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Analysis of vegetable oil demand and its price reform in Iran: using rural and urban household level data

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Abstract

In a group of food types, vegetable oils are the second-largest source of energy in the human diet and their consumption is very important from a health and economic viewpoint. Consumer behavior evaluation can help a lot in adopting the right policies; so, the framework of the Almost Ideal Demand System model for food expenditures was used to examine rural and urban vegetable oil consumer behavior in Iran using household survey data conducted by the Iranian Statistical Institute for the 2018 year. For this purpose, income, price and cross-price elasticities under ten aggregated food groups i.e., Cereal, Meat, Dairy, Butter and Animal Oil, Vegetable Oil, Fruits and Nuts, Vegetables and Legumes, Sugary, Spices and, Dinks were estimated for vegetable oil using the Seemingly Unrelated Regression. The obtained results showed that vegetable oil concerning the positive income elasticities is a necessity goods both rural (0.872) and urban (0.889) consumers. Own-price elasticities revealed that the demand for vegetable oil is less responsive to the increase in the price in urban areas (-0.280) than the rural area (-1.073). Moreover, Butter and Animal Oils food groups are highly substitutable with vegetable oil for rural consumers. Since the absolute value of cross-price elasticities are often less than an entity, consumers of vegetable oil will not have a noticeable change in demand as prices change for other food groups. Due to vegetable oil price reform, per capita compensation payments for a typical rural person would be greater than the urban person. The results suggest that policymakers should adopt different policies about rural and urban consumers of vegetable oil.

Keywords: Almost Ideal Demand System, Demand Elasticities, Households, Iran, Vegetable Oil

Introduction

Nowadays oilseeds constitute the world's second-largest food reserve after cereals (Heydari et al. 2010). The extracted oil from oilseeds has both edible and industrial uses. Between the five components of foodstuffs, oils and fats, after the group of carbohydrates, are the main source of human energy supply, and because of fat-soluble vitamins such as A, D, K, E, and their high saturation, considered as essential and strategic consumer goods. According to the results of the National Nutrition and Food Technology Research, about 21% of the total energy consumed in Iran is provided by vegetable oil. Based on the data of income and consumption expenditure surveys conducted by the Iranian Statistical Center for the 2018 year, per capita vegetable oil consumption is around 14.50 and 13.29 kg (accounting for 4.57% and 4.01% of household food expenditure) for each rural and urban person, respectively (Iranian Statistical Center (ISC), 2019) (Figure 1). Annually, 1.129 million tone vegetable oil is being consumed in Iran.

Various reasons, such as the role of animal oils in heart problems, increasing population, increased consumerism in

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society, changes in villagers' dietary patterns and the cheapness of these oils compared to other oils have led to increasing consumption of vegetable oil in the community.

The sources of vegetable oil supply in Iran highly rely on importing oilseeds, crude oil and extraction from domestic oilseed production. Today, Iran is considered one of the largest importers of vegetable oil. The self-sufficiency coefficient indicates that the vegetable oil supply from domestic sources fluctuated to less than 10% in the 2018 year, implying a high dependency on imports for this essential and strategic commodity (Yuzbashkendi, 2019). Therefore, the supply of vegetable oil in the country can be considered as a significant foreign currency drain. Furthermore, climate change and variability may worsen the condition of food security particularly for water-limited regions such as Iran (Nouri & Homaee, 2020; Paymard, Yaghoubi, Nouri, & Bannayan, 2019; Satari Yuzbashkandi & Khalilian, 2020).

Considering the high consumption of vegetable oil and consequently the high import of this product in Iran, it is important to study and analyze its demand. Demand structure and household consumption patterns analysis was vital and widely used in policy analysis (A. S. Deaton, Ruiz-Castillo, & Thomas, 1989; Sekhampu & Niyimbanira, 2013). Therefore, policymakers and planners use the results to predict the future. It is also important to study the effectiveness of various economic policies, including policies related to market regulation, control or increase of product supply, subsidy management, taxes and price changes on food security and health of the community and consumer welfare (Kalkuhl, von Braun, & Torero, 2016; Pishbahar & Nataj Firoozjah, 2014). Also, producers, food processors and other market players need to forecast demand to plan and design their production and sales, in this regard, demand elasticities are important (Ullah, Jan, Fayaz, Ali, & Shah, 2019).

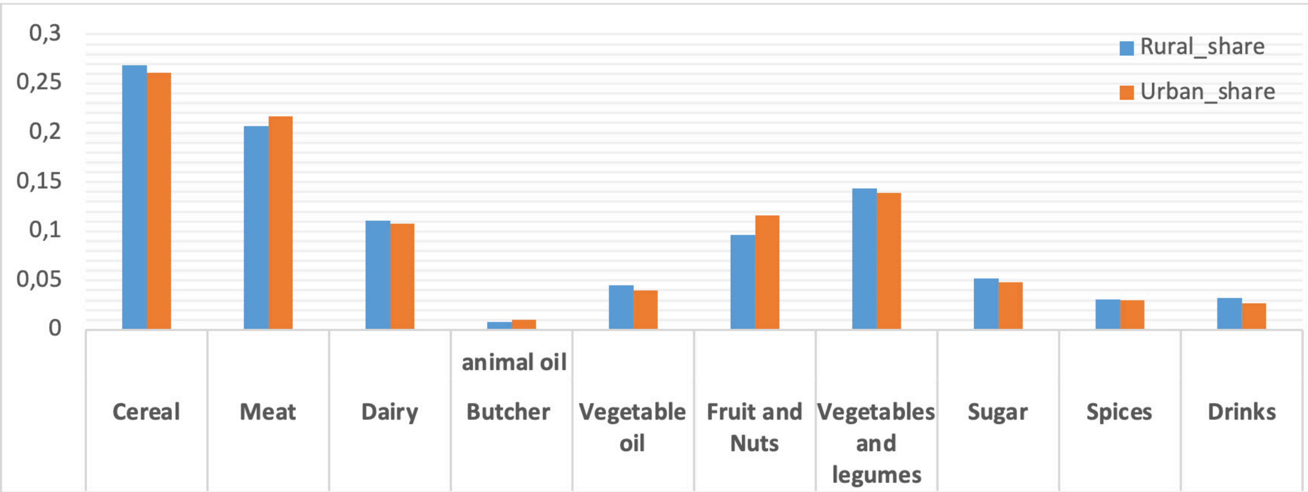

Figure 1. The contribution of different commodity groups from the food expenditure

Given the expenditure and consumption variation among Iranian households, examining the structure of food consumption is an important issue. Thus, the food elasticities of income, expenditure and price can be used as useful tools in the implementation of effective food policy (Şahinli & Fidan, 2012). Some studies have been conducted to analyze food items demand using the AIDS approach in Iran and the world (Alnafissa & Alderiny, 2019; Ataie s & Mohammadi, 2018; Chen, Saghaian, & Zheng, 2018; Hoang, 2018; Hooshmand, Khodadad Kashi, & Khoshnevis, 2017; Pishbahar & Nataj Firoozjah, 2014; Rathnayaka, Selvanathan, Selvanathan, & Kler, 2019; Şahinli & Fidan, 2012; Sekhampu & Niyimbanira, 2013; Yazdani & Sherafatmand, 2013).

In this study, an Almost Ideal Demand System approach was applied to calculation of vegetable oil demand (income and price elasticities) by using the food sub-group expenditure data included in the household income and consumption expenditure surveys conducted by the Iranian Statistical Center for 2018. Given the importance of vegetable oils in the household food basket, this study aimed to evaluate the vegetable oil consumption pattern of the rural and urban households living in Iran. The results can help policymakers as well as non-profit organizations and businesses in adopting appropriate policies.

Materials and methods

Data sources

We have used the 2018 Household Expenditure and Income Survey (HEIS) gathered by the Statistical Center of Iran (SCI). The HEIS is the main annual household survey in Iran. This method is based on a three-stage cluster sampling method with strata and collected for more than fifty years (Akbari, Ziaei, & Ghahremanzadeh, 2013). All the consumed items for a month are recorded by interviewing households. In other words, information about the money spent on each item and the consumption is collected. The 2018 HIES was carried out by a sample of 20350 households in urban areas and 18610 households in rural areas. The raw data of HIES was used instead of published ones. The Classification of Individual Consumption by Purpose (COICOP) data structure in 4 digits was used for organizing and classification of food items. Food items were classified into ten food groups: Cereal, Meat, Dairy, Butter and Animal Oil, Vegetable Oil, Fruits and Nuts, Vegetables and Legumes, Sugary, Spices, and Drinks. Table 1 shows the distribution of food sub-groups and aggregate group name. In this study, to more accurately assess the vegetable oil demand, the vegetable oil and butter (animal oil and butter) groups were separated from each other. These aggregated food groups constitute almost 100% of the food consumption basket of rural and urban households in Iran. To calculate the budget shares of each aggregated food, the expenditure of each sub-group was divided by total expenditure. The geometric mean with expenditure shares as the weight was used to compute the price indices of aggregated food groupings.

Table 1. Distribution of food sub-groups in Iranian households

Commodity coeds	Food sub-group names	Aggregate group name
1111, 1112, 1114, 1115, 1116, 1117	Rice and Rice flour, Wheat and Wheat flour, Bread, Biscuits, Pastry, Confections and Other Cereal Products.	Cereal
1121, 1122, 1123, 1124, 1131, 1132	Mutton, Beef, Chicken, Fish and other meat products.	Meat
1141, 1142, 1143, 1144	Eggs, Milk and Dairy products except butter.	Dairy
1151, 1152	Animal oil, Fats, Butter	Butter
1153	Vegetable oil	Vegetable Oil
1161, 1162, 1163, 1164, 1165, 1166	Nuts, Treed fruits and other fresh fruits	Fruits and Nuts
1171, 1172, 1173, 1174, 1175, 1176	Fresh vegetables, Dried vegetables, Chickpea, Bean, Split pea, Soybean and other Pulses.	Vegetables and Legumes
1181, 1182, 1183, 1184,	Sugar, Jams, Honey, Molasses, and other Sugary Products	Sugary
1191, 1192, 1193, 1194	Salt, Tomato paste, Ketchup, Lemon juice, Sourness, Pickled Cucumbers and other Spices	Spices
1211, 1221	Tea, Coffee, Cocoa and Non-alcoholic drinks	Drinks

The empirical LA-AIDS model

The almost ideal demand system was first proposed by A. Deaton and Muellbauer (1980), and most commonly applied for demand analysis. This demand system is taken by the cost function introduced by Deaton and Muellbauer that indicates the minimum cost necessary to achieve a certain level of utility U at price vector P as follows:

$$\ln C(U,P) = a_0 + \sum_{1}^{n} a_i lnp_i + \frac{1}{2}\sum_{i}^{n}\sum_{j}^{n} \gamma_{ij}\, lnp_i lnp_j + u\,\beta_0 \prod_i p_i^{\beta_i} \quad (1)$$

n=10 i,j=1,2,3,…,n

where is the natural logarithm of the cost function, , , , and are constant coefficients, i and j are the indexes representing different food groups. By using Shephard's lemma theorem and the first derivative of the cost function (), the compensation demand function is obtained. Finally, we extract the modified version of an AIDS model, in which share of the ith food group expenditure is a function of prices and the related food expenditures. It can be written as:

$$w_i = a_i + \sum_j \gamma_{ij}\, lnp_j + \beta_i \ln\left(\frac{m}{p}\right) \quad (2)$$

where and are the expenditure share and price associated with food groups, respectively, m is the total expenditure on the system of the ten food groups given by , where is the quantity demanded j[th] group of food, and , , and are parameters to be estimated, p is the price index of food groups.

In order to convert the AIDS model to LA-AIDS model, A. Deaton and Muellbauer (1980) suggested the Stone price index p (Ngui, Mutua, Osiolo, & Aligula, 2011):

$$\mathrm{lnp} = \sum \mathrm{w_i\, lnp_i} \quad (4)$$

In most empirical studies, the LA-AIDS model is more frequently estimated than the nonlinear AIDS model (Berck, Hess, & Smith, 1997; Chen et al., 2018; Edgerton et al., 1996; Elsner, 2001; Liu et al., 2019).

2.2.1. Demand function restrictions in AIDS

To make LA-AIDS in line with the demand theory, the Eq. (2) must satisfied the adding-up, homogeneity and symmetry conditions which apply on the parameters of the aforementioned equation:

$$\sum_i a_i = 1 \quad \sum_i \gamma_{ij} = 0 \quad \sum_i \beta_i = 0 \quad \forall j \quad \text{"adding – up"}\ condition \quad (5)$$

$$\sum_j \gamma_{ij} = 0 \quad \forall i \quad \text{"homogenity"}\ codition \quad (6)$$

$$\gamma_{ij} = \gamma_{ji} \quad \forall\, i,j \quad and\ i \neq j \quad \text{"symetry"}\ condition \quad (7)$$

Eq.(5) ensures the expenditure shares always sum up to entity , Eq.(6) guarantees that if all prices and expenditure change at the same rate, the quantities purchased do not change, while Eq.(7) shows the stability of consumer choices.

Expenditure and price elasticities

After estimation of system coefficients, expenditure elasticity , Marshallian (uncompensated) and Hicksian (compensated) own-price and cross-price elasticities can be derived from (2) and (4) as follows (Green & Alston, 1990):

$$\eta_i^E = \frac{\beta_i}{w_i} + 1 \qquad \text{(Expenditure elasticity)} \tag{8}$$

$$\varepsilon_{ij} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \beta_i \frac{w_j}{w_i} \qquad \text{(Marshallian)} \tag{9}$$

where δ_{ij} is Kronecker delta $\delta_{ij} = 1 \; for \; i = j;$ $\delta_{ij} = 0 \; for \; i \neq j,$

$$\varepsilon_{ij}{}^* = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} + w_j \qquad \text{(Hicksian)} \tag{10}$$

LA-AIDS specification

The equations system to be estimated is:

$$w_1 = a_1 + \gamma_{1.1} lnp_1 + \gamma_{1.2} lnp_2 + \cdots + \gamma_{1.10} lnp_{10} + \beta_1 \ln\left(\frac{m}{p}\right) + u_1$$

$$w_2 = a_2 + \gamma_{2.1} lnp_1 + \gamma_{2.2} lnp_2 + \cdots + \gamma_{2.10} lnp_{10} + \beta_2 \ln\left(\frac{m}{p}\right) + u_2$$

$$\ldots \ldots \ldots \ldots \ldots \ldots \ldots \tag{11}$$

$$w_{10} = a_{10} + \gamma_{10.1} lnp_1 + \gamma_{10.2} lnp_2 + \cdots + \gamma_{10.10} lnp_{10} + \beta_{10} \ln\left(\frac{m}{p}\right) + u_{10}$$

After applying the constraints into the model, the number of equations in the LA-AIDS model becomes (n-1=9) and the other equations can be estimated using an Iterative Seemingly Unrelated Regressions (ISUR) technique. Furthermore, econometric software Eviews 10 was used. In this study, the Almost Ideal Demand System (AIDS) approach was applied to analyze the vegetable oil demand in the Iranian rural and urban sector for following benefits: a) it applies arbitrarily the first-order approximation to any system; b) it meets the principle of choice; c) it aggregates over consumers perfectly; d) its functional form makes it in consistence with household budget data; e) it can be easily estimated; and f) allows testing of symmetry and homogeneity conditions (Blanciforti & Green, 1983; Şahinli & Fidan, 2012; Satari Yuzbashkandi & Mehrjo, 2020).

Welfare indicators in AIDS system

By changing the vegetable oil price, consumer utility rates may increase or decrease. The Compensating Variation (CV) is often used to determine the impacts of price changes on consumers. The aforementioned index shows the amount of money that is necessary to compensate a consumer as a result of price change so that it achieves the first utility. The CV is represented based on the Compensated Demand Curve, in other words, the Hicksian demand curve (Davoodi, 2010) (Satari Yuzbashkandi & Mehrjo, 2020). Supposed that the price of vegetable oil changes, that way p0≠p1. The change of CV can be written in the form of a difference between two values of the expenditure function after and before the price change (Hicks, 1946; Khalili Araghi & Barkhordari, 2012):

$$CV = E(P1_d, U0) - E(P0_d, U0) \tag{12}$$

Where E and U refer to expenditure and indirect utility functions, respectively. As well as the subscripts of (0) and (1) show the before and after the price change. To measure the welfare effects of rising prices, the compensating variation function for the almost ideal demand system is extracted as follows (Noorollahi, Jabbari, Moradkhani, & Faramarzi, 2017):

$$CV = exp\left[A_1 + \prod_{i=1}^{n} (p_i^1/p_i^0)^{\beta_i}.\left(logc(u^0,p^0) - A_0\right)\right] - c(u^0,p^0)$$

$$A_0 = a_0 + \sum_{i=1}^{n} a_i \, logp_i^0 + 1/2 \sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} \, logp_i^0 logp_j^0$$

$$A_1 = a_0 + \sum_{i=1}^{n} a_i \, logp_i^1 + 1/2 \sum_{i=1}^{n}\sum_{j=1}^{n} \gamma_{ij} \, logp_i^1 logp_j^1 \tag{13}$$

Results and discussion

To explaining the consumer's behavior, the homogeneity and symmetry conditions were tested by Wald test (and (, respectively. The results of the homogeneity test in Table 2 shows that null-hypothesis was rejected in all food groups. Hence, both rural and urban consumers had a monetary illusion to purchase these ten kinds of food especially vegetable oil, instead of considering the real incomes and prices. Moreover, as the results of Wald test are shown separately for rural and urban households in Table 3, the symmetry nature of coefficients in the system was rejected, implying that the price coefficient of the jth commodity in the equation relating to the share of the ith commodity was not equal to the ith commodity price factor in the equation relating to the share of jth commodity.

After performing the required tests and approving the estimation method as systematically, the results of the demand system estimation using the Iterative Seemingly Unrelated Regressions and the Eviews 10 software package are presented in Table 4 and Table 5. Since the problem statement in this study is the analysis of vegetable oil demand for urban and rural households, therefore, we focused more on this part of the equation system. According to Table 4, in the expenditure share of rural vegetable oil equation, all variables except the price of Vegetables and Legumes food group are significant. The coefficients of the intended equation show that increasing the price of food groups of Cereals, Meat, Vegetable Oils, Fruits and Nuts, Sugary and Spices have a negative and inverse effect on the expenditure share of Vegetable Oils, and rising prices for Dairy, Animal Oils and Drinks increase the expenditure share of vegetable oil. With respect to the vegetable oil expenditure-share equation in Table 4, all variables except for the variable of Drink price were also significant. Thus, increasing the prices of the food groups of Cereals, Meat, Fruits and Nuts, Vegetables, Sugary and Drinks decrease the expenditure share of Vegetable Oil in urban household's food basket and the rise in prices for Dairy groups, Animal Oil, Vegetable Oils and Spices have had an adverse effect on the share of vegetable oil expenditure.

To evaluate the goodness-of-fit and also, the existence of autocorrelation in the estimated equations, the R^2 and DW values related to AIDS estimation are shown in Tables 4 and 5 by the food groups, separately. The R^2 values for the rural and urban households' vegetable oil expenditure share were estimated to be 0.84 and 0.89, respectively. it can therefore be concluded that the model explains well the vegetable oil expenditure shares in the rural and urban household's expenditures. The DW statistic values were close to 2, indicating that there is no autocorrelation in the estimated equations.

Table 2. Homogeneity test of demand system (Wald test)

Households	Commodity group	statistics	Prob.	Hypothesis
Rural	Cereal	82.54	0.000	rejected
	Meat	87.46	0.000	rejected
	Dairy	102.52	0.000	rejected
	Butter and animal oil	197.45	0.000	rejected
	Vegetable oil	92.19	0.000	rejected
	Fruit and Nuts	365.19	0.000	rejected
	Vegetables and legumes	32.55	0.000	rejected
	Sugary	8.95	0.002	rejected
	Spices	2.77	0.090	rejected
	Drinks	134.07	0.000	rejected
Urban	Cereal	110.69	0.000	rejected
	Meat	137.85	0.000	rejected
	Dairy	125.78	0.000	rejected
	Butter and animal oil	20.72	0.000	rejected
	Vegetable oil	6.31	0.012	rejected
	Fruit and Nuts	287.23	0.000	rejected
	Vegetables and legumes	5.81	0.015	rejected
	Sugary	26.02	0.000	rejected
	Spices	14.37	0.001	rejected
	Drinks	141.64	0.000	rejected

Table 3. The hypothesis test of symmetry (Wald test)

Household	Commodity group	Statistics	Prob.	Hypothesis
Rural	All	3049.54	0.000	rejected
Urban	All	2294.61	0.000	rejected

Since in an AIDS approach, the dependent variable is the expenditure share of the food group and the independent variable is the logarithm of food groups' price and income, it is necessary to calculate the elasticities to measure the changes in the demand quantity relative to the food groups' price and income changes.

According to the values of estimated parameters in Tables 4 and 5, also by employing the elasticity equations regarding the Almost Ideal Demand System, the elasticity values were determined for each food group. The results of different elasticities for rural and urban households are given in Tables 6, 7, 8 and 9. From the expenditure elasticity view, the expenditure elasticity shows the demand changes of specific food groups in the face of income changes. Based on the expenditure elasticities, commodities are divided into three groups. The commodity with expenditure elasticity greater than 1 are luxury goods, the commodity with an elasticity between 0 and 1 are normal goods and finally for those with elasticity lower than 0 are inferior goods. As can be seen in Tables 6 and 8, the rural and urban expenditure elasticity for vegetable oil was found to be 0.872 and 0.889, respectively. It is concluded that vegetable oil is a normal good for both rural and urban households, and also the value of the aforementioned elasticity is nearly equal. For rural and urban households, assuming all the other variables constant, the mean value of expenditure elasticity indicates that an average increase of 1% in households' income would cause a 0.872% and 0.889% increase in the quantity demanded for vegetable oil, respectively.

To know how consumer's respond to price changes, both compensated (Hicks) and uncompensated (Marshall) price elasticities matrix were calculated. For rural households as it can be seen in Table 6, the mean values of uncompensated (Marshal) own-price elasticities are negative, which is consistent with the demand theory. The value of own-price elasticity for vegetable oil was 1.073. This implies that the rural consumers demand for vegetable oil is elastic demand, and a 1% increase in price will demand to decrease by 1.073%. For urban households, the uncompensated (Marshal) own-price elasticity of vegetable oil was detected not to be demand elastic, unlike the rural households (Table 8). This implies that the mean value is less than unity and a 1% increase of price leads to demand decrease by 0.280%.

The demand reaction of a special food-group to a change in the price of another food-group was also measured by cross-price elasticity. The complementary and substitution relationship between various food-groups determined by the negative and positive signs of cross-price elasticity, respectively. The results of uncompensated cross-price elasticity are shown in Tables 6 and 8. For rural areas, according to the results in table 6, the food-groups of cereal, meat, fruit and nuts, sugar and spices are complementary; the groups of dairy, butter and animal oils, vegetables and legumes, and drinks are substitute goods for the group of vegetable oil. In comparison, for urban households, in the group of vegetable oils, on the other hand, cereals, meat, fruits and nuts, sugar, spices, vegetable and legumes are complementary; dairy, butter and animal oils, and drinks are substitute goods (Table 8).

The interpretation of compensated (Hicks) own and cross-price elasticities for both rural and urban areas are the identical for uncompensated, with this difference that in this type of elasticities, the effect of a change in real income is adjusted due to a change in the price, and changes in demand are only due to price changes, while uncompensated elasticities inclusive the both effects of the income and price of price changes (Table 7 and 9).

Finally, in order to evaluate the correctness of compensated, uncompensated and income elasticities, the relationship between elasticities was investigated based on the demand rules of microeconomic (Henderson & Quandt, 1971):

a- The weighted (the budget share of good i) sum of the income elasticities is equal to the unit

b- The weighted sum of uncompensated own and cross-price elasticities is equal to the negative weight of the commodity whose price has changed

c- The weighted sum of the compensated own and cross-price elasticities is zero

$$\sum_{i=1}^{n} \boldsymbol{w_i \xi_{ij} = 0}$$

d- Hicks decomposition process of a demand change

$$\boldsymbol{e_{ij} = \xi_{ij} + w_i \pi_i}$$

As can be seen in Tables 6, 7, 8 and, 9 the relationship between the several elasticities is established.

Finally, in this section, we investigated the urban and rural consumers' welfare by increasing the vegetable oil prices. For this purpose, vegetable oil price over the five scenarios of 20%, 40%, 60%, 80% and, 100% has been increased. The Compensating Variation (CV) to determine the welfare change was applied. The total and per household's CV are presented in Table 10. The CV results showed that with the increase in the prices under the 20%, 40%, 60%, 80% and 100% scenarios, the welfare of both urban and rural consumers will decrease. For instance, in 100% scenario, in order to reach the initial level of utility, the government compensation payments should be 21539.3 and 15510.3 billion Rials in urban and rural regions, respectively. As well as, the results of per household CV showed that to offset the effects of price increases, the rural households (2471700.8 Rials) need to pay more than urban households (1105237.3 Rials).

Table 4. ITSUR Parameter Estimates from the LA-AIDs Models (Rural households)

model	lpc	lpm	lpd	lpba	lpv	lpfn	lpvl	lps	lps	lpd	lm		DW
Cereal	0.095	-0.047	0.013	0.024	-0.05	-0.02	-0.05	-0.02	-0.003	-0.003	0.017	0.85	1.47
	(49.9)	(-24.9)	(7.67)	(7.17)	(-11.1)	(-14.2)	(-18.2)	(-11.0)	(-2.37)	(-0.95)	(12.02)		
Meat	-0.022	0.107	-0.01	0.003	0.004	0.005	-0.01	-0.001	0.004	-0.005	0.002	0.76	1.59
	(-11.4)	(53.9)	(-5.01)	(0.99)	(0.81)	(3.37)	(-3.15)	(-0.48)	(2.63)	(-1.52)	(1.77)		
Dairy	-0.017	-0.010	-0.021	0.008	0.010	-0.010	-0.007	0.002	0.003	0.00	-0.014	0.89	1.45
	(-16.8)	(-10.0)	(-22.2)	(4.55)	(4.16)	(-13.3)	(-4.75)	(2.10)	(4.68)	(-0.04)	(-18.0)		
Butter and animal oil	0.001	0.004	-0.001	-0.038	0.001	-0.001	0.002	0.002	0.0001	0.004	-0.002	0.45	1.80
	(3.07)	(9.22)	(-3.93)	(-44.6)	(0.18)	(-4.86)	(3.29)	(4.22)	(0.46)	(5.03)	(-7.68)		
Vegetable oil	-0.004	-0.012	0.004	0.005	-0.003	-0.003	0.001	-0.007	-0.003	0.004	-0.005	0.84	1.88
	(-8.6)	(-22.4)	(9.09)	(5.19)	(-2.67)	(-8.96)	(0.23)	(-13.7)	(-8.00)	(4.26)	(-13.5)		
Fruit and Nuts	-0.010	0.002	-0.000	-0.002	0.034	0.045	-0.016	0.023	0.008	0.0005	0.015	0.93	1.34
	(-9.5)	(2.13)	(-0.22)	(-1.4)	(12.8)	(56.0)	(-9.7)	(20.4)	(9.6)	(0.30)	18.5		
Vegetables and legumes	-0.032	-0.029	0.014	0.003	0.016	-0.011	0.075	0.001	-0.004	-0.009	-0.003	0.82	1.33
	(-30.9)	(-28.7)	(14.5)	(1.95)	(6.5)	(-14.7)	(45.5)	(1.72)	(-6.1)	(-5.2)	(-4.7)		
Sugary	-0.003	-0.002	0.003	-0.004	-0.001	-0.000	0.002	0.011	-0.002	0.006	-0.0004	0.69	1.63
	(-5.5)	(-3.1)	(4.9)	(-4.05)	(-0.79)	(-0.95)	(2.03)	(16.8)	(-5.08)	(5.2)	(-0.75)		
Spices	-0.002	-0.007	0.004	-0.000	0.003	-0.000	0.008	-0.001	0.001	-0.008	-0.0006	0.71	1.53
	(-6.04)	(-18.1)	(12.2)	(-0.4)	(3.07)	(-2.9)	(12.3)	(-2.7)	(5.2)	(-11.1)	(-1.9)		
Drinks	-0.003	-0.004	-0.007	0.0007	-0.011	-0.001	0.001	-0.008	-0.003	0.011	-0.0081	-	-
	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)	(-)		

Note: values in parenthesis are t-values. Drinks are calculated from adding-up conditions for that reason t-values are not available

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Table 5. ITSUR Parameter Estimates from the LA-AIDs Models (Urban householders)

Model	lpc	lpm	lpd	lpba	lpv	lpfn	lpvl	lps	lps	lpd	lm		DW
Cereal	0.136	-0.071	-0.0001	0.024	-0.039	-0.023	-0.047	-0.020	-0.009	-0.013	-0.002	0.82	1.51
	(74.24)	(-37.5)	(-0.001)	(7.96)	(-14.4)	(-17.4)	(-15.5)	(-14.4)	(-6.82)	(-4.30)	(-1.66)		
Meat	-0.039	0.139	-0.003	-0.002	-0.003	-0.001	-0.015	-0.008	0.002	0.004	-0.001	0.86	1.57
	(-22.3)	(75.4)	(-1.51)	(-0.93)	(-1.43)	(-1.14)	(-5.15)	(-6.15)	(1.84)	(1.52)	(-0.90)		
Dairy	-0.015	-0.017	-0.007	-0.0001	0.001	-0.006	-0.005	0.0042	0.0040	0.006	-0.020	0.75	1.61
	(-15.9)	(-17.5)	(-7.09)	(-0.55)	(1.00)	(-8.46)	(-3.30)	(5.68)	(5.44)	(3.61)	(-24.9)		
Butter and animal oil	0.002	0.003	-0.005	-0.017	0.0014	-0.001	0.003	0.002	0.0005	0.002	-0.003	0.65	1.79
	(4.17)	(7.53)	(-9.55)	(-20.3)	(1.91)	(-3.71)	(3.90)	(5.95)	(1.45)	(3.16)	(-8.24)		
Vegetable oil	-0.009	-0.011	0.002	0.002	0.028	-0.005	-0.002	-0.005	-0.003	0.0006	-0.004	0.89	1.76
	(-18.4)	(-22.3)	(3.45)	(2.58)	(38.1)	(-13.4)	(-3.40)	(-14.9)	(-8.68)	(0.71)	(-10.49)		
Fruit and Nuts	-0.019	0.006	0.0001	-0.0001	0.013	0.052	-0.019	0.019	0.009	0.006	0.026	0.53	1.43
	(-16.9)	(5.04)	(0.09)	(-0.06)	(7.72)	(59.1)	(-9.82)	(21.62)	(10.36)	(3.08)	(26.35)		
Vegetables and legumes	-0.014	-0.033	0.012	0.0004	0.0006	-0.010	0.076	-0.001	-0.004	-0.006	0.008	0.64	1.54
	(-42.5)	(-33.1)	(10.9)	(0.24)	(0.46)	(-14.4)	(46.9)	(-1.97)	(-6.01)	(-3.59)	(9.72)		
Sugar	-0.007	-0.002	0.001	-0.005	0.001	-0.001	0.003	0.017	-0.0006	0.0059	0.003	0.62	1.69
	(-11.3)	(-4.2)	(1.86)	(-4.70)	(1.14)	(-1.51)	(2.69)	(33.5)	(-1.15)	(5.09)	(6.35)		
Spices	-0.004	-0.006	0.006	-0.0003	0.0003	-0.001	0.006	-0.001	0.003	-0.007	(0.002	0.67	1.61
	(-10.9)	(-15.3)	(12.6)	(-0.46)	(0.59)	(-3.60)	(8.52)	(-4.44)	(11.03)	(-10.0)	(6.21)		
Drinks	-0.0007	-0.0052	-0.0056	-0.0006	-0.003	-0.001	0.0016	-0.005	-0.002	0.001	-0.008	-	-
		-	-	-	-	-	-	-	-	-	-		

Note: values in parenthesis are t-values. Drinks are calculated from adding-up conditions for that reason t-values are not available

Table 6. Mean Values of Expenditure and uncompensated demand price Elasticity (Marshall Elasticity's of AIDS) for rural

Group elasticity	Expenditure	Price									
		Cereal	Meat	Dairy	Butter And animal oil	Vegetable oil	Fruit and Nuts	Vegetables and legumes	Sugar	spices	drinks
Cereal	1.066	-0.661	-0.191	0.044	0.092	-0.198	-0.081	-0.216	-0.085	-0.015	-0.014
Meat	1.013	-0.114	-0.484	-0.046	0.017	0.018	0.022	-0.050	-0.005	0.019	-0.026
Dairy	0.867	-0.123	-0.067	-1.183	0.079	0.103	-0.080	-0.052	0.027	0.038	0.003
Butter And animal oil	0.677	0.252	0.563	-0.163	-5.370	0.039	-0.162	0.329	0.253	0.029	0.488
Vegetable oil	0.872	-0.070	-0.244	0.117	0.115	-1.073	-0.067	0.022	-0.165	-0.070	0.094
Fruit and Nuts	1.162	-0.151	-0.009	-0.020	-0.030	0.350	-0.548	-0.198	0.231	0.078	0.0007
Vegetables and legumes	0.973	-0.216	-0.201	0.101	0.025	0.116	-0.075	-0.473	0.014	-0.033	-0.065
Sugar	0.992	-0.068	-0.038	0.060	-0.093	-0.024	-0.008	0.042	-0.776	-0.049	0.117
Spices	0.981	-0.075	-0.237	0.156	-0.010	0.101	-0.026	0.265	-0.037	-0.945	-0.260
Drinks	0.753	-0.026	-0.073	-0.199	-0.024	-0.347	-0.019	0.089	-0.258	-0.094	-0.647
$e_{ij} = \xi_{ij} + w_i \pi_i$		-0.070	-0.244	0.117	0.115	-1.073	-0.067	0.022	-0.165	-0.070	0.094
$\sum_{i=1}^{n} w_i \xi_{ij} = 0$		-0.269	-0.207	-0.110	-0.008	-0.045	-0.096	-0.144	-0.052	-0.031	-0.032
$\sum_{i=1}^{n} w_i \pi_i = 1$											

Table 7. Mean Values of compensated demand price Elasticity (Hicks Elasticity's of AIDS) for rural

Group elasticity	Price									
	Cereal	Meat	Dairy	Butter nd animal oil	Vegetable oil	Fruit and Nuts	Vegetables and legumes	Sugar	Spices	Drinks
Cereal	-0.375	0.029	0.162	0.101	-0.150	0.021	-0.062	-0.029	0.018	0.020
Meat	0.158	-0.273	0.065	0.026	0.065	0.120	0.096	0.047	0.051	0.006
Dairy	0.110	0.112	-1.089	0.087	0.142	0.003	0.072	0.073	0.065	0.032
Butter And animal oil	0.435	0.704	-0.088	-5.364	0.070	-0.097	0.427	0.289	0.051	0.510
Vegetable oil	0.164	-0.062	0.214	0.123	-1.034	0.016	0.148	-0.120	-0.043	0.123
Fruit and Nuts	0.161	0.231	0.108	-0.020	0.404	-0.436	-0.030	0.292	0.115	0.038
Vegetables and legumes	0.045	0.0004	0.209	0.043	0.161	0.018	-0.322	0.065	-0.002	-0.033
Sugar	0.198	0.167	0.170	-0.084	0.020	0.087	0.185	-0.724	-0.018	0.149
Spices	0.188	-0.033	0.264	-0.001	0.146	0.067	0.406	0.013	-0.914	-0.227
Drinks	0.176	0.082	-0.116	0.031	-0.313	0.053	0.198	-0.218	-0.070	-0.622
$\sum_{i=1}^{n} w_i \xi_{ij} = 0$	0	0	0	0	0	0	0	0	0	0

Table 8 Mean Values of Expenditure and uncompensated demand price Elasticity (Marshall Elasticity's of AIDS) for urban

Group elasticity	expenditure	Price									
		Cereal	Meat	Dairy	Butter and animal oil	Vegetable oil	Fruit and Nuts	Vegetables and legumes	Sugar	Spices	Drinks
Cereal	0.990	-0.475	-0.272	0.001	0.095	-0.152	-0.090	-0.181	-0.078	-0.374	-0.052
Meat	0.993	-0.180	-0.358	-0.013	-0.012	-0.017	-0.007	-0.069	-0.038	0.011	0.021
Dairy	0.812	-0.091	-0.012	-1.051	-0.006	0.020	-0.033	-0.022	0.047	0.043	0.060
Butter And animal oil	0.679	0.273	0.427	-0.466	-2.576	0.144	-0.089	0.341	0.227	0.062	0.261
Vegetable oil	0.889	-0.199	-0.254	0.061	0.055	-0.280	-0.112	-0.055	-0.139	-0.081	0.018
Fruit and Nuts	1.226	-0.230	0.003	-0.023	-0.003	0.108	-0.578	-0.196	0.159	0.075	0.048
Vegetables and legumes	1.058	-0.312	-0.253	0.081	0.002	0.002	-0.082	-0.460	-0.013	-0.034	-0.045
Sugar	1.074	-0.175	-0.077	0.021	-0.111	0.020	-0.024	0.051	-0.644	-0.014	0.120
Spices	1.075	-0.175	-0.243	0.198	-0.012	0.009	-0.471	0.191	-0.052	-0.878	-0.252
Drinks	0.699	0.051	-0.123	-0.172	-0.020	-0.127	-0.022	0.099	-0.198	-0.066	-0.952
$e_{ij} = \xi_{ij} + w_i \pi_i$		-0.199	-0.254	0.061	0.055	-0.280	-0.112	-0.055	-0.139	-0.081	0.018
$\sum_{i=1}^{n} w_i e_{ij} = -w_j$		-0.261	-0.217	-0.108	-0.010	-0.040	-0.116	-0.139	-0.048	-0.030	-0.027
$\sum_{i=1}^{n} w_i \pi_i = 1$											

Table 9. Mean Values of compensated demand price Elasticity (Hicks Elasticity's of AIDS) for urban

Group elasticity	Price									
	Cereal	Meat	Dairy	Butter and animal oil	Vegetable oil	Fruit and Nuts	Vegetables and legumes	Sugar	Spices	Drinks
Cereal	-0.217	-0.057	0.108	0.106	-0.112	0.024	-0.043	-0.030	-0.007	-0.025
Meat	0.079	-0.142	0.094	-0.002	0.022	0.108	0.069	0.009	0.041	0.049
Dairy	0.121	0.057	-0.962	0.002	0.053	0.061	0.090	0.087	0.067	0.082
Butter And animal oil	0.451	0.573	-0.392	-2.569	0.171	-0.010	0.436	0.260	0.082	0.280
Vegetable oil	0.032	-0.070	0.157	0.065	-0.244	-0.008	0.068	-0.096	-0.054	0.043
Fruit and Nuts	0.090	0.270	0.109	0.009	0.157	-0.435	-0.026	0.218	0.112	0.082
Vegetables and legumes	-0.036	-0.023	0.196	0.013	0.045	0.041	-0.312	0.037	-0.002	-0.016
Sugar	0.105	0.155	0.138	-0.099	0.064	0.101	0.201	-0.592	0.017	0.150
Spices	0.105	-0.009	0.315	-0.0003	0.053	0.078	0.341	-0.001	-0.872	-0.222
Drinks	0.233	0.028	-0.096	-0.012	-0.099	0.059	0.197	-0.164	-0.045	-0.933
$\sum_{i=1}^{n} w_i \xi_{ij} = 0$	0	0	0	0	0	0	0	0	0	0

Table 10. Compensated variation of vegetable oil price changes

	Compensating variation (CV)				
	20%	40%	60%	80%	100%
Total urban CV (10^9 Rials)	7996.7	14149.1	18456.9	20920.4	21539.3
Per urban household CV (Rials)	410333.6	726024.2	947071.7	1073476.1	1105237.3
Total rural CV (10^9 Rials)	3446.6	6721.3	9823.4	12753.1	15510.3
Per rural household CV (Rials)	549491.8	1071107.8	1565448.1	2032312.3	2471700.8

Conclusions and policy implications

This study examined the vegetable oil demand in Iranian's rural and urban households, separately. The COICOP data structure was used for the classification of food items in the household's food basket. Food items were classified into ten food groups i.e. Cereal, Meat, Dairy, Butter, Vegetable Oil, Fruits and Nuts, Vegetables and Legumes, Sugary, Spices, and Drinks. To estimate the vegetable oil demand equations and elasticities, the LAIDS model and ISUR technique were employed. The results revealed that vegetable oil was an elastic (-1.073) food groups in the rural household food basket, unlike it was an inelastic (-0.280) food item in urban consumers. The vegetable oil was also found to be a necessity (normal) food item for both rural (0.872) and urban (0.889) consumers. According to the results, the following suggestions are provided for policymakers:

1. The rural consumers of vegetable oils are more responsive to price changes than urban consumers because of its near substitution goods like butter and animal oil (0.115). Thus, the vegetable oil market in urban areas is stable than in rural areas.

2. Consumption of vegetable oil in the urban area has a low demand own-price elasticity, implying the importance of vegetable oil in the urban diet. The urban consumers will therefore incur a large part of the cost of rising prices due to the absence of protection policies.

3. Given that the per capita consumption of vegetable oil in rural (14.5 kg) and urban (13.29 kg) households are higher than the global average (12.5 kg), being inelastic in the urban area leads to inefficient price policy while policy reforms in marketing and trade are likely to impact the consumer's behaviors and consumption pattern reforms in the rural area.

4. Concerning vegetable oil income elasticity, as Iranian household income grows, demand for vegetable oil will continue to increase with a lower ratio.

5. In all cases, the absolute value of uncompensated own-price elasticities is greater than the absolute compensated elasticities. This indicates that consumers' response to commodity price changes is higher when income is not compensated.

6. Given the negative welfare effects associated with price reform, policymakers should mitigate these effects by design the different compensation payments for both rural and urban regions.

Compliance with Ethical Standards

Conflict of interest

The authors declared that for this research article, they have no actual, potential or perceived conflict of interest.

Author contribution

The contribution of the authors to the present study is equal. All the authors read and approved the final manuscript. All the authors verify that the Text, Figures, and Tables are original and that they have not been published before.

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References

Heydari, K., Kavand, M., Otvan, M., & Pirouz, E. (2010). Vegetable oil market. Institute for Trade Studies and Research, Tehran

Iranian Statistical Center (ISC), 2011. National household survey of 2011. Available at: www.amar.org.ir

Akbari, A., Ziaei, M. B., & Ghahremanzadeh, M. (2013). Welfare Impacts of Soaring Food Prices on Iranian Urban Households: Evidence from survey data. *International Journal of Business and Development Studies, 51*(1), 23-38.

Alnafissa, M., & Alderiny, M. (2019). Analysis of Saudi demand for imported honey using an Almost Ideal Demand System (AIDS). *Journal of the Saudi Society of Agricultural Sciences*. doi:https://doi.org/10.1016/j.jssas.2019.05.001

Ataie s, k., & Mohammadi, h. (2018). Determining the demand elasticity of selection food product in Mazandaran province by using Almost Ideal Demand System (AIDS) Case study: Hen, Aquatic and Beef Meat v. *Agricultural Economics Research, 10*(39), 173-186. Retrieved from http://jae.miau.ac.ir/article_2887_1be8d9d97c916deb03f1f1a9081e60f9.pdf

Berck, P., Hess, P., & Smith, B. (1997). Estimation of household demand for goods and services in California's dynamic revenue analysis model. *Department of Agricultural & Resource Economics, UC Berkeley, Working Paper Series*. Retrieved from https://ideas.repec.org/p/cdl/agrebk/qt4jj0t5j7.html

Blanciforti, L., & Green, R. (1983). An Almost Ideal Demand System Incorporating Habits: An Analysis of Expenditures on Food and Aggregate Commodity Groups. *The Review of Economics and Statistics, 65*(3), 511-515. doi:https://10.2307/1924200

Chen, B., Saghaian, S., & Zheng, Y. (2018). Organic labelling, private label, and U.S. household demand for fluid milk. *Applied Economics, 50*(28), 3039-3050. doi:https://10.1080/00036846.2017.1414936

Davoodi, P. (2010). Microeconomic 1. In (pp. 280): Danaei and Tavanaei.

Deaton, A., & Muellbauer, J. (1980). An almost ideal demand system. *The American economic review, 70*(3), 312-326. Retrieved from https://www.jstor.org/stable/1805222

Deaton, A. S., Ruiz-Castillo, J., & Thomas, D. (1989). The Influence of Household Composition on Household Expenditure Patterns: Theory and Spanish Evidence. *Journal of Political Economy, 97*(1), 179-200. doi:https://10.1086/261597

Edgerton, D. L., Assarsson, B., Hummelmose, A., Laurila, I. P., Rickertsen, K., & Vale, P. H. (1996). *The econometrics of demand systems: with applications to food demand in the Nordic countries* (Vol. 34): Springer Science US.

Elsner, K. (2001). *Food consumption in Russia*: Wissenschaftsverlag Vauk Kiel KG.

Green, R., & Alston, J. M. (1990). Elasticities in AIDS models. *American journal of agricultural economics, 72*(2), 442-445. doi:https://doi.org/10.2307/1242346

Henderson, J. M., & Quandt, R. E. (1971). Microeconomic theory: A mathematical approach.

Hicks, J. R. (1946). An Inquiry into Some Fundamental Principles of Economic Theory. In *Value and Capital*: Clarendon Press Oxford.

Hoang, H. K. (2018). Analysis of food demand in Vietnam and short-term impacts of market shocks on quantity and calorie consumption. *Agricultural Economics, 49*(1), 83-95. doi:https://doi.org/10.1111/agec.12397

Hooshmand, Z., Khodadad Kashi, F., & Khoshnevis, M. (2017). Evaluating the Consumption Behavior of Urban Families in Tehran Province. *The Journal of Economic Policy, 9*(18), 183-203. doi:https://10.29252/jep.9.18.183

Kalkuhl, M., von Braun, J., & Torero, M. (2016). Volatile and Extreme Food Prices, Food Security, and Policy: An Overview. In M. Kalkuhl, J. von Braun, & M. Torero (Eds.), *Food Price Volatility and Its Implications for Food Security and Policy* (pp. 3-31). Cham: Springer International Publishing.

Khalili Araghi, M., & Barkhordari, S. (2012). An evaluation of the welfare effects of reducing energy subsides in Iran. *Energy Policy, 47*, 398-404. doi:https://doi.org/10.1016/j.enpol.2012.05.007

Liu, L., Xu, W., Xu, Z., Xu, S., Li, Z., Yu, W., & Li, G. (2019). *Empirical Analysis on the Mutual Substitution Relationship between Vegetables in Beijing Based on LA-AIDS Model.* Paper presented at the Journal of Physics: Conference Series.

Ngui, D., Mutua, J., Osiolo, H., & Aligula, E. (2011). Household energy demand in Kenya: An application of the linear approximate almost ideal demand system (LA-AIDS). *Energy policy, 39*(11), 7084-7094. doi:https://doi.org/10.1016/j.enpol.2011.08.015

Noorollahi, S., Jabbari, A., Moradkhani, N., & Faramarzi, A. (2017). Evaluation of compensated variation in rising commodity prices: The case of iranian urban households. *Journal of economic research and policies, 25*(81), 155-185.

Nouri, M., & Homaee, M. (2020). Drought trend, frequency and extremity across a wide range of climates over Iran. *Meteorological Applications, 27*(2), e1899. doi:https://doi.org/10.1002/met.1899

Paymard, P., Yaghoubi, F., Nouri, M., & Bannayan, M. (2019). Projecting climate change impacts on rainfed wheat yield, water demand, and water use efficiency in northeast Iran. *Theoretical and Applied Climatology, 138*(3), 1361-1373. doi:https://10.1007/s00704-019-02896-8

Pishbahar, E., & Nataj Firoozjah, M. (2014). Evaluation the dairy demand of Iran using almost ideal demand system (AIDS). *Iranian Journal of Agricultural Economics and Development Research, 45*(4), 693-701. doi:https://10.22059/ijaedr.2014.53843

Rathnayaka, S. D., Selvanathan, S., Selvanathan, E. A., & Kler, P. (2019). Modelling Sri Lankan consumption patterns using error corrected LA-AIDS. *Economic Modelling, 80*, 185-191. doi:https://doi.org/10.1016/j.econmod.2018.11.006

Şahinli, M. A., & Fidan, H. (2012). Estimation of food demand in Turkey: method of an almost ideal demand system. *Quality & Quantity, 46*(2), 653-663. doi:https://10.1007/s11135-010-9419-4

Satari Yuzbashkandi, S., & Khalilian, S. (2020). On Projecting Climate Change Impacts on Soybean Yield in Iran: an Econometric Approach. *Environmental Processes, 7*(1), 73-87. doi:https://10.1007/s40710-019-00400-y

Satari Yuzbashkandi, S., & Mehrjo, A. (2020). Towards agricultural demand for the main energy carriers in Iran: Application of linear approximate almost ideal demand system (LA-AIDS) analysis. *Journal of the Saudi Society of Agricultural Sciences, 19*(5), 313-318. doi:https://doi.org/10.1016/j.jssas.2020.02.001

Sekhampu, T. J., & Niyimbanira, F. (2013). Analysis Of The Factors Influencing Household Expenditure In A South African Township. *, International Business & Economics Research Journal (IBER), 12*(3), 279-284 doi:https://doi.org/10.19030/iber.v12i3.7671

Ullah, I., Jan, A. U., Fayaz, M., Ali, A., & Shah, A. U. (2019). A Cross-Sectional Analysis of Food Demand in Khyber Pakhtunkhwa, Pakistan. *Sarhad Journal of Agriculture, 35*(2), 378-385.

Yazdani, S., & Sherafatmand, H. (2013). A Comparison of Almost Ideal Demand System vs. Rotterdam model as Related to Milk and Dairy Products. *Iranian Journal of Agricultural Economics and Development Research, 43*(4), 693-703. doi:https://10.22059/ijaedr.2013.51355

Yuzbashkendi, S. S. (2019). Climate And Government'S Guaranteed Price Policy Effects On The Major Oilseeds Cultivation Area And Land Rental In Iran. *International Journal of Food and Agricultural Economics (IJFAEC), 7*(1128-2019-3388), 257-269.