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The Welfare Effects of Rising Imported Food Prices in Iran

Zakariya Farajzadeh*, Abdoulkarim Esmaeili
Department of Agricultural Economics, Shiraz University, Shiraz, Iran.

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Abstract

Imports of food products account for a significant amount of total imports into Iran. Despite a rise in price of food products over the last two decades, there has been a rise in their imports. The present study was an attempt to analyze the import demand for foodstuffs through the use of a Quadratic AIDS model. Welfare impacts were also measured using compensated variation. The findings revealed own-price inelastic demand for all products, except for tea and cheese. The price response of food imports was found to be low. Overall, the rise in price of food products as high as their trend over the last two decades has resulted in an annual welfare loss of 2.2 percent.

1. Introduction

Irrespective of their level of development, almost all governments have some plans to provide the society, especially the most vulnerable members of society with basic foodstuffs. Subsidizing some foodstuffs can be considered as one of these plans (Gharibnavaz & Waschik, 2015). The implementation of food subsidy programs in Iran can be traced back to the famines caused by World War II, when a substantial amount of wheat was supplied by the Iranian government through the use of a rationing system (Farajzadeh & Najafi, 2005). During the last decades, a significant portion of some foodstuffs has been provided via imports into the country and the subsidy system of consumption has induced a growing trend of food imports. Although domestic agricultural output was high, considering population growth over 1961-2012, food imports increased due to the increase in the country's population and per capita food consumption (Esmaeili & Farajzadeh, 2016).

1.1 Some stylized facts

Considering nominal values, Iran's import of agricultural products grew by 8.8% annually during 1965-2009, increasing from 0.12 to over 5 billion USD (FAO, 2012). Although a decrease can be observed in some periods, the general

* zakariafarajzadeh@gmail.com
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trend indicates an increase. Unlike the nominal value of import, there were considerable changes in the real import value. Imports increased by an annual rate of 21.6%, during 1965 to 1975; however, a 6% decrease was observed during 1975 to 2002. In general, the real value of imports grew by 1.9% annually during the years 1965-2009. Borensztein and Reinhart (1994) reported a decreasing trend in prices for agricultural commodities in developing countries. The real price of the Iran's agricultural import bundle shows a decrease before 1990s. During the last two decades, however, as indicated by FAO (2012) and illustrated in Figure 1, there has been an increase in the food price index. Indeed, an annual 1.45 % increase in the food price index can be observed during the years 1990-2012. Similarly, an increase in the food price has been reported for the UAE (Azzam & Rettab, 2012) and Mexico (Attanasio et al., 2013) over the same period of time.

As it can be seen from Figure 1, there has been an increase in the general trend in the price index for the selected food products over 1990-2012. The prices for dairy, grains, cooking oils and sugar have increased annually by 2.48, 2.38, 3.44 and 0.77% respectively; however, there has been an insignificant reduction of 0.18% in the meat price during the aforementioned years. The corresponding value for the food products, as a whole, has been 1.45%. Although there has been a general trend for all the items, as Figure 1 shows, some of them, such as sugar and cooking oils have indicated a more fluctuating trend.

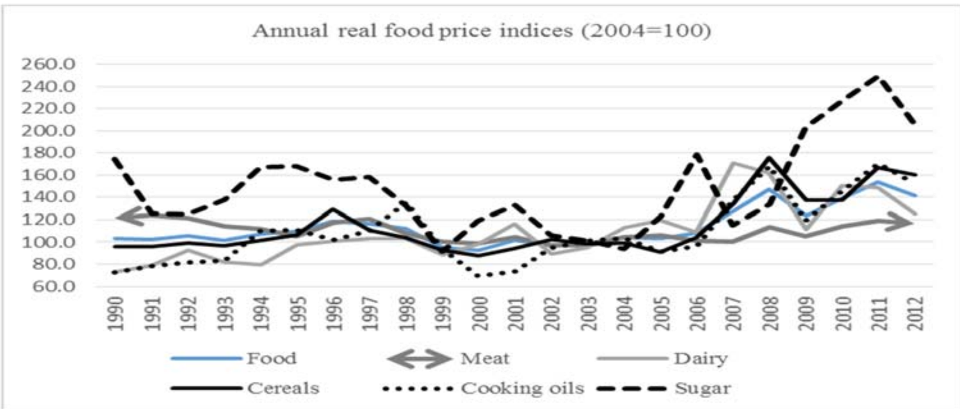

Figure 1. Annual food price indices over 1990-2012

The recent and expected growing surge in food prices has reignited concerns (Azzam & Rettab, 2012). The increasing prices of imported foods can affect the social welfare of Iranian households since a significant amount of their everyday food is imported. For instance, nearly 60% of oil crops and more than 40% of cereals supplied to the Iranians were imported in 2009. The aforementioned products accounted for more than 75% of Iranian food imports, of which over 38% accounted for cereals, over the years 1961 to 2009. The corresponding shares of cooking oils and meat were almost 17.5 and 5.3%, respectively (FAO, 2009).

1.2 Literature review

During the last two decades, many studies have been done on imports through using economy-wide models, especially CGE models. These studies have focused specifically on liberalization. For example, Farajzadeh et al. (2017) have shown that removing import barriers, including tariff and non-tariff barriers, in Iran can increase imports, especially imports of agricultural commodities since agricultural and agricultural industries sectors are the most important sectors. Import is determined by a set of relative prices and the degree of substitutability in the empirical models (Beghin et al., 2002). For instance, the findings of studies done in Syria (Chemingui & Dessus, 2008), Norway (Fæhn & Holmøy, 2003), Malaysia and Indonesia (Arunanondchai, 2003), and Iran (Farajzadeh et al., 2017) have showed that trade liberalization may lead to an increase in imports of agricultural products. Karami et al. (2012) have also suggested that an increase in price of food products after removing their subsidies can lead to a decrease in their import. Esmaeili and Farajzadeh (2016) have suggested relative price and tariff rate are among the driving forces which can affect imports of agricultural products in Iran.

Welfare has also been analyzed in trade liberalization context. The positive impact of trade liberalization on welfare has been identified in developing countries (Acharya & Cohen, 2008; Hosoe, 2001; Jensen & Tarr, 2003) and in developed countries (Fæhn & Holmøy, 2003; Zhu & van Ierland, 2006; Adkins & Garbaccio, 2007). As one of the sources, welfare gains might be caused by a decrease in import prices due to removal of trade barriers. Furthermore, welfare is expected to increase and import price is expected to decrease when production occurs in a more efficient way (Zhu & van Ierland, 2006), or when it is produced by more productive firms (Olper et al., 2014). The possible welfare gains are available as far as import prices are low; however, the expected condition turns out to be different as the recent trend for an increase in food prices is expected to be reinforced. As Azzam and Rettab (2012) have shown, in relation to the UAE, this may adversely affect the low-income groups specifically. Khosravinejad et al. (2013) have also found that a rise in food prices may result in lower welfare of the urban households and, especially, have an adverse effect on low-income groups.

In addition to the possible impact of import prices on welfare, addressed by many demand analysis empirical studies, there is a growing literature on applied demand analysis in which Translog or Almost Ideal Demand System (AIDS) functional forms are used. These specifications have budget-share equations that are linear functions of the logarithm of income; however, translog form is widely used for factor demand. Koetse et al. (2008) and Ma et al. (2008) are two empirical case studies in which translog cost function is used to estimate factor demand elasticities. Also, there is a great body of literature which has investigated demand at households' level using households' expenditure survey data and AIDS model as the most conventional approach. Some of the relevant studies include Deaton and Mulbaer (1980) for Great Britain; Blanciforti and Green (1983) for United States; Hayes et al. (1991) for Japan; Fulponi (1989) for France; Abdulai et al. (1999) for India; Tefera (2010) for Ethiopia; and Suharno (2010) for Indonesia. Farajzadeh and Najafi (2004); Khosravinejad et al. (2013); and Shahabadi et al. (2016) are also examples of three other empirical studies which have benefitted from the AIDS approach to examine the household consumption in Iran. Moreover, Falsafian and Ghahremanzadeh (2012) have examined meat demand in Iran through the application of two systems of demand; namely a generalized ordinary differential demand system and AIDS model. They have suggested that AIDS model is more consistent with the behavior of Iranian households. However, the shortcoming of AIDS model stems from the assumption of linear Engel curve (Tefera, 2010). Banks et al. (1997) have proposed a generalized Quadratic Almost Ideal Demand System model which permits non-linear Engel curves. Matsuda (2006) has applied a QAIDS model to estimate food demand in Japan. Caro et al. (2017) has also used a QAIDS model to examine purchases tax effect on food and beverage demand in Chile. The researchers have pointed to the flexibility and appropriateness of the QAIDS model as compared to the LA/AIDS model. Harding and Lovenheim (2017) have reported that the non-linear nature of Engel curve needs to be considered in the use of the QAIDS model. The researchers have examined tax on beverages in the US. The QAIDS model includes the desirable properties of the LA/AIDS model. Additionally, it is more compatible with consumer expenditure patterns (Arabatzis & Klonaris, 2009).

To the best of the present researchers' knowledge, there are only a few empirical studies in which AIDS model has been used to provide a model for import demand[1]. In the study done by Arabatzis and Klonaris (2009), the QAIDS model was applied in relation to wood product imported into Greece. The current study that uses a QAIDS model to analyze the import demand for foodstuffs can be considered both as a contribution to the literature and as a novelty.

Another reason for why the present study is novel is that it takes into consideration the substitution effect of price changes in welfare analysis through the use of a second order Taylor expansion of the expenditure function. In addition, the present researchers have indirectly provided some insight into the possible policy option of removing food subsidies as the food subsidy programs have been criticized because of their improper targeting and imposition of an unnecessary burden on the public budget (Karami et al., 2012). The removal of food subsidies is expected to increase food prices.

1This is mainly due to empirical studies' interest in examining imports as a whole or import of an individual commodity and closely related group of commodities have not been considered.

Given the above mentioned conditions, the present study is to contribute to the empirical literature of import demand through the use of a QAIDS model and to explore the welfare impacts of an increase in food prices through the use of the Compensated Variation (CV).

The remainder of the present article has been organized as follows: in the next section the empirical model is described. The data are presented in the third section. The empirical results including elasticities estimation and welfare implications are presented in the fourth section and the paper ends with our conclusions. The following section sheds light on the empirical model applied in the present study.

2. Methods

The employed model is the linear version of the Quadratic Almost Ideal Demand System (QAIDS) model developed by Matsuda (2006) and Arabatzis and Klonaris (2009). If $p = (p_1,..., p_n)$ denotes the nominal price vector of n goods and y denotes the total expenditure on the goods, the indirect utility function of the QAIDS model can be determined through:

$$[\log V(p,y)]^{-1} = [\frac{\log y - \log f(p)}{g(p)}]^{-1} + h(p) \tag{1}$$

where $\log$ is the natural logarithm and $f(p)$ $g(p)$ ،andare distinct $h(p)$ price aggregator functions defined as follows:

$$\log f(p) = \alpha_0 + \sum_i \alpha_i \log p_i + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \log p_i \log p_j \tag{2}$$

$$\log g(p) = \beta_0 + \sum_i \beta_i \log p_i \tag{3}$$

$$h(p) = \eta_0 + \sum_i \eta_i \log p_i \tag{4}$$

$f(p)$ is homogeneous of degree one and $g(p)$ $h(p)$ are homogeneous of degree zero in p. Therefore, $\log V(p,y)$ is homogenous of degree zero in p and y, as required. Therefore, the parameters are assumed to meet the corresponding restrictions which jointly ensure that the resulting demand system fulfils adding-up, homogeneity and Slutsky symmetry:

$$\sum_i \alpha_i = 1 \quad \sum_i \beta_i = 0 \quad \sum_i \gamma_{ij} = 0 \quad \sum_j \gamma_{ij} = 0 \quad \sum_i \eta_i = 0 \quad \gamma_{ij} = \gamma_{ji} \; i,j = 1,2,...,n \tag{5}$$

Applying Roy’s identity, one can derive the expenditure share equation through the following formula:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log p_j + \beta_i \log \frac{y}{f(p)} + \frac{\eta_i}{g(p)} \left[\log \frac{y}{f(p)} \right]^2 \quad i = 1,\ldots,n \tag{6}$$

where w_i stands for the expenditure share of good i for each individual[2]. To find the linear approximations to the QAIDS model, both f(p) and g(p) need to be replaced with composite variables. The most usual composite variable for the approximation to the translog aggregator function f(p) in the AIDS is the Stone price index, suggested by Deaton and Muellbauer (1980). However, Moschini (1995) has indicated that the application of Stone price index instead of f(p) can seriously bias elasticity estimates as it can be affected by changes in units of measurement. Therefore, the following alternative price indices have been suggested (Matsuda, 2006):

$$\log P^T = (1/2) \sum_i \left(\overline{w}_i + \overline{w}_i^0 \right) \log \left(p_i / p_i^0 \right) \tag{7}$$

$$\log P^S = (1/2) \sum_i \overline{w}_i \log \left(p_i / p_i^0 \right) \tag{8}$$

$$\log P^C = (1/2) \sum_i \overline{w}_i^0 \log p_i \tag{9}$$

where superscript 0 indicates the base point, P^T is the Tornqvist price index, P^S is the log linear analogue of the Paasche price index, and P^C is the log linear analogue of the Laspeyres price index. All the variables are for a linearly homogeneous Cobb–Douglas aggregator function (Diewert, 1981). In order to approximate g(p), the index $\log P^Z = \sum_i \left(\overline{w}_i + \overline{w}_i^0 \right) \log \left(p_i / p_i^0 \right)$ proposed by Matsuda (2006) was used. P^Z may be viewed as a zero degree homogeneous analogue of P^T and is also invariant to changes in units. Regarding the non-linear approximations, the equations for the expenditure (e_i^{LA}) and the uncompensated price (ε_{ij}^{LA}) elasticities may also be modified as follows:

$$e_i^{LA} = 1 + \frac{\beta_i}{w_i} + \frac{2\eta_i}{w_i P^g} \log \frac{y}{P^f} \quad i = 1,\ldots,n \tag{10}$$

$$\varepsilon_{ij}^{LA} = -\delta_{ij} + \frac{\gamma_{ij}}{w_i} - \frac{\beta_i}{w_i} \frac{\partial \log P^f}{\partial \log P_j} - \frac{\eta_i}{w_i P^g} \left[2 \frac{\partial \log P^f}{\partial \log P_j} + \left(\frac{\partial \log P^g}{\partial \log P_j} \right) \log \frac{y}{f(p)} \right] \log \frac{y}{f(p)} \quad i = 1,\ldots,n \tag{11}$$

2It is worth noting that, as originally suggested by Deaton and Muellbauer (Alston et al., 2001); the intercepts of the expenditure share equations are commonly expressed as the linear functions of other explanatory variables.

where

$$\frac{\partial \log P^f}{\partial \log P_j}\begin{cases}\approx \bar{w}_j, & if \quad P^f = P^* \, or \quad P^f = P^S \\ \approx \left(\bar{w}_j + \bar{w}_j^0\right)/\,2if & P^f = P^T \\ \bar{w}_j^0 & if \quad P^f = P^C\end{cases} \tag{12}$$

$$\frac{\partial \log P^g}{\partial \log P_j}\begin{cases}\approx \bar{w}_j - \bar{w}_j^0 & if \quad P^g = P^Z \\ = 0 & if \quad P^g = 1\end{cases} \tag{13}$$

where δ_{ij} is the Kronecker delta and equal to unity if $i=j$ and zero otherwise.

In order to calculate elasticities, the system of Eq. (6) was estimated using the seemingly unrelated regression (SUR). The estimated compensated elasticities were used to explore the welfare impacts of real price changes using Compensated Variation (CV) measure. CV has been defined as the maximum Willingness to Pay (WTP) for an increase in consumption, without becoming worse off compared to the initial level of utility (Johansson, 1993). CV can be expressed using the expenditure function e (p, u), as follows:

$$CV = e(p_c^1, u^1) - e(p_c^1, u^0) \tag{14}$$

where u stands for utility, and p_c for the vector of prices for consumer goods. The subscripts (0) and (1) refer to the initial period and the period after price change, respectively. The compensated variation for the first order effect of price changes, which does not take into account households' behavioral response substitution between commodities, can be approximated using a first order Taylor expansion of the minimum expenditure function as follows (Friedman & Levinsohn, 2002):

$$\Delta \ln e \approx \sum_{i=1}^{n} w_i \Delta \ln p_{ci} \tag{15}$$

where w_i is the budget share of good i in the initial period, and $\ln p_{ci}$ represents the proportionate consumer and producer price changes of commodity i. If households can substitute for the goods with the largest increase in price, then the income required to maintain households' level of utility after price changes will be lower. Thus, one has to consider a second order Taylor expansion of expenditure function which allows for substitution behavior as follows (Friedman & Levinsonh, 2002):

$$\Delta \ln e \approx \sum_{i=1}^{n} w_i \Delta \ln p_{ci} + \frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n} w_i \varepsilon_{ij} \Delta \ln(p_{ci}) \Delta \ln(p_{cj}) \tag{16}$$

where ε_{ij} stands for the compensated price elasticity. This method was used to analyze the welfare impacts of an increase in food prices by Friedman and Levinsohn (2002) and Minot and Goletti (2000) for households in Vietnam and by Tefera (2010) for households in Ethiopia.

3. Data

As one can see from Table 1, the selected products are grains, meat, cooking oils, tea, cheese, and sugar. These products account for more than 80% of total food imports over the years 1980 to 2012 and are considered as some extremely important and sensitive products as they play a significant role in food security (Esmaeili & Farajzadeh, 2016). Grains have accounted for more than 54% of the import value over the aforementioned period, followed by cooking oils and sugar, each with a share 20.7% and 11.5%, respectively. Moreover, meat products have comprised 7.4% of the import value of the selected products over the specified years. Among all the products, wheat, with a share of around 24% on average, has had the greatest contribution to the import value over the specified period. The average import value share for rice, soybean oil, sugar and maize have been between 10 and 16%. On average, an annual amount of 2117.8 million USD has been spent on the import of the selected food products during the specified period.

The data on import quantities and values, during the years 1980 to 2012, has been taken from FAO dataset. The prices for each different commodity category have been determined by dividing the relevant value into the relevant quantity. Tariff data was also taken from various issues of the Statistical Yearbook of Iran published by the Iranian Customs Organization.

4. Results

It is difficult to interpret the demand system parameters directly (Lewbel, 1995)[3]. Therefore, applied data was used to estimate Eq. (6) and to compute corresponding elasticities through the use of Eviews 9 Software. The four systems of equations were estimated based on Eq. (6) using Seemingly Unrelated Regression (SUR) estimation method, as applied by Azzam and Rettab (2012). First, the three main imported products, namely cereals, meat and cooking oils were considered individually. Then, cheese, tea and sugar were considered while cereals, meat and cooking oils were applied in terms of their aggregate levels. To meet the theoretical conditions, restrictions of homogeneity and symmetry as well as the additional restriction for Slutsky symmetry were imposed on the systems while one of the budget shares was excluded in each system[4]. The results have been presented in the following sections. The findings

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3 The estimated results regarding demand system coefficients have been presented in the Appendix, Tables A1 and A2.

4 The true elasticities can be calculated through these restrictions. In addition, the total number of free parameters of the QAIDS model exceeds those of AIDS by $n-1$, where n is the number of equations (Matsuda, 2006). Having lower degrees of freedom in QAIDS model, imposing the restrictions

on elasticites will be presented first. Then, the welfare analysis will be discussed.

Table 1. The Average Import Quantity, Import Value and Expenditure Share for the Selected Food Products

		Import quantity (1000 tones)	Import value (million USD)	Expenditure Share (%)
Grains				
	Wheat	3038.5	499.2	23.6
	Maize	1396.7	225.7	10.7
	Rice	806.1	340.1	16.1
	Barley	531.2	84.5	4
Meat				
	Red meat	36.9	70.5	3.3
	Sheep meat	41.6	68.7	3.2
	Poultry	13.4	18.2	0.9
Cooking oils				
	Soybean oil	509.8	295.1	13.9
	Sunflower oil	105.7	71.2	3.4
	Butter	32.3	67.6	3.2
	Maize oil	3	3.9	0.2
Tea		27.7	78.5	3.7
Cheese		35.8	51.7	1.4
Sugar		730.2	242.9	11.5

4.1 Elasticity

The findings regarding price and expenditure elasticities for the individual products of grains, meat and cooking oils and the products' elasticites as aggregate commodities have been depicted in Tables 2 and 3. It can be seen that the own-price elasticities for grains and most of the meat groups have not been statistically significant. However, own-price elasticity of cooking oil groups has been statistically significant. In general, a statistically significant elasticity was observed in relation to most of the cooking oils and poultry which were associated with high price sensitivity. In case of poultry, a 1% rise in the own-price was associated with an average decrease of 3.73% in import. Similarly, decreases in import for soybean oil, sunflower oil and butter were revealed as 1.4%, 2.5% and 1.6%, respectively. As far as the main groups were concerned, of the grains, meat and cooking oils, only the grains, with the own-price elasticity of nearly 1, showed a statistically significant response. Therefore, as far as each category of grains is considered separately, no significant own-price response can be expected (Table 2); however, all categories of grains, when considered as an aggregate commodity, are sensitive to their own-price changes

increases the degrees of freedom. It may improve the relative precision of the estimated parameters (Gujarati & Porter, 2008).

(Table 3). One can arrive at a different conclusion regarding the cooking oils, as there were significant own-price elasticities for most of the individual products but no statistically significant own-price elasticity for the aggregate group. The response for these may have been caused by the relationship between individual commodities which can be explained by the cross price effect.

Regarding the cross price elasticities, wheat may be considered as more isolated than other grains since it has no statistically significant cross price effect. Mousavi and Sadrolashrafi (2007) reported population and domestic production as the main determinants of wheat imports, leaving insignificant role for other factors. Esmaeili and Farajzadeh (2016) also proposed domestic production as the major driving force for import demand for wheat. The substitutionability between maize and barley was observed while the maize-rice and rice-barley appeared as complements. Given the elasticities' absolute values, the complementary relationship between maize and barley was more significant than the substitution relationship between them. Regarding the statistical significance and the absolute value of elasticites for grains, the negative responses of the import to price changes was more than the positive responses. Therefore, considering the grains as a whole, one may expect a significant response to the own-price changes.

In case of meat items, sheep meat played a more important role than the two others as it showed a statistically significant relationship with others. In terms of absolute values, a higher degree of substitution was found between sheep meat and poultry while sheep meat had a complementary relationship with red meat. In general, the import response of meat items to price changes is statistically significant. However, the price changes of meat products as a whole are not expected to affect their import (Table 3). In other words, individual meat products import changes in opposite direction as their price changes, leaving no significant response for their aggregate import. The present finding is consistent with the findings of Esmaeili and Farajzadeh (2016).

In spite of the great sensitivity of cooking oils products with respect to their own-prices, most cross elasticities were not considerable as they showed low absolute values or statistically insignificant coefficients. Among all the cross price effects, complementary relationships of butter-soybean oil and maize oil-sunflower oil were statistically significant. In general, the responses of the import of cooking oils were sensitive to their own-price changes and most of the cross price elasticities were statistically insignificant. This pattern of price response for cooking oils products can lead to an insignificant price response when all cooking oils are regarded as an aggregate group. As shown in Table 1, for the most of cooking oils items, expenditure share was low. A lower budget share may induce an insignificant response to price changes.

As shown in Table 3, demands for tea and cheese were elastic, with respect to their own price changes. For the other commodities, however, there seems to be an insignificant response in terms of elasticity magnitude or statistical importance. A 1% increase in tea and cheese prices can cause a fall in their import demands by more than 1.8% and 1.3%, respectively.

As far as the magnitude of cross price elasticities is concerned, the relationship between the aggregate groups and tea may be different from those of the aggregate groups. However, when there is a focus on the statistical significance, grains can also be considered more important than others. Grains showed a complementary relationship with most of the other items. Considering absolute values, however, the cross price effects were not significant. In case of tea, substitution effect can be better conceived than complementary impact with higher elasticity coefficients. The low budget share of tea may result in substitution of tea as prices for other items rise.

Based on expenditure elasticity, different responses can be also observed as commodities are aggregated. Among the grain items, only maize showed statistically insignificant expenditure elasticity; however, barley and rice showed statistically significant expenditure elasticites of 2.72% and 1.60%, respectively, and thus they may be considered as luxury goods. Similarly, expenditure elasticity of grains as a whole was also statistically significant. Therefore, the group of grains, as a whole, might also be considered as luxury because a 1% increase in expenditure share can lead to a 1.74% increase in demand. Rice is expected to have a significant contribution to this response since imported rice is mostly consumed by low-income groups with a higher propensity to consumption.

Table 2. Price and Expenditure Elasticities of Individual Products

	Grains				Meat			Cooking oils			
	Wheat	Maize	Rice	Barley	Red meat	Sheep meat	Poultry	Soybean oil	Sunflower oil	Butter	Maize oil
Uncompensated price demand elasticities											
wheat	-0.21	-0.40*[a]	-0.02	0.00							
Maize	-0.64	-0.14	-0.85*	1.34**							
Rice	-0.42	-0.85**	0.58	-0.92**							
Barley	-0.83	3.60*	-7.45***	-1.05							
Red meat					0.62	-2.24***	0.31				
Sheep meat					-2.98***	-1.10	2.49***				
Poultry					1.08	3.31***	-3.73***				
Soybean oil								-1.40***	0.14	0.20*	-0.03
Sunflower oil								0.52	-2.53***	-0.01	0.69**
Butter								1.34**	0.14	-1.56**	-0.33
Maize oil								-0.49	3.97**	-1.92	-2.01
Expenditure elasticities	0.63*	0.23	1.60***	2.72*	1.35	1.27	-0.31	1.10***	1.33*	0.40*	0.32

a The levels of statistical significance are denoted with ***, ** and * which stand for 0.01, 0.05, and 0.1 levels of significance, respectively.

Among the cooking oils, maize oil, with insignificant expenditure elasticity, showed a statistically insignificant response to expenditure changes. Considering sensitivity to expenditure changes, there was a considerable difference among the individual cooking oil items. While a 1% rise in expenditure can increase butter demand by 0.40%, it can increase demands for soybean and sunflower oils by 1.1% and 1.33%, respectively. The cooking oils as an aggregate group also showed a significant expenditure elasticity. However, it appears to be a necessity as a 1% increase in expenditure is expected to increase demand for cooking oils by only 0.77%.

Table 3. Price and Expenditure Elasticities of Aggregate Products

	Grains	Meat	Cooking oils	Tea	Cheese	Sugar
Uncompensated price demand elasticities						
Grains	-0.96***a	-0.25**	-0.59***	0.17**	-0.08*	-0.03
Meat	-0.42	-0.08	0.14	-0.16	-0.06	0.20
Cooking oils	-0.71***	0.01	-0.16	-0.07	0.14**	-0.13
Tea	4.51***	0.14	1.48**	-1.82**	0.96**	-1.91**
Cheese	0.41	0.13	0.23	0.02	-1.34**	0.10
Sugar	0.39	0.15	-0.19	-0.67**	-0.12	-0.10
Expenditure elasticites						
	1.74***	0.22	0.77**	-3.39	0.07	0.53

a The levels of statistical significance are denoted with ***, ** and * which stand for 0.01, 0.05, and 0.1 levels of significance, respectively.

4.1 Welfare changes

The welfare impacts of the change in price of selected food items will be examined in this section. Simulations are based on the annual changes in real prices, presented by FAO (2012), during the years 1990 to 2012. As illustrated in Figure 1, the price for the selected food items imported into Iran has risen over the specified period. Azzam and Rettab (2012) have also enumerated the years 1990-2011 as a period during which increase in prices became more apparent for the global food products. There was an increase in annual prices for dairy, grains, cooking oils and sugar, each with 2.48, 2.38, 3.44 and 0.77%, respectively but a 0.18% decrease in price for meat over the same years. Welfare changes were determined through the use of Equations (15) and (16), as the first and second order Taylor expansion of the minimum expenditure function. Three scenarios for price changes have been considered in welfare simulation. Scenario One included price changes for all the individual commodities over the years 1990-2012. In other words, welfare changes for each food item were calculated individually. It is also worth mentioning that the annual price change of the products was similar to their average growth rate during the aforementioned period. Scenario Two included increases in price for all the selected commodities, except meat, reported, in terms of their annual average values, by FAO for the years 1990 to 2012. Although this scenario was similar to scenario One; it did not include the changes in meat price because, despite the prices for the other products, the price for meat tended to decrease over the specified years. The value for the welfare change, as reported in Table 4, was the sum of the values for welfare changes determined for all the selected food products, through the use of Equations (15) and (16). In this scenario, dairy products price increase which is 2.48% was applied for cheese. A 1.15% increase in price for tea, which was the average price increase for all the food items, was also applied in welfare analysis. Scenario Three included price changes in scenario One; however, meat was also considered, showing a 0.18% decrease in price. The reported values for welfare changes (Table 4) were the sum of values for welfare changes in relation to all the selected food items.

As shown in Table 4, there was an insignificant difference between the first and the second order welfare impacts. This can indicate a low possibility for substituting one commodity with the other when there is a change in the relative prices. This may reveal that a bundle of all commodities are needed and this can leave little room to substitute for the goods with the largest increase in price. An increase in price for grains was associated by the greatest welfare loss among the selected groups, as an increase in their annual price led to a 1.15% welfare reduction. An increase in the annual price of cooking oils was also followed by a 0.83% welfare reduction. As shown in Table 1, more than half of import expenditures of the selected products have belonged to grains. This has led to higher welfare losses followed by an increase in prices. The corresponding welfare loss for changes in the individual price indices of sugar was nearly 0.1%. Although the expenditure share for sugar was significant (Table 1), the modest increase in price for sugar during the selected period of time resulted in a small welfare loss. The decrease in meat price was also accompanied with an insignificant welfare increase, due to both insignificant price changes as well as lower expenditure share. In general, price changes of all the commodities can increase import expenditures by nearly 2.2%. Karami et al. (2012) has also reported the low welfare effects of increase in prices of food items after removing their subsidy.

Table 4. First and Second Order Welfare Impacts (Expenditure Changes) of Price Changes (%)

	Individual price changes by annual growth, 1990-2012 (Scenario1)						Changes in prices of all the selected commodities except meat (Scenario2)	Changes in prices of all the selected commodities (Scenario3)
	Grains	Meat	Cooking oils	Tea	Cheese	Sugar		
First order	1.147	-0.017	0.832	0.050	0.061	0.095	2.184	2.167
Second order	1.145	-0.017	0.832	0.049	0.059	0.095	2.181	2.164

5. Conclusion

While the main focus of the empirical works in Iran has been on the effects of removal of food subsidies (Farajzadeh & Najafi, 2005; Karami et al., 2012; Gharibnavaz & Waschik, 2015), a narrow focus has been on the increasing prices of imported food products. Azzam and Rettab (2012) have indicated that the increasing prices of imported food can result in welfare losses, especially among low-income groups. Domestic producers, however, can benefit from higher prices as they will produce more products and receive higher prices.

This study investigates the driving forces behind import demand for the main imported food products through the use of a QAIDS model and by taking into account the welfare impact of an increase in prices of the selected items. The QAIDS model has been widely used for case studies based on household survey data. However, a few empirical case studies are also available in relation to import demand.

The findings of the present study indicated that grains, meat and cooking oils as well as sugar were not own-price elastic but cheese and tea showed significant responses to their own-prices. Low response to own-price changes was also found for the individual products of grains and meat. However, all the individual cooking oil products, except maize oil, showed an own-price elastic behavior, unlike what was observed for their aggregate response. As the cross price elasticities indicated, substitution relationship was more likely than complementary relationship for the cooking oils. This might account for the own-price inelastic behavior of cooking oils as a whole. Regarding the own-price elasticities, this implication can be considered for grains and meat products, as well. The Insignificant responses of these individual items to their own-price changes are the main reason behind the own-price inelastic response of aggregate grains and meat. Considering the absolute values as well as statistical significance, the imported food products showed an insignificant response to price changes and this can offer policy makers a low possibility of pricing policy. This, to some extent, may stem from the food subsidy system in which price changes are not completely transferred to the domestic market and which makes the government be responsible for providing consumers with their basic needs. However, regarding the subsidies burden on the public budget and inefficient distribution system which does not target the poor properly (Karami et al., 2012); food subsidy is expected to be removed. In other words, as long as the government plays the central role in markets of such food products as grains and meat, an insignificant response to price will be expected.

Low elasticities can also be responsible for a low welfare change of nearly 2.2%. Azzam and Rettab (2012) have estimated a corresponding welfare loss of approximately 4.5% for the UAE. In case of Iran, the welfare losses need to be considered in the context of severe poverty. For example, Mahmoodi (2013) has reported that for the most part of the years 2005-2010, around 40% of people in urban areas of Iran have been poor. Therefore, food subsidy system can be supported as much as food prices tend to increase and when a large number of households are considered as poor. Especially, the CV can be interpreted as a "supplementary income" or as a compensation for higher food prices (Azzam & Rettab, 2012). Subsidization has also been considered as a policy, adopted by the Mexican government, to stop the rise in food prices in Mexico (Attanasio et al., 2013). Regarding expenditure elasticities, an insignificant response can also be expected. The higher response of grains can be attributed to rice because Iranian consumers care a lot about rice consumption and its quality. Considering Iran's per capita income, import response to expenditure can also be considered as very important. Current GNI per capita, PPP in Iran (15,440 USD in 2014) is much lower than those of the developed economies (UNDP, 2015) and a significant increase in Iran's per capita income can induce a significant import, and thus must be taken into account.

As far as the technical features and suggestions for future studies are concerned, it is worth noting that trade-related policy analysis can benefit from the results obtained from the QAIDS model, as suggested by Arabatzis and Klonaris (2009). The results can be used in trade models as well as in measurements of costs and benefits associated with changes in trade policies concerning import of food products. Furthermore, from a technical point of view, the linear approximations of the QAIDS model, when nonstationary time series are used, can be especially useful (Matsuda, 2006). The QAIDS model includes desirable properties of the popular AIDS model of Deaton and Muellbauer (1980). In addition, it is compatible with the consumer expenditure patterns. The QAIDS model, quadratic in the logarithm of total expenditure, can turn a luxury into a necessity through increasing expenditures (Arabatzis and Klonaris, 2009). Future studies can investigate the welfare effects of rising food prices for different income groups, for which group-specific elasticities are needed. Finally, given the high possibility for reducing food subsidies, the applied scenarios can also be examined through the food subsidy removal option.

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Appendix

Table A1: Estimated Parameters of the QUAIDS model for the Individual Products

Dependent variable (expenditure share)	Grains				Meat			Cooking oils			
	Wheat	Maize	Rice	Barley	Red meat	Sheep meat	Poultry	Soybean oil	Sunflower oil	Butter	Maize oil
Intercept	-0.003	0.009	-0.002	0.996***							
Wheat price	0.265**a	-0.195*	-0.058	-0.012							
Maize price	-0.195*	0.147	-0.230*	0.278*							
Rice price	-0.058	-0.230*	0.562***	-0.273***							
Barley price	-0.012	0.278*	-0.273***	0.007							
Expenditure	-0.151**	-0.161*	0.191*	0.121							
Squared expenditure	-0.000	0.000	-0.000	0.000							
Adjusted R^2	0.711	0.364	0.226	-							
Q(1) c	0.81(0.36)	4.36(0.11)	3.72(0.15)								
Q(2)	0.87(0.64)	4.37(0.19)	3.81(0.28)	-							
Jarque Berra	0.82(0.66)	0.97(0.21)	2.42(0.29)	-							
Intercept					-0.748*	-0.032	1.780***				
Red meat price					0.815	-0.999**	0.184				
Sheep meat price					-0.999**	0.051	0.948***				
Poultry price					0.184	0.948***	-1.133***				
Expenditure					0.370**	0.089	-0.460***				
Squared expenditure					-0.039**	0.006***	-0.003**				
Adjusted R^2					0.589	0.583	-				
Q(1) c					0.29(0.58)	2.83(0.10)	-				
Q(2)					0.45(0.79)	3.21(0.20)	-				
Jarque Berra					0.35(0.83)	0.92(0.63)	-				
Intercept								0.518***	-0.017	0.436***	0.063
Soybean oil price								-0.237*	0.103	0.154*	-0.020
Sunflower oil price								0.103	-0.212*	0.010	0.099***

Dependent variable (expenditure share)	Grains				Meat			Cooking oils			
	Wheat	Maize	Rice	Barley	Red meat	Sheep meat	Poultry	Soybean oil	Sunflower oil	Butter	Maize oil
Butter price								0.154*	0.010	-0.111	-0.053
Maize oil price								-0.020	0.099***	-0.053	-0.026
Expenditure								0.064*	0.048	-0.094***	-0.018
Squared expenditure								0.000	0.000	-0.000**	0.000
Adjusted R^2								0.319	0.383	0.676	-
Q(1) [b]								0.01(0.93)	0.55(0.45)	0.58(0.44)	-
Q(2)								0.36(0.83)	0.68(71)	0.89(0.63)	-
Jarque Berra								1.84(0.39)	1.57(0.41)	1.28(0.52)	

a The levels of statistical significance are denoted with ***, ** and * which stand for 0.01, 0.05, and 0.1 levels of significance, respectively.

b $Q(p)$ is the significance level of the Ljung–Box statistic in which the first p of the residual autocorrelations is jointly equal to zero.

Table A2: Estimated Parameters of the QUAIDS for the Aggregate Products

Dependent variable (expenditure share)	Grains	Cooking oils	Meat	Sugar	Tea	Cheese
Intercept	1.334***a	-0.614**	0.098	-0.134	-0.064	0.380*
Grains price	0.179*	-0.198***	-0.072	0.091***	-0.023	0.023
Cooking oils price	-0.198***	0.193**	-0.004	0.015	0.032*	-0.037
Meat price	-0.072	-0.004	0.091**	-0.017	-0.009	0.011
Sugar price	0.091**	0.015	-0.017	-0.032	0.027*	-0.084***
Tea price	-0.023	0.032*	-0.009	0.027*	-0.010	-0.018
Cheese price	0.023	-0.037	0.011	-0.084***	-0.018	0.105
Expenditure	0.362***	-0.056	-0.073	0.152***	-0.023	-0.058
Squared expenditure	-0.000	0.000	-0.000	-0.000	0.000	-0.000
Adjusted R^2	0.377	0.242	0.257	0.089	0.057	-
Q(1) [b]	1.70(0.19)	2.37(0.12)	2.96(0.09)	0.07(0.78)	14.3(0.11)	-
Q(2)	2.18(0.33)	2.54(0.28)	3.20(0.20)	10.99(0.14)	14.4(0.15)	-
Jarque Berra	2.85(0.21)	0.50(0.77)	3.76(0.15)	1.82(0.40)	1.69(0.42)	-

a The levels of statistical significance are denoted with ***, ** and * which stand for 0.01, 0.05, and 0.1 levels of significance, respectively.

b $Q(p)$ is the significance level of the Ljung–Box statistic in which the first p of the residual autocorrelations is jointly equal to zero.