	0.739	0.439179	D(W410)
Durable	0.347	0.463	0.739	0.115497	D(P11)
Durable	0.347	0.463	0.739	0.179295	D(P21)
Durable	0.347	0.463	0.739	0.102503	D(P31)
Durable	0.347	0.463	0.739	0.10461	D(P41)
Durable	0.347	0.463	0.739	0.323485	D(P51)
Durable	0.347	0.463	0.739	0.4584	D(M1)

Thus, the results in Table 2 indicate that all the variables of the model, except for clothing and housing (which already proved to be durable) are durable with the first-order difference and the model is ready to be estimated.

Computational Requirements

In order to estimate the system of equations, expenditure of commodity groups, disturbance vector u, is added to the system of equations; thus, a stochastic model is created. Exemplary contribution in the ith equation is obtained from the real contribution in addition to ui disturbance. Assuming that u≈N(0, ∂2I) and ∂2I are the variance-covariance matrix of error which is nn and symmetric, thus:

$$s_i = g(v_t, \vartheta) + u_t$$

where, s=(s1, …, sn)’, g(ν,ϑ)=(g1(ν,ϑ), …, gn(ν,ϑ))’ are the vector of parameters which are to be estimated; g1(ν,ϑ) is the same term right of the equation.

Given the assumptions for ui, although there may be a correlation between the components of disturbance at time t, there is no autocorrelation between the components of disturbance. Based on the above assumptions and considering the adding-up of equation system, covariance matrix of disturbances is expected to be singular and estimation of coefficients becomes impossible. To solve this, one equation is removed from the system; eventually, the removed equation will be obtained from four other models. The important thing here is the lack of sensitivity of results to the removed equation. Thus, parameters of the removed equation can be obtained by the constraints.

Another point to be noted is the distributional form assumed for error term. Because the studied functions are related to contribution and values of contributions ranges from zero to one, the error term cannot be exactly normally distributed; however, as Davidson and Macckinnon (1993) showed, the normal distribution can be used in statistical analysis if exemplar samples are not close to zero or one.

Estimation of the Model

In this study, the linear form of AIDS is estimated using seemingly unrelated regressions (SUR) and then the classical constraints are imposed.

As noted earlier, this study used a linear form of AIDS to estimate the structural parameters of demand equations. The model used in this study is as follows:

W1jt=C(1)+C(11)*LOG(P11)+C(12)*LOG(P21)+C(13)*LOG(P31)+C(14)*LOG(P41)+C(15)* LOG(P51)+C(16)*(LOG(M1)-P10)+C(17)*W110(-1)+u

W2jt=C(2)+C(12)*LOG(P11)+C(22)*LOG(P21)+C(23)*LOG(P31)+C(24)*LOG(P41)+C(25)* LOG(P51)+C(26)*(LOG(M1)-P10)+C(27)*W210(-1)+u

W3jt=C(3)+C(31)*LOG(P11)+C(23)*LOG(P21)+C(33)*LOG(P31)+C(34)*LOG(P41)+C(35)* LOG(P51)+C(36)*(LOG(M1)-P10)+C(38) *W310(-1)+u

W4jt=C(4)+C(14)*LOG(P11)+C(42)*LOG(P21)+C(43)* LOG(P31)+C(44)* LOG(P41)+C(45)* LOG(P51)+C(46)*(LOG(M1)-p10)+C(47)*W410(-1)+u

where, W1jt represents expenditure of jth commodity at time t; P1t is price index of food at time t; P2t is the price index of clothing at time t; P3t represents price index of housing at time t; P4t is the price index of gasoline at time t; Mt is total expenditures at time t; Pit* denotes the Stone price index; finally, Wij(-1) is expenditures of the jth commodity at the previous period.

As noted, this study evaluates demand of essential commodities in Iranian low-income groups. By data series related to 1991-2009 and AIDS, equations of expenditures on household commodities were estimated using SUR. One of the most important economic applications of SUR models is to estimate the systems of demand equations as well as Tranzlag cost functions. The correlation between demand equations is an invisible characteristic of household which influences consumption behaviour.

It is noteworthy that the results from income coefficients of the unconstraint model are not reliable, because the classic assumption of demand is not inserted in the model. Therefore, it is necessary to test classic demand constraints in the system of equations; if rejected, the constraints will be inserted and elasticity will be analysed by new coefficients based on the inserted constraints.

Governing Constraints on the System of Demand Equations in AIDS

Since AIDS model does not follow the condition to maximize utility with respect to a certain level of income, there is no reason to apply the theoretical constraints of demand such as adding-up (budget), constraints of homogeneity and symmetry constraints on the system of equations. For consistency of demand functions and validation of preferences, some limitations can be inserted in the model. In the AIDS model, these limitations include budget constraint (collective constraint), homogeneity and asymmetry constraints, which will be explained in the following.

Adding-up Constraint

This constraint is expressed as follows:

$$\sum \alpha_i = 1, \ \sum \beta_i = 0, \ \sum \gamma_{ij} = 0$$

This constraint indicates that the total contribution of commodities to total expenditures is equal to one in this system. This constraint is automatically inserted in the AIDS system.

Homogeneity Constraint

A demand function must be homogeneous to prices and income (total expenditure) with zero degree. This means that the assumption of continuity and consistency of selection has ruled out the presence of money illusion. Therefore, testing this constraint practically means the presence or absence of money illusion.

The results of the homogeneity assumption using Wald tests show that the hypothesis was accepted for all commodity groups. This indicates the lack of money illusion in this income group. The results are presented in Table 3.

Table 3: homogeneity constraint test in system of equations for low-income group

Result	prob	chi-square	Group
Accepted	0.25	1.3	Food
Accepted	0.36	0.808	Clothing
Accepted	0.71	0.134	Housing
Accepted	0.06	3.45	gasoline

Symmetry Constraint

This symmetry constraint shows Slutsky matrix arrays. This constraint is a mandatory requirement in calculating Marshall and Hicks elasticity.

Table 4: symmetry test in system of equations for low-income groups

Result	prob	chi-square	Hypothesis
Accepted	0.08	2.92	C(12)=C(21)
Accepted	0.39	0.73	C(13)=C(31)
Accepted	0.6	0.26	C(14)=C(41)
Accepted	0.2	1.64	C(23)=C(32)
Accepted	0.83	0.045	C(24)=C(42)
Accepted	0.98	0.00034	C(34)=C(43)

$$\gamma_{ij} = \gamma_{ji}$$

The results of the symmetry assumption using Wald tests show that the hypothesis was accepted for all commodity groups. The results are presented in Table 4.

Estimation of System of Constrain AIDS Equations

This section estimates the constrain model of equation system. By symmetry constraints imposed on the coefficients of the system of equations as well as the homogeneous constraint in equations in which is violated, the system model is re-estimated (considering the results from testing constraints, it is not required to insert them for this income group). It is noteworthy that coefficients of parameters related to other commodities are calculated by adding-up constraint. The results are shown in Table 5.

Table 5: results of estimation

DW	R^2	(LOG(M1)-P10)	LOG(P51)	LOG(P41)	LOG(P31)	LOG(P21)	LOG(P11)	α	Commodity group
1.83303	0.828748	-0.041243	-0.01287	0.015875	0.002699	0.076221	- 0.09701	0.825808	Food
2.00102	0.844662	-0.023491	-0.00652	-0.00324	-0.01084	0.02539	-0.00083	0.293438	Clothing
1.70483	0.677706	0.024887	0.004339	-0.001	-0.06069	-0.06069	0.066984	0.068659	Housing
2.14328	0.905683	0.002069	0.00065	0.00016	-0.002	-0.00045	0.00201	-0.02368	Gasoline

The estimated model revealed that the coefficient of determination R2, which is from the good explanatory power of the model, is well fitted by the equations. Moreover, Durbin-Watson statistic was used to discover auto-regression, which indicates the lack of auto-regression in estimated equations.

According to the above table, gasoline price index suggests 0.015% increase in contribution of food group if gasoline price index increases by 1% keeping real household expenditures constant. Contribution of clothing group will also decrease by 0.003%. There will be also 0.004% increase and 0.0006% increase in housing group.

Variations in real expenditures are visible through Bi coefficients. The commodity will be luxury if Bi≥0; otherwise, it will be essential.

Except for Bi which is interpreted as income elasticity, economic interpretation of parameters estimated in AIDS is not possible directly; thus, different elasticities are estimated and interpreted.

Calculation of Price and Income Elasticity

Given that AIDS parameters cannot be interpreted directly, different elasticities are estimated and interpreted. Several formulas have been proposed for calculating price elasticities (compensatory and non-compensatory) and expenses including Chalfant-Griffin and Aston Greene formulas. Biose fully explained how to calculate the uncompensated price elasticities. Based on Monte Carlo experiments, he evaluated conventional formula for calculating the price and income elasticities and his proposed formula. He concluded that price elasticity formula suggested by Chalfant is more suitable than others are.

Moreover, the simplest measure for evaluating the effect of expenditure variations on demand is the total expenditure elasticity.

Measurement of Marshal Elasticity for the Constrained Model

Table 6 presents uncompensated self-price elasticity related to low-income group. The elasticity is extracted by common demand functions. Reviewing price elasticities show that demand price elasticity is negative in all groups and demand law is not violated in none of the groups.

By reviewing Table 6, it can be concluded that there is a high sensitivity to changes in food price index followed by housing price index. The price elasticity of the former is -1.2 and the latter is -1.05. The price index of gasoline is -0.9 which is low.

Table 6: marshal elasticity of AIDS by inserting the Slutsky symmetry, homogeneity, and adding-up constraints

Price index	Self-price factor	Income factor	Consumption (mean)	Commodity
-1.20343796	-0.097016	-0.041243	0.3965	Food
-0.53409743	0.02539	-0.023491	0.05739	Clothing
-1.05834798	-0.012233	0.024887	0.36559	Housing
-0.94864663	0.00016	0.002069	0.002995	Gasoline
-0.5685869	0.083699	0.037778	0.17839	others

Measurement of Constrained Income Elasticity

Uncompensated self-price elasticity related to low-income group is shown in Table 7.

According to the results shown in the table, food and clothing are essential commodities. Moreover, housing is considered as a luxury commodity.

More importantly, income elasticity related to gasoline is clearly different from other income groups. This confirms the different significance of gasoline. In the low-income group, gasoline is considered as an essential commodity.

Table 7: income elasticity of AIDS by inserting Slutsky symmetry constraint for low-income group

Type	Income elasticity	Income factor	Consumption (mean)	Commodity group
Essential	0.895982346	-0.041243	0.3965	Food
Essential	0.590677818	-0.023491	0.05739	Clothing
Luxury	1.068073525	0.024887	0.36559	Housing
Luxury	1.69081803	0.002069	0.002995	Gasoline
Luxury	1.21177196	0.037778	0.17839	Others

Conclusion

By testing homogeneity and symmetry constraints, it was clear that hypotheses were rejected for none of the groups. Considering the information and results from estimations, it was discovered that it is not possible to interpret coefficients of parameters estimated in AIDS directly. Therefore, different elasticities are estimated and interpreted. It can be concluded that food and clothing are an essential commodity for the low-income group. Moreover, housing is considered as a luxury commodity for this income group. Gasoline is a luxury commodity for the low-income group. Considering the coefficients of real expenditures, increase in gasoline price will increase contribution of expenditures in the low-income group.

In this group, the highest and lowest price elasticity is related to food and clothing, respectively.

For gasoline which is the focus of this study, the price elasticity is -0.94, which is considerably close to one. This indicates that, although a commodity is considered with low elasticity, it is partially sensitive to price changes (compared to other income groups). Increase in gasoline price will be followed by highest reduction in consumption by this income group.

According to above, the first hypothesis that there is a negative significant relationship between gasoline price and gasoline demand is supported for this income group. In contrast, the second hypothesis that there is a positive significant relationship between gasoline price and expenditures of other groups is not supported, because the relationship is negative for some commodities.

Recommendation

Because price elasticity of gasoline is low in the low-income group, effectiveness of price policies on gasoline demand is not proper. In addition, rapid increase in gasoline price is not recommended, because this will increases expenses of the low-income groups in short term.

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