Edible oil market liberalization in Iran: producer and consumer welfare effects

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Abstract
Due to importance of edible oils in nutrition and food security of the community as well as of creating employment and income for its producers, it is always subsidized by several protection policies in Iran. Considering the importance of edible oil as a necessary ingredient in the consumer basket of urban and rural households, reducing or eliminating subsidies for edible oils can have considerable welfare effects. In this study, we used the partial equilibrium model of edible oils market to determine the extent of welfare changes of producers and consumers for the period of 1981-2010. After estimating the supply and demand functions of edible oil, the changes in welfare due to the prices changes by 25, 50, 75 and 100 percent were evaluated.

The results indicated that edible oil is a necessity commodity with regard to income elasticity's for urban consumers and is a luxury commodity for rural consumers. Furthermore, the price elasticity of demand for urban consumers is less than that for rural consumers implying that the edible oil is less elastic to urban consumer. Moreover, the welfare of producers would increase and consumers would decrease as a consequence of the price increment in edible oil. There was a greater Change in urban consumer welfare relative to change of rural consumer welfare. In addition, the overall decline in urban and rural consumer welfare was higher than that in the welfare of the producers gain.

Keywords: Edible oil; Partial equilibrium; Producer and consumer surplus; Welfare effects

Introduction
Edible oils and fats, after hydrocarbons, are the second most important source of energy for human nutrition, so have a great importance for meeting the food security. The results of the comprehensive surveys performed by the Iranian Institute of Nutrition indicate that Iranian provide about 21% of daily energy by edible oil. Population, consumption of edible oil and total consumption of oil increased by 3.3, 6.6 and 22 times over the last 40 years in the country, respectively (Heydari et al., 2010). The Iranian generous food subsidy programs inherited from the Iran-Iraq war began in September 1980 and was then pursued to achieve the goal of self-sufficiency and to protect the poor in after-war period (Mosavi, 2015). Subsidy paid to edible oil exhibited a positive trend during the last five decades. The subsidy amount increased from 7275 million Rials in 1978 to 2730215 million Rials in 2009 (consumer and producer protection organization, 2009). However, experiences revealed that Iran subsidy program have run for much longer periods and deviated from original objectives (Lechtenbohmer et al., 2010). In addition, Iran subsidy programs have caused substantial adverse socioeconomic consequences such as extensive consumption of subsidized goods, inefficient production technologies, budget deficiency and unfair income distribution (Guillaume and Zytek, 2010). According to the law legislated in 2010, the direct subsidy paid on sixteen items of goods and services would be gradually eliminated and the price of gasoline, gas, oil, electricity, water, wheat, sugar, rice, edible oil and milk will be offered based on the Persian Gulf markets.

Social welfare change is one of the parameters should be taken into account by policy-makers for developing economic plans. Price changes are also one of the factors affecting the economic well-being of the community. Price change of each product would impact the level of production and welfare of the producers and the consumption and welfare of the consumers. The welfare of a society depends generally on levels of consumer satisfaction. However, almost all economic welfare policies considered by economists could have positive implications for some people, but negatively influence some other groups of people (Rahmani and Soltani, 1994). Although some trade liberalization studies are based on general equilibrium analysis (Taniguchi, 2001), partial equilibrium analysis of supply and demand is widely used to analyze food policies (Schneider, 1988; da Silva and Grennes, 1999; bakhshode and soltani, 2002; shoshtarian and bakhshode, 2007). Applying partial equilibrium frameworks are appropriate method for assessing the changes in the consumer and producer welfare surplus (Henderson and Quandt, 2003). Since economic adjustment and reaching to real prices cannot be reached in the short term, the fragile groups of the society (the poor) which are already under great economic pressure seem to be highly negatively affected by such policies during the transition period to real prices. Knowledge of how the welfare of producers and consumers are changing is, therefore, one of the major issues for economic decision-makers (monjazeb, 1991).

Considering the importance of edible oil for producers as well as in household consumption basket, the purpose of this study is to estimate the supply and demand elasticity's of edible oil for urban and rural consumers, and finally, asses the welfare effects of market liberalization of edible oil in Iranian society.

Materials and methods

In this study, the welfare effects of liberalization in Iranian edible oil market were analyzed by applying a partial equilibrium analysis for the period of 1981-2010. This was performed using the market supply and demand curves for edible oil shown in Fig. 1, where D is market demand; S is the market supply, P_d, P_s and P_w are consumer price, producer price and price after liberalization, respectively.
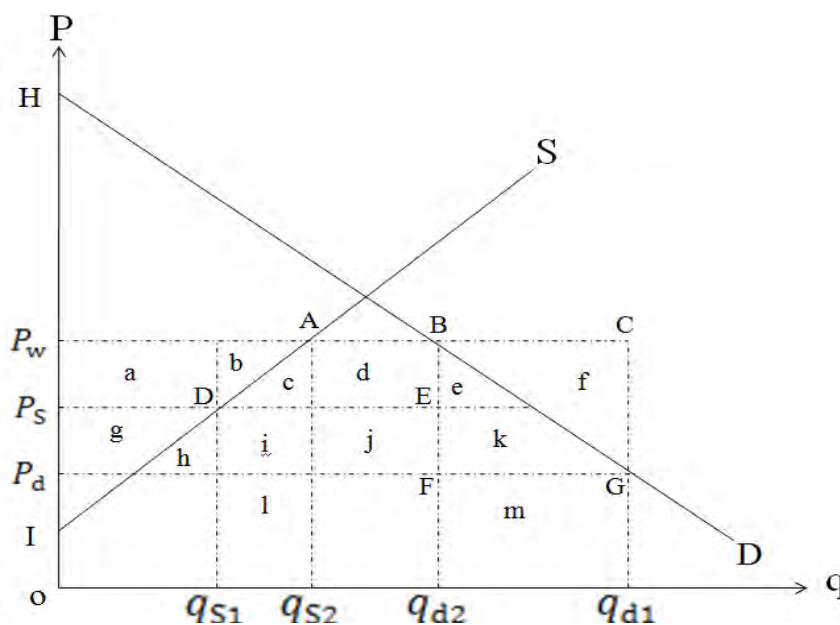

Figure 1: Effects of liberalization on Iranian edible oil market

As the price of this commodity increases for producers and consumers with the liberalization of the market for edible oil, this liberalization will cause the effects of change in consumer and producer welfare, per capita consumption and the supply of oil. If Fig. 1 shows the effects of liberalization on Iranian edible oil market and the price for the production and consumption of edible oil increase from P_s, P_d to P_w and so in the production and consumption section assuming constant elasticity supply function $Q_s = \alpha P_s^\varepsilon$, demand function $Q_d = \beta P_d^\eta$, where Q_s and Q_d are quantities of supply and demand and $\alpha, \beta, \varepsilon$ and η are parameters to be estimated.

The effects of liberalization can be summarized as following:

The effect of liberalization on income redistribution

Assuming that the benefits of consumers and producers are determined based on the change in their welfare and the benefits of the government with changes in their revenues, in this case consumer surplus is the monetary gain was obtained by consumers because they are able to purchase a product for a price that is less than the highest price that they would be willing to pay (Henderson and Quant, 2003). In other words, the total benefit or value that a consumer gained is more compared with that is practically paid for a commodity (Bar, 2004). Similarly, there is a producer surplus when the market price for a commodity is greater than the minimum price which is necessary for the supply of that commodity (Henderson and Quant, 2003). Note that the producer's surplus welfare is the total gain or income that a producer receives in addition to the cost of the goods production (Bar, 2004).

1. Change in producer's welfare (area a+b) = $CPW = \dfrac{q_{S1}}{\varepsilon+1}\left[\left(\dfrac{P_W}{P_S}\right)^\varepsilon P_W - P_S\right]$

2. Change in consumer welfare (area $P_w BGP_d$) = $CCW = -\dfrac{q_{d1}}{\eta+1}\left[\left(\dfrac{P_W}{P_d}\right)^\eta P_W - P_d\right]$

The liberalization impacts upon change in quantity produced

The producer current price changes from P_s to P_w leading to producer support, and as a result of this increase, producers are encouraged to produce more, the domestic supply increase from q_{S1} to q_{S2}.

Change in Quantity Produced= $CQP = q_{S2} - q_{S1} = q_{S2}\left[1 - \left(\dfrac{P_S}{P_W}\right)^\varepsilon\right]$

The liberalization effect on change in quantity of consumption

As the price increases from P_d to P_w, the demand for oil decreases from q_{d1} to q_{d2}. Therefore, the amount of reduction in consumption due to liberalization will be equal to $q_{d1}q_{d2}$. This value can be calculated using the following equation:

Change in Quantity Consumed= $CQC = q_{d2} - q_{d1} = q_{d2}\left[1 - \left(\dfrac{P_d}{P_W}\right)^\eta\right]$

The effect of liberalization on government expenditure

The total subsidy paid to producers is equal to the difference between the price of P_s and P_w in the amount after the liberalization:

Treasury cost of production policy subsidy= TTP= $(P_w - P_s)q_{s2}$

In the consumer market, the difference between P_d and P_w is the amount of money that government pays for each product unit:

Treasury cost of consumption policy subsidy=TCC=$-(P_w - P_d)q_{d2}$

In previous studies that have been carried out in the field of welfare effects of price changes, supply and demand functions were estimated independently which is likely to result in an incompatibility in the model. Therefore, the welfare effects on both sides of market equilibrium have been discussed separately in such studies. In this study, however, the simultaneity of supply

and demand functions was considered by employing partial equilibrium model in a system of simultaneous equations to better evaluate the market and the welfare changes.

Simultaneous equation system in this model includes supply of edible oil, domestic demand in urban and rural areas and the demand for imported edible oil. The required elasticity's of the model were obtained and then the final form of model was established based on the supply, demand, import, and equilibrium among them. The results of previous studies i.e. Shushtarian (2003), Azizan (2005), bakhshode (2001), (Schmitt & Kaiser, 2004), Shahbazi and et al (2009) and Da Silva & Grennes (1999) were used to develop the model.

$$\text{Ln}Q_t^S = \beta_0 + \beta_1 \text{Ln}p_{t-1}^{os} + \beta_2 \text{Lnwp}_t^d + \beta_3 \text{Lnim}_t + \text{Ln}U_{t1} \quad \text{supply equation} \tag{5}$$

$$\text{Ln}Q_t^{Dr} = \alpha_0 + \alpha_1 \text{Lnrep}_t^d + \alpha_2 \text{Lnpop}_t^r + \alpha_3 \text{Lny}_t^r + \text{Ln}U_{t2} \quad \text{rural demand equation} \tag{6}$$

$$\text{Ln}Q_t^{Du} = \gamma_0 + \gamma_1 \text{Lnrep}_t^d + \gamma_2 \text{Lnpop}_t^u + \gamma_3 \text{Lny}_t^u + \text{Ln}U_{t3} \quad \text{urban demand equation} \tag{7}$$

$$\text{Lnim}_t = \delta_0 + \delta_1 \text{Lnp}_t^{im} + \delta_2 \text{Lnrer}_t + \delta_3 \text{Lny}_t + \text{Ln}U_{t4} \quad \text{import demand equation} \tag{8}$$

$$Q_t^S = Q_t^{Dr} + Q_t^{Du} \qquad\qquad\qquad \text{market equilibrium} \tag{9}$$

In our simultaneous equation system, the introduced variables are:

Table 1: the introduced variables

variable	explanation
Q_t^{Dr}	The amount of rural edible oil demand for the year t
Q_t^{Du}	The amount of urban edible oil demand for the year t
Q_t^S	The supply of edible oil in domestic markets for the year t
im_t	Import of edible oil in year t
wp_t^d	Wholesale price of edible oil in year t
rep_t^d	Retail price of edible oil in year t
p_{t-1}^{os}	Guaranteed oilseed price in year t-1
y_t^r	rural per capita income in year t
y_t^u	urban Per capita income in year t
pop_t^r	Rural population in year t
pop_t^u	Urban population in year t
p_t^{im}	Imported prices for year t
rer_t	Real exchange rate for year t
y_t	Real national income for year t

The augmented Dickey-Fuller test was used to determine the stationary or non-stationary nature of time series (seddighi et al, 2002):

$$\Delta Y_t = \beta_1 + \beta_2 . t + \partial . Y_{t-1} + \alpha_i . \sum_{i=1}^{P} \Delta Y_{t-i} + \varepsilon_t$$

In the regression analysis, the basic assumption is that there is no correlation between the explanatory variables and the error terms. If this assumption is violated, use of Ordinary Least Square (OLS) and Generalized Least Square (GLS) methods will result in simultaneity bias and caused the estimates be bias and incompatible.

In the current study, a system of equations in which the simultaneity was determined using the Hausman test was used to analyze the welfare effects. When the equations have a simultaneity bias, in order to determine the estimation strategy in the form of a system or single equation, the Diagonality Test (Breusch- Pagan test) for variance-covariance matrix of residuals is recommended to be performed (seddighi et al., 2002). In this test, λ statistics was computed as follows:

$$\lambda = n \sum_{i=2}^{G} \sum_{j=1}^{i-j} r_{ij}^2$$

$$r_{ij}^2 = \frac{s_{ij}^2}{s_{ii}s_{jj}}$$

Where λ has χ^2 distribution with freedom degree of $G(G-1)/2$ and (G is the number of equations). The decision was taken based on followed hypothesis test:

H_0 ： All covariance between equations is zero
H_1: At least one covariance is nonzero

Data

The required data including domestic production, wholesale and retail price of oil, consumer price index, rural and urban demand, rural and urban per capita income, national income, import and exchange rate were collected from Consumer and Producer Protection Organization, Ministry of Agriculture, Statistics Center of Iran, Central Bank and Association of Iranian Edible Oil Industries over 1981-2010.

Results and discussion

The results of stationary test are given in Table 2. Illustrate that all series were stationary at level or in first difference.

Table 2: Results of Dickey-Fuller test

variable	T ratio	T critical	Significant level	I(0)	I(1)
LnQ_t^{Dr}	-4/15	-3/60	%5	*	
LnQ_t^{Du}	-5/82	-4/32	%1	*	
LnQ_t^{S}	-6/34	-4/35	%1	*	
$Lnim_t$	-5/42	-4/32	%1	*	
$Lnrep_t^{d}$	-5/04	-3/69	%1		*
$Lnwp_t^{d}$	-4/80	-3/69	%1		*
Lnp_{t-1}^{os}	-3/92	-3/58	%5	*	
Lny_t^{r}	-5/94	-3/69	%1		*
Lny_t^{u}	-3/87	-3/69	%1		*
$Lnpop_t^{r}$	-3/33	-2/97	%5	*	
$Lnpop_t^{u}$	-2/85	2/62	%10	*	
Lnp_t^{im}	-3/70	-3/58	%5	*	
Lny_t	-6/05	-4/46	%1		*
$Lnexr_t$	-5/74	-3/69	%1		*

Since the import, import price and price of edible oil series were endogenous, the simultaneity of supply, rural and urban demand, and imports equations were investigated. The results of the simultaneity test are presented in Tables 3-6. The supply equation has a simultaneity bias as the coefficient of residual term was statistically significant at 1% level (Table 3). However, the coefficient obtained for the simultaneity of urban and rural demand and import equations was not significant implying the absence of simultaneity bias in these equations (Tables 4-6).

Result of Hausman test

Table 3: Results of simultaneity test of supply equation

T ratio	Standard deviation	coefficients		variables	
-4/32	0/96	-4/22		intercept	C
3/15	0/052	***	0/16	price	$Lnwp^d$
17/74	0/06	***	1/17	Estimated import	Lnim hat
4/00	0/14	***	0/57	Error term	u
1/25	0/095	ns	0/12	Oilseed price	Lpos(-1)
		R^2=0.96		F=150.36 ***	statistics

*** indicate as significant at 10%

Table 4: Results of simultaneity test of rural demand equation

t statistics	Standard deviation	coefficients		variables	
-1/41	19/58	-27/78		intercept	C
-3/83	0/12	***	-0/46	Estimated retail price	$Lnrep^d$ hat
7/48	0/17	***	1/31	Per capita income	d(lyr,1)
-0/27	2/60	ns	-0/71	Error term	u
-1/42	19/58	ns	1/49	Rural population	lpopr
		R^2=0.73		F=15.88 ***	statistics

Table 5: Results of simultaneity test of urban demand equation

t statistics	Standard deviation	coefficients		variables	
-8/61	2/69	-23/18		intercept	C
-1/93	0/09	*	-0/18	Estimated retail price	$Lnrep^d$ hat
3/63	0/16	***	0/60	Urban per capita income	d(lyu,1)
0/55	1/57	ns	-0/87	Residual term	u
8/17	0/20	***	1/64	Urban population	lpopu
		R^2=0.93		F=79.85 ***	statistics

* And *** significant at 1% and 10%, respectively

Table 6: Results of simultaneity test of import equation

t statistics	Standard deviation	coefficients		variables	
3/37	3/54	11/95		intercept	C
-3/78	0/16	***	-0/62	Imported price	Lnpim hat
2/28	0/22	**	0/51	National income	d(ly,1)
-0/24	0/17	ns	-040	Residual term	u
0/13	0/07	ns	0/01	Exchange rate	LnExr
	$R^2=0.82$		F=28.52	***	statistics

** Significant at 5%
ns not significant

The results of the endogeneity test (Table 7) indicate that the wholesale price, the retail price and the imported price coefficients were not significant, so the assumption of the exogenous nature of these variables was acceptable.

Table 7: Results of endogeneity test

t statistics	Standard deviation	coefficients		variables	
1/64	0/10	ns	0/165	Wholesale price	$Lnwp^d\ hat$
-0/86	0/40	ns	-0/34	Imported price	Lnpim hat
-0/65	0/12	ns	-0/08	Retail price	$Lnrep^d$ hat

Results of simultaneous equations system identification:

According to the results of the Hausman test, we perform the identification problem to determine the appropriate method and obtain efficient and consistent estimate for the supply equations. It is noteworthy that the demand and import equations did not have a simultaneity bias and were estimated using the OLS method and carrying out the identification process for these equations was unnecessary. The first decision rule for identification is the so called order condition. For an equation to be identified the total number of variables excluded from it must be equal to or greater than the number of endogenous variables in the model less one. This rule specifies the necessary conditions for identification .In our system, the number of endogenous and predetermined variables was four and nine, respectively.

Table 8: the order condition of identifiability

identification	$m-1$	K-k	Predetermined variable	Endogenous variable	equation
Over identification	1	7	2	2	Supply equation

A sufficient condition for the identification of a relationship is that the rank of the matrix of parameters of all the excluded variables (endogenous and pre-determined) from that equation are equal to (G-1).The rank condition is a necessary and sufficient condition.

$$A \underline{} \begin{pmatrix} 1 & 0 & 0 \\ 0 & -\gamma_2 & 0 \\ 0 & 0 & -\delta_1 \end{pmatrix} \implies |A| \neq 0$$

According to the results of the Hausman and endogeneity test, only the oil supply equation was simultaneity and should be estimated by 2SLS or 3SLS methods. In order to determine the method of estimation and selection method, the Breusch-Pagan test or a diagonal test of the correlation coefficient matrix among residual terms was undertaken. The result of this test is as follow:

$$\lambda = n \sum_{i=2}^{G} \sum_{j=1}^{i-j} r_{ij}^2 = 7/68$$

λ Distribution is χ^2 with the degree of freedom G (G-1) / 2, where G is the number of equation, the value of χ^2 was obtained at 95 and 90% confidence level respectively 11.07 and 9.23, respectively, Therefore, it can be said that supply equation is not a system model, so it can be estimate with 2SLS method (Seddighi et al, 2000).

Estimation of Supply and demand equation

Table 9: Results of the supply equation

t statistics	Standard deviation	coefficients	variables	
-3/53	1/21	-4/30	intercept	c
2/25	0/12	0/27 **	*Guarantee price of oilseeds*	lnp_{t-1}^{os}
2/61	0/06	0/17 ***	*Wholesale price*	$lnwp_t^d$
11/33	0/09	1/09 ***	*import*	$lnim_t$
DW=1/97	R^2=0/93	F=123/83	*statistics*	

Around 93% of the changes in the supply in each period can be accounted for by changes in the price of oil, the guaranteed price of oilseeds of the previous year and the import of vegetable oil (Table 9). In this equation, the elasticity sign of the wholesale price of edible oil, the guaranteed price of oilseeds and imports was in line with the direction of supply changes and consistent with supply theory. The Durbin-Watson statistics show that there was no correlation between the error terms.

The price elasticity (0.17) has a significant role in the supply of edible oil based on the t-ratio value. The partial elasticity of the guaranteed price of oilseeds (0.27) demonstrates a 0.27% increase in the supply of edible oil due to 1% increase in the guaranteed price of oilseeds. This can be explained by the fact that farmers would be encouraged to grow more oilseeds (the main inputs for vegetable oil production) due to increase in the guaranteed price of oilseed. . The supply in Iran is strongly depended on imports and the quantity of import elasticity confirms this dependency.

Table 10: Results of Rural demand function

t statistics	Standard deviation	coefficients	variables	
-2/04	17/86	-36/49	*intercept*	*c*
7/65	0/17	1/32***	*Rural per capita income*	
-4/25	0/11	-0/50 ***	*Retail price*	
1/95	1/03	2/01 *	*Rural population*	
DW=2/09	*R2=0/82*	*F=23/8*	*statistics*	

Table 11: Results of urban demand function

t statistics	Standard deviation	coefficients	variables	
-9/34	2/46	-23/02	*intercept*	*c*
4/07	0/15	0/61 ***	*urban per capita income*	lny_t^u
-2/05	0/11	-0/18 **	*Retail price*	$lnrp_t^d$
9/42	0/17	1/62 ***	*Urban population*	$lnpop_t^u$
DW=2/6	*R²=0/93*	*F=122/8*	*statistics*	

As for rural household, all determined coefficients were significant at 1% and 10% level and the price and income elasticity was calculated to be -0.50 and 1.32, respectively. The price and income elasticity was, respectively, -0.18 and 0.61 for urban household. It is worth mentioning that the demand price elasticity of edible oil for rural households was higher as compared to that for urban households and rural households were more responsive to price changes. Furthermore, income elasticity of edible oil for urban household varied between 0 and 1 implicitly indicating that oil is necessity goods for urban households. However, this variable was more than 1 for rural households because the animal oils can be consumed as an appropriate alternative for edible oils. In other words, edible oil is a luxury good for the rural household which its consumption increases as the income rises.

Table 12: results of import demand function

t statistics	Standard deviation	coefficients	variables	
2/17	3/06	6/68	*intercept*	*c*
3/53	0/21	0/77 ***	*National income*	lny_t
-2/65	0/13	-0/34 **	*Import price*	lnp_t^{im}
-1/8	0/05	-0/09 *	*Real exchange rate*	$lnexr_t$
DW=1/85	*R²=0/78*	*F=122/8*	*statistics*	

Results of import demand function of edible oil shows that all variables are significant at 1, 5 and 10% level. The sign of the explanatory variables also corresponds to the demand theory. The sign of the explanatory variables also corresponds to the demand theory. The price elasticity of edible oil imports was, therefore, negative and inelastic. A 0.34% decrease in demand was resulted in when the price of imported vegetable oil increased by 1%. . Income demand elasticity values also suggested that increasing national revenue by 1% caused a 0.77% increase in import demand. Moreover,, the import demand of exchange rate indicated that if the exchange rate increases by 1%, imports would decrease by 0.9%.

Welfare effects of edible oil market liberalization
Welfare effects in rural and urban households

Based on the estimated coefficients and elasticities, various issues of edible oil liberalization were addressed. In the final part of the research, determination of the welfare effects of the gradual decrease in the subsidy of edible oil (price increase) has been paid to the welfare of various social groups by using different scenarios (25, 50, 75 and 100 percent increase), which are reflected as follow. The results of the study for the period 2001-2010 are presented in the following tables.

Table 13: Rural and urban consumer welfare changes due to various scenarios for market liberalization of edible oil (million Rials)

% 100		% 75		% 50		% 25		year
urban	rural	urban	rural	urban	rural	urban	rural	
-766987	-536028	-566840	-385519	-371790	-245412	-182528	-116545	2001
-1234888	-929037	-912641	-668178	-598601	-425345	-293880	-201994	2002
-1369168	-886012	-1011880	-637233	-663691	-405647	-325836	-192639	2003
-1414388	-907248	-1045301	-652507	-685612	-415369	-336598	-197256	2004
-1917322	-1274931	-1416993	-916950	-929404	-583707	-456287	-277199	2005
-2219511	-1446955	-1640325	-1040672	-1075888	-662466	-528202	-314601	2006
-2806858	-1748915	-2074403	-1257846	-1360599	-800714	-667980	-380254	2007
-3201958	-2192378	-2366400	-1576791	-1552120	-1003747	-762006	-476674	2008
-3398077	-2240049	-2511342	-1611077	-1647187	-1025572	-808679	-487038	2009
-3595866	-2294176	-2675997	-1695696	-1756121	-1047341	-836248	-498734	2010

The results given in Table 13 showed that the welfare of rural and urban household's decreased as a result of the liberalization of prices during 2001-2010. The above table represents the fact that with further liberalization, this group will lose more welfare.

Comparing the welfare effects of subsidies reduction (increase in prices) of edible oils in urban and rural households demonstrates that urban households suffered more than rural households from subsidy reduction. As the demand price elasticity for rural sector (50%) was higher than that for urban households (18%), the edible oil was found to be more elastic for rural household. Hence, one can concluded that rural households was able to transfer price increases while urban households were forced to accept this price rise which seemingly reduced the welfare of consumers in urban sector greater relative to rural sector.

Reducing or eliminating the subsidy of edible oil can decrease government expenditure. For the consumer side, the difference between the changed price and the initial price is equivalent to the subsidy paid by the government per unit of product. The reduction in government expenditure in different years is shown in Table (13).

Table 14: Reduce in government expenditure due to various scenarios for market liberalization of edible oil (million Rials)

% 100		% 75		% 50		% 25		year
urban	rural	urban	rural	urban	rural	urban	rural	
715017	439745	536262	329809	357508	219872	178754	109936	2001
1151213	762161	863409	571621	575606	381080	287803	190540	2002
1276394	726864	957295	545148	638197	363432	319098	181716	2003
1318550	744286	988912	558214	659275	372143	329637	186071	2004
1787405	1045924	1340554	784443	893702	522962	446851	261481	2005
2069118	1187049	1551838	890287	1034559	593524	517279	296762	2006
2616667	1434770	1962500	1076077	1308333	717385	654166	358692	2007
2984995	1798577	2238746	1348933	1492497	899288	746248	449644	2008
3167825	1837685	2375869	1378264	1583912	918842	791956	459421	2009
3384314	1936615	2578525	1464270	1692157	944690	815789	472345	2010

As shown in the table 14, government expenditures should be reduced by the liberalization of the edible oil market.

In order to more accurately assess the welfare effects of subsidy removal program for edible oils, negative (reduced consumer welfare) and positive impacts (government spending cuts) should be taken into account simultaneously. As can be followed in Table 15, the total welfare of rural and urban community was decreased by the subsidy elimination policy.

For both urban and rural communities, social welfare decreased due to edible oil subsidy reduction. Despite having greater social costs, rural household welfare experienced less welfare loss with respect to urban sector. Implementing targeted subsidy plan for energy carriers and essential goods, there was an increase in the price of all the goods and services. This rise in prices was higher than the amount of direct subsidies paid by the government to the households. In addition, this price increment made the poorer segments of the population (which are mostly rural households) unable to transfer the price increase and caused a significant increase in the cost of payments by rural households. The government attempted to overcome the gap by allocating direct subsidies but such policies failed. Unlike rural households, medium- and high-income groups of society which are urban households were able to react to the price rise. The direct subsidy paid by the government was

thus not enough to cover the price increase and overall welfare of rural households is likely to have negatively affected.

Table 15: Changes in social costs due to the gradual reduction of subsidies for edible oil for rural and urban households (million Rials)

% 100		% 75		% 50		% 25		year
urban	rural	urban	rural	urban	rural	urban	rural	
51970	96282	30577	55710	14281	25539	3774	6608	2001
83675	166876	49232	96556	22994	44264	6077	11454	2002
92774	159148	54585	92085	25494	42214	6738	10923	2003
95838	162962	56388	94292	26336	43226	6960	11185	2004
129916	229006	76439	132506	35701	60745	9435	15718	2005
150392	259906	88486	150385	41328	68941	10922	17839	2006
190191	314145	111902	181768	52265	83328	13813	21562	2007
216963	393801	127654	227858	59622	104458	15757	27029	2008
230251	402363	135473	232813	63274	106729	16723	27617	2009
211552	357561	97472	231426	63964	102651	20459	26389	2010

Table 16: Change in per capita consumption of edible oil in rural and urban after a 50% increase in the price (kg)

Urban after liberalization	Rural after liberalization	Urban before liberalization	Rural before liberalization	year
13/54	11/30	15/62	14/22	2001
15/52	11/86	16/63	14/66	2002
15/78	12/43	16/91	15/65	2003
15/89	12/57	17/09	15/80	2004
16/38	12/94	17/59	16/36	2005
17/00	12/67	18/28	16/02	2006
17/01	11/80	18/40	15/55	2007
17/67	13/22	18/97	16/11	2008
18/66	13/10	19/88	15/82	2009
18.43	12.9	19.3	16.1	2010

Decrease in demand for edible oils is also another consequence of the price liberalization policy. Reforming consumption patterns was one of the objectives pursued by the government with the price liberalization and targeted subsidy plans. The results presented in Table 16 indicate that the government was successful to modify the consumption patterns in Iran.

Results of welfare effects on producers

The price increment of edible oils not only affects the consumer's welfare, but also the producers' welfare. The results given in Table 16 illustrate that the price liberalization policy enhanced the welfare of producers. The producers' welfare increase was, however, less than the total welfare loss estimated for urban and rural consumers (Table 12 and 16). As an instance in 2009, the total loss of urban and rural consumers' welfare due to 100% increase in prices was 5638126 million Rials, while the welfare obtained for the producer was 5063197 million Rials.

Table 17: Producers' welfare changes due to various scenarios for market liberalization of edible oil (million Rials)

% 100	% 75	% 50	% 25	year
1011792	748383	491313	241455	2001
1812849	1340893	880295	432619	2002
1836404	1358315	891733	438240	2003
1788578	1322941	868510	426827	2004
2580547	1908729	1253079	615823	2005
3184925	2355763	1546557	760052	2006
3996200	2955831	1940502	953656	2007
4801218	3551272	2331408	1145766	2008
5063197	3745047	2458622	1208285	2009
5163216	4001492	2710688	1290804	2010

The effect of liberalization on government expenditure

The total subsidy allocated to producers is equal to the difference between the initial price and the increased price multiplied by the amount of production after the price increase.

Table 18: Increase in government expenditure due to various scenarios for market liberalization of edible oil (million Rials)

% 100	% 75	% 50	% 25	year
1022820	765635	507520	251486	2001
2356211	1728469	1121974	503896	2002
1961826	1439145	934177	452858	2003
1956879	1368716	893732	436299	2004
3055898	2241744	1355149	705408	2005
3954959	2901289	1883261	812943	2006
4130237	3149531	2095312	976402	2007
5280152	3993096	2542876	1151842	2008
5300961	3888683	2524197	1223648	2009
5514078	4184691	2816992	1344897	2010

Table 19: Changes in social costs due to the gradual reduction of subsidies for edible oil for producers (million Rials)

% 100	% 75	% 50	% 25	year
-11027	-17252	-16206	-10031	2001
-543362	-387576	-241678	-71276	2002
-125422	-80829	-42443	-14617	2003
-168300	-45775	-25222	-9471	2004
-475350	-333015	-102069	-89585	2005
-770034	-545525	-336704	-52890	2006
-134037	-193700	-154810	-22745	2007
-478933	-441824	-211467	-6076	2008
-237763	-143635	-65575	-15363	2009
-350862	-183199	-106304	-54093	2010

In order to assess more precisely the welfare effects of the elimination of edible oil subsidies, the positive effects (increase in producer's welfare) and the negative effects (increase in government expenditure) should be taken into account simultaneously.

Social welfare of production was reduced due to implementation of the subsidy reduction policy (Table 19). It is worth noting that the social cost amount appears to be negligible as compared with the welfare surplus or government expenditure.

The edible oils price liberalization benefits producers and suppliers and encourages them to produce more. There would be a 62,001 tones increase in domestic supply as a result of a 25% increment in price in 2009 (Table 20).

Table 20: Changes in the supply of oil due to the gradual liberalization of price (tonnes)

% 100	% 75	% 50	% 25	year
118400	94545	67567	36610	2001
194610	155402	111057	60174	2002
156114	124661	89089	48271	2003
114911	91758	65576	35531	2004
191997	153316	109566	59366	2005
215474	172064	122964	66626	2006
130641	104319	74552	40395	2007
159856	127649	91224	49428	2008
200546	160142	114444	62010	2009
237498	184953	128243	65342	2010

Table 21 shows the total change in the welfare of consumers and producers. The results indicate that reducing subsidies under any scenario would reduce the welfare of the society.

Table 21: The aggregated change in consumers and producers welfare due to the gradual liberalization (million Rials)

% 100	% 75	% 50	% 25	year
-291223	-203976	-125889	-57618	2001
-351076	-239926	-143651	-63255	2002
-418776	-290798	-177605	-80235	2003
-533058	-374867	-232471	-107027	2004
-611706	-425214	-260032	-117663	2005
-481541	-325234	-191797	-82751	2006
-559573	-376418	-220811	-94578	2007
-593118	-391919	-224459	-92914	2008
-574929	-377372	-214137	-87432	2009
-726826	-370201	-92774	-44178	2010

Conclusion

In recent years, a policy adopted in Iran is a steady reduction in subsidy of commodities and price liberalization. Edible oil is one of the basic ingredients of consumer goods that are subsidized by the government. In this study, a partial equilibrium model was used to analyze the welfare effects of vegetable oil market liberalization. The results of the study showed that edible oil for rural consumer was elastic than urban consumer and this good for rural consumer is luxury commodity

and for urban necessity. In addition, supply price elasticity was also elastic. It should be noted that eliminating the subsidy (price increase) of edible oil will reduce the welfare of the community in the short term. As it has been shown, with liberalization, increase in producers' welfare is always lower than the decline in consumer welfare. Therefore, in the short term, the overall welfare of the society will be reduced. To use the effects of eliminating subsidies in the long run, a steady increase in prices, in addition to helping to produce more and better edible oil, the consumer will also be able to buy, but without increasing prices, producers will be discouraged. Since the edible oil is a necessity for urban households, price increment causes a greater decrease in the welfare of urban household with respect to rural household. Different consumer policy packages should thus be considered for the urban and rural sectors.

The results indicated that the combined effect of consumer and producer welfare decreased. If price changes and subsidy targeting could change the consumer pattern behavior and the producer, the welfare of these two sectors would likely to increase. But this change in prices has not been able to use new methods and modify consumption patterns both in the consumption sector and in the producer sector.

Since the liberalization cause to increase the producer and consumer prices and leads to an increase in the supply and a decrease in demand for edible oil, this will reduce the demand surplus and thus reduce imports.

References

Bakhshodeh, M, Akbari, A., (2002). Welfare Effects of Rice Market Liberalization in Iran: a Case of Multi Exchange Rate System. At IRRC 2002, Beijing, China, September 16-20.

Bakhshodeh, M., Najafi, B., (2002). Welfare Effects of wheat Market Liberalization in Iran: paper for presentation at fourth Conference of Asian Society of Agricultural Economics (ASAE),20-22, Alor Setar, Kedah, Malaysia, 19 p.

Bakhshodeh, M., SHoshtarian, A., (2007). The effect of Iranian wheat market liberalization on social welfare. Agricultural Scientific Journal. 30(1),1-13.

Consumers and Producers' Protection Organization (CPPO) ,(2009). Department of Statistics and Information. Iran-Tehran.

Da Silva e Souza, G., Alves, E., Gazzola, R., Marra, R., (2007). The Meat Market in Brazil: A Partial Equilibrium Model. Brazilian society of rural economics, management and sociology (SOBER). 46: 1189-1209.

Guillaume, D., Zytek, R., (2010). The economics of energy price reform in the Islamic republic of Iran. International monetary fund. Approved by Middle East and central Asia department, Selected Issues Paper.

Hal, R., Varian., (2000). Microeconomic Analysis.

Henderson, J M., Quandt, R E., (2003). Microeconomic theory: A mathematical Approach.

Heydari, kh., Kavand, M., Pirouz, E., (2010). Vegetable Oil Market .Institute for Trade Studies and Research.

Iranian Commerce Ministry, Internal Commerce Development Assistance. Tehran-Iran.

Lechtenbohmer, S., Supersberger, N., Moshiri, S., Atabi, F., Panjeshahi, M.H., Massarrat, M., (2010). Development of Three Cornerstones for a Sustainable Energy Future in Iran. Work package 2. Energy price reform in Iran. Wuppertal institute of Climate, Environmental and Energy. German-Iranian cooperation IV.

Ministry of Industry and Mines, Iranian vegetable oil association, (2009).

Monjazeb, M. (1991). Investigating the Impact of Subsidy on Distribution of Income and its Impact on Some Essential Goods in Iran. Master's Thesis. Faculty of Economics. University of Tehran. 108 p.

Monteiro da Silva, O., Grennes, T., (1999). Wheat Policy and Economy-wide Reform in Brazil. Agricultural Economics, 20: 143-157

Mosavi, S. H. (2016). Energy Price Reform and Food Markets: The Case of Bread Supply Chain in Iran. Agr. Econ., 47:169-179.

Najafi, B., (1999). Evaluating Government Policies in Agriculture Sector, the Iranian Ministry of Agriculture (in Persian).

Nicolas Barr, N., (2004). Economics of the welfare state. Oxford university press.

Rahmani, R., Soltani, Gh., (1994). Effects of Trade Liberalization of Agricultural Products on Economic Welfare in Iran, Case Study: Date and Rice. Master's thesis, Faculty of Agriculture. Shiraz University. 124 p.

Schneider, R. R., (1988). A Framework for Analyzing Food Subsidies, World Development. 16 (7): 835-845.

Seddighi, H. R., Lawler, K.A., Katos, A.V., (2000). Econometrics: A practical approach. London, Routledge, 369 p.

Taniguchi, K. (2001). A General Equilibrium Analysis of Japanese Rice Market Trade Liberalization. Food and Agriculture Organization of the United Nations, Presented at the Annual Meeting of the AAEA, Chicago, IL, August 2001

Yavari, A., Mordi, L., (2006). Estimation of Vegetable Oil Demand Function in Urban Society. Second Scientific-Applied Seminar on Oilseeds and Vegetable Oil of Iran.