Welfare Effects of Food Desubsidization for Iranian Urban Households

(The Index Number and Demand System Approach)

Aliakbar Khosravinejad, PhD[1]
Assistant Professor of Economics,
Azad University, Central Tehran Branch
&
Institute for Trade Studies and Research

Abstract

Designing a system of policies for basic goods subsidy adjustments and welfare effects of subsidy reduction widely accentuate by Iranian policy makers and economists. This article tries to answer to the one of the main questions of this matter such as "what the equivalent amount of money for compensative welfare loss of household is through eliminating bread, sugar and oil subsidies?" By using microeconomic methodology and with regards to the theoretical literature of welfare indices, demand systems and household clustering, we cluster household base on homogeneity of consumption behaviors and estimate linear approximate almost ideal demand systems (LA\AIDS) for different clusters in five independent groups and also compute welfare indices (equivalent income, compensated variation and the cost of living index). After that, we analyze results of bread, sugar and edible oils price adjustment in five groups of households. For cluster one to three, relative effects of bread price is greater than sugar and edible oils and for clusters four and five, relative effect for edible oils is greater than bread and sugar. Finally, we introduce "Policy Effects Matrix" for bread and conclude that its price adjustment policy is decreasing from cluster one to five.

Keywords

Welfare Indices, Compensated Variation, Cost of Living Index, Demand System, Subsidy

[1]- ***khosravinejad@gmail.com***

1- Introduction

The measurement of welfare forms the basis of public policy analysis. Planning of taxes, subsidies, transfer program, health care reform, regulation, social security system, and educational reform must ultimately address the question of how these policies affect the well-being of individuals[1]. Cost of living indices are an effective tool for measuring welfare effects. But these index numbers for individual households can be expected to differ substantially.

In the last three decades, great improvement yielded in development of welfare measurement indices that in the initial form are equivalent to household utility. The fact that consumption patterns vary by income level means that welfare effects also vary for different income groups when commodity prices change. Under these conditions, aggregate demand analysis is not very useful and may be misleading if policy makers are concerned with the effects of these adjustments on the well-being of specific target groups. Specific demand parameters by income group can be used not only to measure accurately the welfare effects caused by given price policies but they also allow the design of compensation schemes for the poor based on specific commodities. These welfare indices don't have consumer surplus limitations and also, implementation of them is easier relative to consumer surplus indices. In the noted methods, welfare changes base on the household behavior and measure with econometric or number indices. Generally, we can claim existence of close relation between applied demand subjects (static and intergenerational) and general welfare matters[2].

The process of liberalizing the agricultural sector is continuing in progress in many countries. Budget and macroeconomic imbalances and the high costs of agricultural support programs, in the process of globalization, are the main reasons for this change in policy. In the transition from governmental to private and market base economy, liberalization of different sectors of economy is the necessary condition for this transition. In this road we should implement some adjustment in economic system such as price structures adjustment and welfare effects of it, a problem encounter to Iranian policy makers. Designation a system of policies for basic good subsidy adjustments, have a high priority for Iranian policymakers. This paper use Microeconomics methodology for calculation of Compensated Variation of food commodities in income groups by clustering Iranian urban households. Because price adjustment is along with gradual subsidy reduction in a distinct time process, so, measurement of national welfare change for provision of

[1]- Slesnick, T.D. (1998).
[2]- Pinstrup-Andersen, A. et al., (1976).

compensative systems has a high importance. Subsidy provision or cutting off, coverage of subsidy system for households, protected sectors, amount of subsidy, provision methods and other, are the main subjects of policy makers in this area. Because these reforms are likely to lead to food price adjustments, the aim of this study is answer to this question that "what is the equivalent amount of money for compensative welfare loss of household through eliminating bread, sugar and oil subsidies?" These are essential food items and nearly 90 percent of Iranian food subsidy volume is devoted to them.

In this paper we have three basic objectives. First, selection and development of classifying procedures, Second, analyzing food expenditure patterns and structure of demand for different income groups utilizing urban household data, and third, calculation of the compensated variation, cost of living index and equivalent income for urban population in different income group.

The plan of this paper is as follows. After introduction, section II review some main studies and section III pays attention to the linear approximate almost ideal demand systems (LA\AIDS) model. Also welfare indices will be explored in this section. Section IV devoted to the data and clustering issues and after that, in section V we present estimation of demand system for five income groups. Finally, section VI show the calculation of welfare indices in two (50%) and (100%) scenario of price adjustment. The article finishes with a conclusion.

2- Review of Literature

King (1983) in his analysis discussed a methodology for calculating the distribution of gains and losses from a policy change using data for a large sample of households. Estimates were based on the equivalent income function, which was money metric utility defined over observable variables. Equivalent income is related to measures of deadweight loss, and standard errors are computed for each of the welfare measures. Finally he simulated U.K. data for 5,895 households for a reform that involves eliminating housing subsidies.

Vertia (1983) considered a utility maximizing consumer with a completely known system of ordinary demand functions $q=h(p,C)$. When (p^0, q^0) and (p', q') be two arbitrary equilibrium situations; he solved evaluation problem of the situations the utility is higher without knowing the utility function. He presented how the compensated income $Ci=C\ (p^1,q^0)$ and the compensated demand $\bar{q}=h(p',C^1)$ are calculated with arbitrary accuracy using only the ordinary demand system. His two efficient algorithms also have interesting interpretations in terms of index numbers and consumer surplus measures.

Bulk (1990) presented a method for calculating cost-of-living index numbers for arbitrary base period income levels without using heavy econometric estimation methods. He showed that the second order approximation formulas contain parameters which can easily be estimated by a differential demand system and by using a suitable specification; it is possible to work at a low level of commodity aggregation. His method is demonstrated on Netherlands data for the period 1952-1981.

Jorgensen (1990) described a new approach to normative economics, combining the theory of social choice with econometric modeling of aggregate consumer behavior. He first derives a system of aggregate demand functions by exact aggregation over individual demand functions and then constructs measures of individual welfare from systems of individual demand functions. Finally, he incorporates these measures into a social welfare function, introducing ethical assumptions based on horizontal and vertical equity. To illustrate the application of this approach, he considers the U.S. standard of living and its cost over the period 1947-1985.

Banks, Blundell and Lewbel (1996) showed that the exact measurement of the welfare costs of tax and price reform require a detailed knowledge of individual preferences. Typically, first order approximations of welfare costs are calculated avoiding detailed knowledge of substitution effects. They drive second order approximations which, unlike first order approximations, require knowledge of the distribution of substitution elasticities. Also they were ask to what extent simple approximations can be used to measure the welfare costs of tax reform and evaluates the magnitude of the biases for a plausible size tax reform. In their empirical examples first order approximations display systematic biases; second order approximations always work well.

Jensen and Manrique (1998) performed an analysis of the structure of demand was on household data, classified into income groups for urban Indonesia in eight (Meat, Dairy, Rice, Fruits, Fish, Palawija, other-food and non-food) commodities. They presented a methodology for classifying households in income groups. Then, they use demographically augmented linearized almost ideal demand system (AIDS) to estimate the structural parameters. Also endogenous switching regression techniques yielded unbiased and consistent demand parameter estimates for the low-income group, which had a large number of zeros for some food groups. In addition, they use seemingly unrelated equation (SUR) techniques to estimate the demand parameters for the other income groups. Their results show demands for the medium to high- and high-income households to be responsive to prices, income and demographic variables. Demands for the medium to low-income households were responsive to income and prices only. Demands for low-income households were responsive to income and prices of rice and fish only.

In his paper, Creedy (2004) reported estimates of the potential welfare effects of hypothetical increases in the petrol excise tax in New Zealand. He computes equivalent variations, for a range of household types and total expenditure levels along with distributional measures. Also he modelled Household demand responses by using the Linear Expenditure System (LES), where parameters vary by total expenditure level and household type. Finally, he founds negligible effects on inequality, as the marginal excess burdens typically ranged between 35 and 55 cents per dollar of additional revenue.

3- Almost Ideal Demand System and Welfare Indices

Deaton and Muellbauer (1980) develop the AIDS model using a general algorithm for demand system, 1- specify the Price Independent Generalized (PIGLOG) expenditure function[1] as shown in equation (1), 2-differentiate with respect to price to get compensated demand, 3-invert the expenditure function to get the indirect utility function, v , and 4- use v to uncompensated the demands.

$$\ln c(u,p) = \alpha_0 + \sum_{k=1}^{n} \alpha_k \ln p_k + \frac{1}{2}\sum_{k=1}^{n}\sum_{j=1}^{n} \ln p_k \ln p_j + u\beta_0 \prod_{k=1}^{n} p_k^{\beta_k} \qquad (1)$$

The derived share equation is:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_j \ln(M/P) \qquad (2)$$

Where w_i is the budget (expenditure) share of the i_{th} good, p_j is the nominal price of the j_{th} good, *lnM* is total expenditure, and *lnP* is the Translog price index defined by:

$$\ln P = \alpha_0 + \sum_j \alpha_j \ln p_j + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j \qquad (3)$$

As a linear approximation to this demand system, Deaton and Muellbauer utilized Stone's index ($\ln P_j^* = \sum_{j=1}^{n} w_j \ln p_j$), where P^* is assumed to be approximately to P. The equation (2) is redefined as:

$$w_i = \alpha^*{}_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln(M/P^*) \qquad (4)$$

Where $\alpha^*{}_i = \alpha_i - \beta_i \alpha_0$. Equation (4) will be referred to as the Linear Approximate Almost Ideal Demand System (LA\AIDS). The conditions which are required to make the model consistent with demand theory are

[1]- Muellbauer, J. (1976).

$$\sum_j \gamma_{ij} = 0, \quad \sum_i \beta_i = 0, \quad \sum_i \alpha_{ij} = 1 \qquad \text{Adding Up} \qquad (5)$$

$$\sum_j \gamma_{ij} = 0 \qquad \text{Homogeneity} \qquad (6)$$

$$\gamma_{ij} = \gamma_{ji} \qquad \text{Symmetry} \qquad (7)$$

Linear restrictions (6) and (7) may be tested by standard techniques, where as condition (5) is imposed by the model and so is not testable. The uncompensated own, cross-price, and income (expenditure) elasticities for this system are. The equations (8) to (10), respectively.

$$\varepsilon_{ii} = \frac{\gamma_{ij}}{w_i} - \beta_i - 1 \qquad (8)$$

$$\varepsilon_{ij} = \frac{\gamma_{ij}}{w_i} - \beta_i \left(\frac{w_j}{w_i}\right) \qquad (9)$$

$$\eta_i = 1 + \frac{\beta_i}{w_i} \qquad (10)$$

Welfare Indices

According to King (1983), household preferences may be represented by either the direct or indirect utility function which are denoted, respectively, by

$$u = u\,(q) \qquad (11)$$

And,

$$v = v\,(p,M) \qquad (12)$$

We compare household's welfare levels in the face of different consumption sets. To do this, we choose a reference price vector, denoted by $p^{r\cdot}$ The choice of the reference price vector is arbitrary, although as we shall argue below equivalent income. For a given budget constraint *(p,M)* , equivalent income, is defined as that level of income which , at the reference price vector, affords the same level of utility as can be attained under the given budget constraint. Formally,

$$v(p^r,M_E) = v\,(p,M) \qquad (13)$$

Inverting the indirect utility function we obtain equivalent income in terms of the expenditures function:

$$M_E = e\,(p^r,v) \qquad (14)$$

Combining (13) and (14),

$$M_E=f(p^r,p,M). \qquad (15)$$

This definition of equivalent income has been suggested by Varian (1980). It is very similar to the concept proposed by McKenzie (1956) which was later christened "money metric utility", by Samuelson (1974), and which is defined by,

$$m \equiv e(p^r, u) \qquad (16)$$

Substituting from (11), we obtain:

m = g (p^r,q) (17)

The main advantage of using the equivalent income function is that it makes computations extremely easy because preferences affect only the form of the function *f* and the arguments of the function depend only upon the reform under consideration and are completely independent of preferences.

Equivalent Income for AIDS

Refer to Willig (1976) and King (1983), assume that the consumer behaves as though he were choosing his consumption basket $q=q^0$, to maximize his direct utility function (11) subject to budget constraint. So in this situation he spend all of his money income, so c*(u,p)=M*, and take logarithm we have,

ln c(u,p) = ln M (18)

The left hand side of equations (1) and (18) are equal combing both equations,

$$\ln M = \alpha_0 + \sum \alpha_k \ln p_k + \frac{1}{2}\sum_k \sum_j \ln p_k \ln p_j + u^0 \beta_0 \prod_{k=1}^{n} p_k^{\beta_k}$$

$$u^0 \beta_0 \prod_k p_k^{\beta_k} = \ln M - \alpha_0 - \sum_k \alpha_k \ln p_k - \frac{1}{2}\sum_k \sum_j \gamma_{kt} \ln p_k \ln p_j \quad (19)$$

$$v(p,M) = u^0 = \frac{1}{\beta_0 \prod_k p_k^{\beta_k}}[\ln M - \alpha_0 - \sum_k \alpha_k \ln p_k - \frac{1}{2}\sum_k \sum_j \gamma_{kj} \ln p_k \ln p_j] \quad (20)$$

Redefine the equation (19) by reference price p^r,

$$u^0 \beta_0 \prod_k p_k^{r^{\beta_k}} = \ln M_E - \alpha_0 - \sum \alpha_k \ln p_k^r - \frac{1}{2}\sum_k \sum_j \gamma_{kj} \ln p_k^r \ln p_j^r \quad (21)$$

And solving (21) for u^0 obtains,

$$v(p^r, M_E) = u^0 =$$

$$\frac{1}{\beta_0 \prod p_k^{r^{\beta_k}}}[\ln M_E - \alpha_0 - \sum \alpha_k \ln p_k^r - \sum_k \sum_j \gamma_{kj} \ln p_k^r \ln p_j^r] \quad (22)$$

Combining (20) and (22) we get equivalent income for the AIDS as below,

$$\ln M_E = \alpha_0 + \sum \alpha_k \ln p_k^r + \frac{1}{2}\sum_j \sum_j \gamma_{kj} \ln p_h^r \ln p_j^r$$

$$\prod_k (\frac{p_k^r}{p_k})^{\beta_k} [\ln M - \alpha_0 - \sum_k \alpha_k \ln p_k - \frac{1}{2}\sum_k \sum_j \gamma_{kj} \ln p_k \ln p_j]. \quad (23)$$

Compensating Variation for AIDS

The compensating variation is the amount of money which household would need to be given at the new set of price in order to attain the pre-reform level of utility. In terms of expenditure function it is defined by,

$$CV = c(u^0, p^1) - c(u^0, p^0) = c(u^0, p^1) - M_0 \quad (24)$$

With regard to equation (1), when we revise price for after reform period (denoted by one) and utility for reference period (denoted by zero), we have,

$$\ln c(u^0, p^1) = \alpha_0 + \sum \alpha_k \ln p_k^1 + \frac{1}{2}\sum_k \sum_j \gamma_{ij} \ln p_k^1 \ln p_j^1 + u^0 \beta_0 \prod_k (p_k^1)^{\beta_k} \quad (25)$$

Also combining u^0 from equation (20) in equation (25), we get,

$$\ln c(u^0, p^1) = \alpha_0 + \sum \alpha_k \ln p_k^1 + \frac{1}{2}\sum_j \sum_j \gamma_{kj} \ln p_h^1 \ln p_j^1$$

$$+\prod_k (\frac{p_k^1}{p_k^0})^{\beta_k} [\ln M - \alpha_0 - \sum_k \alpha_h \ln p_k^0 - \frac{1}{2}\sum_h \sum_j \gamma_{hi} \ln p_k^0 \ln p_j^0] \quad (26)$$

Equation (26) is equivalent income, so we can write,

$$\ln c(u^0, p^1) = \ln M_1$$

$$c(u^0, p^1) = M_1 \quad (27)$$

Combining (24) and (27), compensating variation equation is,

$$CV = M_1 - M_0 \quad (28)$$

Equation (28) shows the relation between compensating variation and equivalent income functions. In other word, we can compute equivalent income from equation (23) and then compute compensating variation by (28). This procedure sorely reduces the complexity of calculation and its deviations.

True Cost of Living Index and Compensating Variation Relations

The cost of living index is the ratio of the minimum expenditures necessary to reach the reference indifference curve at the two sets of prices. Hence, if u^0 is the label of the indifference curve taken as reference, the true cost of living index number is given by,

$$p(p^1, p^0 | u^0) = \frac{c(p^1, u^0)}{c(p^0, u^0)} \quad (29)$$

Multiplying and Subtracting both side of equation (29) by $c\ (p^0,u^0)$ gives,

$$c(u^0, p^0)\, p(p^1, p^0 | u^0) - c(p^0, u^0) = c(u^0, p^1) - c(u^0, p^0) \quad (30)$$

The right hand side of equation (30) is compensating variation thus,

$$c(u^0, p^0)\, p(p^1, p^0 | u^0) - c(p^0, u^0) = CV$$

And,

$$p(p^1, p^0 | u^0) = \frac{c(p^0, u^0) + CV}{c(p^0, u^0)} \quad (31)$$

We have $c(p^0,u^0)=M_0$ by using the definition of expenditure in reference period,

$$p(p^1, p^0 | u^0) = \frac{M_0 + CV}{M_0} = \frac{M_1}{M_0}. \qquad (32)$$

4- Data and Clustering Issues

Data Issue

In this study we used the *Urban and Rural Household Income and Expenditure Survey (URHIES)*, from the Statistical Center of Iran (SCI). The *URHIES* project aims to estimate the average income and expenditure of urban and rural households at national and provincial level. The survey's target population included all private households residing in urban and rural areas and the methodology adopted was the two-stage cluster sampling. For the first stage the sampling unit was *block* in urban areas and villages with block maps, and the *village* itself for the remaining rural areas; while for the second stage the selected unit was the *household*. The number of samples was optimized according to the survey's objective – estimating household average annual income and expenditure. To come to estimates more representative of the total year, the samples were distributed over months of the years. This survey makes it possible to examine the combination and distribution of household expenditure and income, recognize household's pattern of consumption, compute the importance coefficient of each item in the household basket of consumption, determine the poverty line, and study such cases as difference in facilities and income between households.

Six commodity groups formed the basis of the analysis: bread, dairy (milk, cheese and egg), sugar, edible oils, other-foods and non-foods products. These commodity groups had similar nutritional components or source, were important to food policy concerns. In this study, we used "Unit Values" (expenditures divided by quantities) as "Prices" for bread, dairy products (milk, cheese and egg), sugar and edible oils. For calculation of other-food and non-food commodity group price, we use a weighted average of these commodity prices (without considering food commodities), using the index price data of Iran Central Bank for urban, which weighted are respective budget shares.

Clustering Issue

Because behaviour individual households can be expected to differ substantially, there are various reasons for implementation of clustering issue. In some of applied studies, researchers use average expenditure as a representative level of income and assume that the approximation error is small. Result of this assumption is the ignorance of the effects of income distribution in aggregate demand analysis and welfare indices computation. This error, however, is minimized only if the expenditure distribution and the demographic composition remain relatively constant[1], the assumptions that generally do not hold. Second, prices paid for the same commodities can vary between households just because each household has it own preference structure implying its own substitution behavior in the presence of changing prices. Third, income differences between household imply differences in consumption patterns. Fourth, from the policy making aspects, the results of aggregate data don't give enough contribution in implementing of public policies. Clustering can address the inefficiency of protective systems through designation of effective identification and targeting methods[2].

On the object of the study, methodology of the clustering is different. In the district of microeconomic theories of consumer behaviour and demand function, main methodology is Jarque (1987) and Jensen and Manrique (1998) that offer two different methodologies for household clustering. In this study we use the later applicable methodology that is compatible with our objectives. Jensen and Manrique (1998) assume that Differences in household behavior, as expressed by differences in income and household characteristics in the acquisition of goods, were the fundamental criterion behind this classification. Households showing similar consumption behaviors were classified as belonging to the same income group. The method for classifying households into income groups was based on an analysis of homogeneity of variances of residuals from these Engel regressions. The procedure has two basic steps: estimation of Engel relations and tests for homoscedasticity of variances.

We regressed the equation $EF=f(E,Z)$ where EF_i and E_i are food expenditure and total expenditure per household, respectively. Also, Z is a k dimension vector of demographic, social and economic characteristics. After running above equation in linear specification on data of household separately for each year, the households grouped in five mutually independent clusters as shown in table (1),

[1]- Deaton; A. and Muellbaure, J., (1980b)

[2]- ***Please refer to "from Targeting to Clustering", the other article that will be presented in the International Conference on Policy Modeling (2008) by Khosravinejad, A. and A. Maleki.***

Table (1) - Distribution of Households Income and Number in Five Clusters

	Cluster 1	*Cluster 2*	*Cluster 3*	*Cluster 4*	*Cluster 5*
Minimum	278724	4548398	8823911	13127770	22428834
Maximum	1212293	19007949	28582474	45684111	92390574
Domains	11843569	14459551	19758563	32556341	69961740
Mean	6040129	11264857	17857635	26941856	47926765

Source: Computations of this Study

Table (2) - Distribution of Households between Five Clusters (1979-2002)

	1997	*1998*	*1999*	*2000*	*2001*	*2002*	*Period*
Cluster 1	1170	1095	1693	1308	1989	2001	9256
Cluster 2	2922	1971	3383	2943	2982	2801	17002
Cluster 3	2630	1752	2031	3270	2651	3601	15935
Cluster 4	2630	1971	3721	2943	2651	3601	17517
Cluster 5	1170	1095	1355	1308	1658	2401	8987
Un Clustered	14	5	19	0	18	5	61
Total	10536	7889	12202	11772	11949	14410	68758

Source: Computations of this Study

As the table (1) shows that cluster 1 and cluster 5 are lowest and highest groups, respectively. Also households number in cluster two, three and four have the most frequency and first and fifth households have lowest frequency.

Table (2) shows household distribution between five clusters for 1997 to 2002. The number of households for each cluster in every year is different. With pooling data for each cluster on all of the years of study (1997-2002), we will have the Unbalanced Pooled Data.

The participation food rate for i_{th} good by definition is the number of households that consume goods i_{th}, over total number of household into the sample. This ratio provides a good indication of expenditure patterns and is important for understanding the extent of the problem of zero expenditure for subsequent econometric analysis. Food participation rates for urban Iranian during the six years illustrated in Table (3),

Table (3) - Household Participation Rates for Food Expenditures
By Income Group, Urban Iran, All years

Cluster	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5	*total*
Bread	94	96	97	98	98	97
Dairy and Egg[*]	91	96	99	99	100	98
Oil seed	77	84	87	89	90	86
Sugar	75	82	84	85	84	82

Source: Computations of this Study

*.Household Consumes Milk or Cheese or egg or Combination of these

Table (3) shows that the participation for bread, edible oils, sugar and dairy products have an almost high rate for all of five clusters. So, we don't have any zero expenditure problems.

5-Estimation of Demand System for Income Groups

Disturbances have similar structure into each household cluster because we are using clustered data and clustering method is based on the same behavioral patterns of households. Additionally, period of study is six years and this reduces the probability of variation in model coefficients, extremely. This two logic reasoning imply the assumption of equality of coefficient for each cluster. On the basis of this assumption, we choose seemingly unrelated regression (SUR) method for estimation (equation (35)),

$$w_{ij_t t} = \alpha_i + \sum_{k=1}^{n} \gamma_{ik} \ln p_{ik_t t} + \beta_i \ln(M_{ij_t t} / P_{j_t t}) + u_{ij_t t}. \qquad (33)$$

$$i,k = 1,\dots,n \qquad j = 1,\dots,m_t \qquad t = 1,\dots,T$$

Differences in household behavior not only depend on prices and income but also on household characteristics and demographic factors. These relationships were estimated by adding parameters to the demand system; only these additional parameters depended on the demographic variables (Pollak and Wales, 1980, 1981). This demographic translating was used to incorporate demographic variables into the model so that

$$\alpha_i = \alpha_{i0} + \sum_s \theta_{is} Z_s \qquad (34)$$

Where the *Zs* are the demographic variables (*s* =1… *d*).The resulting system is

$$w_{ij_t t} = \alpha_{io} + \sum_{s=1}^{d} \theta_{is} Z_s + \sum_{k=1}^{n} \gamma_{ik} \ln p_{ik_t t} + \beta_i \ln(M_{ij_t t} / P_{j_t t}) + u_{ij_t t} \qquad (35)$$

$$i,k = 1,\dots,n \qquad j = 1,\dots,m_t \qquad t = 1,\dots,T$$

In this study Z_s contains five variables age, sex and employment status of households head and also number of employee and home ownership. In this case adding up constraint defines as follow,

$$\sum_i \alpha_{i0} = 1; \sum_i \theta_{is} = 0; \sum_i \gamma_{ij} = 0; \sum_i \beta_i = 0 \qquad (36)$$

Demand Model Estimation for Five Clusters

For estimation of parameters with assumption of consumer rational behaviour, we estimated (35) with and without the restriction for implying Wald Test. Table (4) and Table (5) show that the result of homogeneity and symmetry conditions for five clusters and that the restrictions can be enforced in the estimation process.

Table (4) - Wald Test Statistics for Testing Symmetry Restrictions for the Iranian LA/AIDS Demand System

	χ^2	*Critical Value*	*Result*
Cluster 1	225.76	32.8	Reject
Cluster 2	9026.1	32.8	Reject
Cluster 3	100.3	32.8	Reject
Cluster 4	9139.2	32.8	Reject
Cluster 5	32.8	340.1	Reject

Source: Computations of this Study
Degree of Freedom = 15

Table (5) - Wald Test Statistics for Testing Homogeneity Restrictions for the Iranian LA/AIDS Demand System

	χ^2	*Critical Interval*	*Result*
Cluster 1	51.43851	16.75	Reject
Cluster 2	1757.3	16.75	Reject
Cluster 3	125.7	16.75	Reject
Cluster 4	1805	16.75	Reject
Cluster 5	55.5	16.75	Reject

Source: Computations of this Study
Degree of Freedom = 5

For all of clusters, the demand system represented by equation (35) subject to restrictions (6), (7) and (36) was estimated by using iterative SUR method. The procedure provided maximum likelihood estimator for linear equation system and produce parameter estimation invariant to the choice of equation. The omitted equation is the budget share of non-food commodities. Also, we used White (1980) robust regression for increasing the efficiency of estimators. Results show that only three demographic variables have significant statistics (head of household's age and employment status and number of employee). Almost all of the estimated coefficients for five clusters are statistically meaningful. Number of meaningful variables is 38, 37, 37, 37 and 35 of 40, for clusters 1, 2, 3, 4 and 5, respectively[1]. Tables (6) and (7) outline Income (total expenditure) and own price (uncompensated) elasticities for five clusters,

Table (6)- Income (Total Expenditure) Elasticities for Five Clusters

	Bread	*Dairy*	*Sugar*	*Edible oils*	*Other-food*	*Non-Food*
Cluster 1	0.855	0.847	0.825	0.845	0.726	1.160
Cluster 2	0.840	0.851	0.806	0.829	0.714	1.125
Cluster 3	0.826	0.839	0.811	0.835	0.683	1.152
Cluster 4	0.830	0.812	0.779	0.817	0.662	1.146
Cluster 5	0.788	0.803	0.747	0.803	0.688	1.131

Source: Computations of this Study

Table (7) - Uncompensated Price Elasticities for Five Clusters

	Bread	*Dairy*	*Sugar*	*Edible oils*	*Other-food*	*Non-Food*
Cluster 1	-0.59	-1.13	-0.19	-0.02	-0.48	-0.90
Cluster 2	-0.86	-1.08	-0.21	-0.07	-1.03	-1.08
Cluster 3	-0.48	-1.09	-0.12	-0.03	-0.96	-0.14
Cluster 4	-0.56	-1.07	-0.8	-0.02	-0.49	-0.96
Cluster 5	-0.54	-1.04	-0.106	-0.804	-0.407	-0.949

Source: Computations of this Study

Table (6) shows that elasticity of non-food expenditure is greater than one for all of clusters. The other commodities base on elasticity of expenditure is necessary for five clusters. Also table (7) explains that except dairy products and two special cases (non-food and other-food for cluster 2) all of the expenditures are inelastic.

6- Welfare indices and Price Adjustment

In this paper, for measurement of subsidy reduction welfare effects, two scenarios containing 50 (scenario 1) and 100 (scenario 2) percent reduction in subsidy volume is included. With regard to this point that every price adjustment has an initial (before policy) and benchmark (after policy) point, we choose year 2002 as the initial point for policy analysis. Between bread, sugar, edible oils and dairy (milk, cheese and egg) products, we implemented these two scenarios for bread, sugar and edible oils and leave dairy products

[1]- Significance is above 95 percent

for theirs special nutritional roles. Also government has an emphasis on the provision of dairy products. Table (8) shows average price of subsidy goods in five clusters.

Table (8) - Average of Unit Values

	Cluster 1	*Cluster 2*	*Cluster 3*	*Cluster 4*	*Cluster 5*
Bread	619	630	657	693	740
Sugar	2641	2742	2661	2747	2884
Edible oils	4614	4785	4947	5169	5470

Source: Computations of this Study

From Table (9) we can saw that compensating variation (CV) and change in cost of living index (CLI) reduce from cluster one to five for all three goods. This result also is correct for ratio of CV to total expenditure (CV/TE) as shown in the table. Implementation of scenario 1 shows that respectively, bread, edible oils and sugar have the most effects on the changes of CLI for clusters one to four. But relative importance of edible oils is greater that bread for cluster five. When we implement scenario 2 for all clusters, we can saw that edible oils have a prominent status in the determining welfare conditions and bread place in the second position for more clusters (cluster three, four and five). Also we have some consideration here. With looking to the first part of table (9), we show that compensating variation for cluster one, two and five are the same, after enforcing scenario 1 for bread. The cause of this result can be explained by attendance to this reality that different cluster encounter with different prices in consuming bread and rich people have more diversity in consumption than the poor. The ratio of CV to total expenditure also gives a good vision to policy makers in designation of adjustment packages.

Table (9) – Welfare Effects of Price Adjustment and it's Compensating Variations

Cluster	*EI (1000 Rial)*	*CV (1000 Rial)*	*CV/TE (%)*	*ΔCLI (%)*
Bread (50%)				
Cluster 1	8968	117	1.94	1.32
Cluster 2	15865	120	1.07	0.76
Cluster 3	23619	67	0.38	0.28
Cluster 4	35885	82	0.30	0.23
Cluster 5	61619	108	0.23	0.18
Sugar (50%)				
Cluster 1	8894	43	0.71	0.49
Cluster 2	15794	48	0.43	0.31
Cluster 3	23574	21	0.12	0.09
Cluster 4	35848	45	0.17	0.13
Cluster 5	61565	55	0.11	0.09
Edible Oils (50%)				
Cluster 1	8926	76	1.26	0.85
Cluster 2	15842	97	0.86	0.61
Cluster 3	23616	64	0.36	0.27
Cluster 4	35893	90	0.33	0.25
Cluster 5	61659	148	0.31	0.24
Bread (100 %)				
Cluster 1	9067	216	3.58	2.44
Cluster 2	15979	233	2.07	1.48
Cluster 3	23690	138	0.77	0.58
Cluster 4	35965	162	0.60	0.45
Cluster 5	61720	209	0.44	0.34
Sugar (100 %)				
Cluster 1	8938	88	1.46	0.99
Cluster 2	15847	101	0.90	0.64
Cluster 3	23612	60	0.34	0.26
Cluster 4	35912	109	0.40	0.3
Cluster 5	61642	131	0.27	0.21
Edible Oils (100 %)				
Cluster 1	9004	154	2.55	1.74
Cluster 2	15942	197	1.75	1.25
Cluster 3	23690	148	0.83	0.63
Cluster 4	23875	322	1.20	1.37
Cluster 5	36005	202	0.42	0.56

Also, for better understanding of changing distribution in different clusters, we introduce R index as the variations of welfare index of each clusters to reference cluster.

$$r_i = \frac{c_j}{c_i}; \qquad i, j = 1,2,...,5$$

c_j and c_i are change in welfare index of cluster j and variation in welfare index of reference cluster, respectively. Table (10) that we nominate it "*Policy Effects Matrix*" shows the computation results of R index.

Table (10) – Policy Effects Matrix for Bread by Five Clusters

	Cluster 1	*Cluster 2*	*Cluster 3*	*Cluster 4*	*Cluster 5*
Cluster 1	1	0.6	0.2	0.2	0.1
Cluster 2	1.6	1	0.4	0.3	0.2
Cluster 3	4.2	2.6	1	0.8	0.6
Cluster 4	5.4	3.3	1.3	1	0.8
Cluster 5	7	4.4	1.7	1.3	1

Source: Computations of this Study

"*Policy Effects Matrix*" is a square matrix that its diagonal elements are ratio of welfare changes (CLI) in cluster i to the same cluster. In the other word, in this matrix clusters on the main diagonal known as the reference clusters and their value are equal to one. For example, in the first row, we saw that off diagonal elements is lesser that one, so welfare changes in cluster 2 to 5 are lesser than cluster 1 (Upper Triangle Matrix). We can saw reverse of this matter for columns of table (10) that all the elements are above one. With a closer look, we can find that elements of Lower Triangle Matrix, in this special policy, are greater than one. Otherwise, we can conclude that cluster one bear the most effects of bread price adjustment policy and from cluster one to five this effects are decreasing.

7- Conclusion

Results show that bread, dairy, sugar and edible oils are necessary goods for different households of five clusters, thought the relative importance of them is different and compensating variation of five clusters is dissimilar. The relative importance of goods depends on the intensity of adjustment policies. For cluster four and five, effects of edible oils prices adjustment is greater than bread and sugar. So, from the policy making perspective, bread subsidies must target to clusters one to three because they are the main losers of welfare when price of bread increase. Also, welfare effects of bread price adjustment policy decrease from cluster one to five.

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