# Evaluation of Welfare Effects of Rising Price of Food Imports in Italy

**Filippo Arfini[1], Mona Aghabeygi[2]**
1. Full Professor in Economics and management Agri-Food Networks
2. PhD. Student Economics and Management of Innovation and Sustainability
Parma University, Italy
Filippo. arfini@unipr.it


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**Abstract**
In Italy as one of the developed countries, the agricultural sector is reason to supplying food, food security and food safety. In this study, the amount and value of imports for various foodstuffs in Italy has been used. At first, compensatory price elasticities were calculated by using the Almost Ideal Demand System (AIDS) and the effect of increasing the global price of food on welfare was studied. The results show that the welfare index of compensatory changes calculated for the entire food groups is 1061.48 billion USD. Meat and fruit groups have the most and the least compensatory changes respectively.
**Keywords:** Import, Welfare, CV, AIDS, Italy.

## Introduction

Food security is a broad concept that is determined by the interaction of a set of biological, economic, social, agricultural and physical factors. This complexity can be summed up by focusing on three components of food security: food availability, food access and food use (Barrett, 2002). In developed countries, the agricultural sector is reason to supplying food, food security and food safety along to achieve sustainable growth and development goals (Umesha. et al., 2018). Although high-income countries have long considered their population sheltered from food insecurity, the recent economic and financial crisis has challenged such assumption and food poverty has become an increasingly relevant policy issue across Europe. Over the last decade food security has also become a salient policy issue in high-income countries where an increasing number of people have problems in accessing safe and nutritious food on a daily basis (Maxwell and Devereux, 2001).

Generally, the demand for food will increase because of growing population and income, shifting diets from grains to meats, and diversion of grains to biofuels. In this regard, supplying food, has decreased as a result of declining agricultural productivity, increasing water scarcity, and diversion of land to biofuels and etc. (Maxwell and Devereux, 2001; Azzam and Rettab, 2012). As well, surely, price of food will increase in future. Therefore, it is important to know, how changes in food price, effect on demand and welfare. In this regards, food safety and food security are the main goals to consider in domestic and foreign policy decisions in different European states (Azzam and Rettab, 2012 ;Wood et al., 2012).

During the last two decades, many studies have been done on imports through using economy-wide models, especially Computable General Equilibrium (CGE) models. These studies have focused on liberalization (Farajzadeh et al., 2017). Import is determined by a set of relative prices and the degree of substitutability in the empirical models that trade liberalization may lead to an increase in imports of agricultural products (Beghin et al., 2002; Chemingui and Dessus, 2008; Fæhn and Holmoy, 2003; Arunanondchai, 2003; Farajzadeh et al., 2017).

Welfare has also been analyzed in trade liberalization context. The positive impact of trade liberalization on welfare has been identified in developed countries (Fæhn and Holmøy, 2003; Zhu and van Ierland, 2006; Adkins and 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 and 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 (Maxwell and Devereux, 2001).

In addition, the impact of import prices on welfare, addressed by lots of factors that are impacted on food price shocks. These shocks include: changing in relative price, substitution of commodities, income, as well as reaction and response of consumers to all these factors (Osei-Asare and Eghan, 2013).

Many studies worked on relative prices and substitution relation among commodities by estimating elasticities of demand functions based on Translog cost function or Almost Ideal Demand System (AIDS) or Quadratic(QAIDS) forms (Banks et al, 1997; Deaton and Mulbaer, 1980; Blanciforti and Green, 1983; Hayes et al.1988; Fulponi, 1989; Abdulai et al, 1999; Matsuda, 2006; Arabatzis and Klonaris, 2009; Tefera, 2010; Suharno, 2010 and Tefera, 2010; Bakhshoodeh ,2010; Layani and Esmaeili, 2015 ; Layani and Bakhshoodeh, 2016).

There are only a few empirical studies in which AIDS model has been used to provide a model for import demand. The current study that uses an AIDS model to analyze the import demand for foodstuffs.

According to the variation of food in Italy, food security in Italy has always been concerned for policymakers. Specially, measuring changes of welfare due to increasing in global food prices to provide compensation support system is essential issue.

During the last decades, a significant portion of some foodstuffs has been provided via imports in to Italy. Although domestic agricultural output was high, considering population growth and number of immigrants over last years, food imports increased (FAO, 2017).

Considering nominal values, Italian imports during 2000-2013 has shown that the average annual imports of six main groups of food (including cereals, meat, tea, coffee and cocoa, dairy products, fruits and vegetables) were more than 19.5 million tons (FAO, 2017). Also, Italy's import for these groups of food grew by 2% annually during 2000-2013, increasing from 10 to over 24 billion USD (FAO, 2017). Although a decrease can be observed in some periods, the general trend indicates an increase.

Italy from the 70en has significantly increase the volume of food imports, and after the implementation of the AGENDA 2000 of CAP, with the constant market liberalization, and considering the feature of Italian economic crisis, the increasing prices of imported foods can affect the social welfare of Italian consumers since a significant amount of their everyday food is imported (Ivanic and Martin, 2008; Robles and Keefe, 2011).

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

Within this context, the objectives of this paper are (1) Determining the price and income elasticity for food groups by using Almost Ideal Demand System (AIDS); (2) Exploring welfare impacts of increasing global food prices by using Compensated Variation (CV); (3) Calculating the lost welfare due to food price shocks.

The rest of the paper is structured as follows. The next section provides the methodology of Compensated Variation (CV), AIDS model and lost welfare index and data. The results of

estimating are reported and discussed in results section. The final section offers concluding remarks and policy discussions.

**Methodology**

*Welfare Index with Multiple Price Changes*

In general, in the welfare literature, there are various indexes for measuring the welfare changes due to implementation of different policies (Gohin, 2005). By changing economic conditions, such as price changes, utility rates may increase or decrease. To determine how and how much of the utility changes due to changing economic conditions, criteria such as Compensated Variation (CV) is used(Azzam and Rettab, 2012; Tefera, 2012 and Cranfield, 2007).

The starting point of the CV model with multiple price changes is minimizing expenditures on N food commodities subject to a specific utility level $U^0$ . By substituting optimal Hicksian quantities in to the expenditure function would be (Azzam and Rettab, 2012):

$$E = E(P_1, P_2, \dots, P_3, U^0) \\ = p_1 q_1^H(P_1, P_2, \dots, P_3, U^0) + p_2 q_2^H(P_1, P_2, \dots, P_3, U^0) + \cdots + p_N q_N^H(P_1, P_2, \dots, P_3, U^0) \quad (1)$$

Where Pi for $i = 1,2, \dots, N$are respected to N commodities prices, and the superscript H stands for Hicksian. Denoting the initial and the subsequent periods by superscripts ‘‘0’’ and ‘‘1’’, respectively. 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.

$$CV = E(p_1^1, p_2^1, \dots, p_{\mathrm{N}}^1, U^0) - E(p_1^0, p_2^0, \dots, p_N^0, U^0) \quad (2)$$

Using (1), we can expand (2) as follows:

$$CV = p_1^1 q_1^H(p_1^1, p_2^1, \dots, p_N^1, U^0) - p_1^0 q_1^0 + p_2^1 q_2^H(p_1^1, p_2^1, \dots, p_N^1, U^0) - p_2^0 q_2^0 + \cdots \\ + p_N^1 q_N^H(p_1^1, p_2^1, \dots, p_N^1, U^0) - p_N^0 q_N^0 \quad (3)$$

Direct measurement of CV using (3) is not possible because the Hicksian demand functions $q_i^H(.)$ for $i = 1,2, \dots, N$ depend on the utility level$U^0$, which is unobservable. If, the respective changes in prices and Hicksian quantities are defined as:

$$dp_{\mathrm{i}} = p_i^1 - p_i^0 \; for \; i = 1,2, \dots, N \quad (4)$$

And substituted in to (3), CV can be approximated by:

(5)

$$dq_i^H = q_i^H - q_i^0 \; for \; i = 1,2,\dots,N$$

The percentage change in Hicksian quantities is not observed. However, an approximation of the change is obtained though the total differential of the Hicksian demand functions$q_i^H(.)$ for$i = 1,2,\dots,N$. So as an example:

(6)

$$\frac{dq_1^H}{q_1^0} = \epsilon_{11}^H \frac{dp_1}{p_1} + \epsilon_{12}^H \frac{dp_2}{p_2} + \cdots + \epsilon_{1N}^H \frac{dp_N}{p_N}$$

$$\frac{dq_2^H}{q_2^0} = \epsilon_{21}^H \frac{dp_1}{p_1} + \epsilon_{22}^H \frac{dp_2}{p_2} + \cdots + \epsilon_{2N}^H \frac{dp_N}{p_N}$$

$$\vdots$$

$$\frac{dq_N^H}{q_N^0} = \epsilon_{N1}^H \frac{dp_1}{p_1} + \epsilon_{N2}^H \frac{dp_2}{p_2} + \cdots + \epsilon_{NN}^H \frac{dp_N}{p_N}$$

Where $\epsilon_{ij}^H$ is the Hicksian price elasticity for $i = 1,2,\dots,N$ and$j = 1,2,\dots,N$.

*Almost Ideal Demand System (AIDS)*

To estimate the Hicksian price elasticities as shown in (6), an Almost Ideal Demand System (AIDS) model estimated for N commodities by imposing the usual restrictions: adding-up, homogeneity and symmetry. The AIDS model function is (Gorman, 1981 and Jing et al, 2001):

(7)

$$S_i = \alpha_i + \sum_{j=1}^{N} \gamma_{ij} log p_j + \beta_i log\left[\frac{M}{f(p)}\right]$$

Where $S_i$is the Share of $i$ food group in total expenditure on the N food groups, $p_j$ is a vector of prices and M is total expenditure. Also f (p) is the Paasche price index define by:
$log f(p)^* = \sum_i s_i log p_i$.

The restrictions are: (8)

$$\sum_{i=1}^{n} \alpha_i = 1, \sum_{i=1}^{n} \gamma_{ij} = 0, \sum_{i=1}^{n} \beta_i = 0 \quad , \gamma_{ij} = \gamma_{ji} \quad i,j = 1,2,\dots,N$$

The respective formulas for computing the Hicksian price elasticities for N groups are:

(9)

$$e_{ij}^{h} = -\delta_{ij} + (\frac{\gamma_{ij}}{s_i})s_j$$

Where $\delta_{ij}$ is the Kronecker delta taking the value $\delta_{ij} = 1$ if i = j and $\delta_{ij} = 0$ ifi ≠ j. In terms of theu$_i$, the formula for income elasticities can be written as:

(10)

$$e_i = 1 + \frac{\alpha_i}{s_i}$$

Negative cross-price elasticities indicate a complementary relationship and the positive values for cross-price elasticities indicate substitution. Also, the positive (negative) values for income elasticity indicated non-inferior (inferior).

The system of Eq. (7) is estimated by using the Seemingly Unrelated Regression (SUR) to calculate elasticities for six groups of food (cereals, meats, dairy, tea and coffee, fruits and vegetables).

**Data and Information**

This study is based on the amount and value of imports for various foodstuffs in six main groups includes: cereal, meat, beverages, dairy, fruit and vegetable in Italy. This information has obtained from Food and Agriculture Organization (FAO) in series form since 1961 to 2013 for computing price changes and income elasticities. For this aims, the average annual growth of imported food prices defined as a price shock scenario.

Average annual import expenditure, average import expenditure share and standard deviations of six groups of foods including cereal, meat, beverages, dairy, fruit and vegetable are represented in table 1. Among six food groups, the maximum and the minimum average expenditure share is related to meats 29.81 %( 2773.18 billion USD) and fruit 6.18 % (703.22 billion USD) respectively.

**Table 1. Expenditure of Different Food Groups(1961-2013)**

| | Average annual import expenditure(Billion USD) | Average import expenditure share (%) | Standard deviation | Coefficient of variation |
|---|---|---|---|---|
| Cereals | 1501.94 | 22.03 | 862.28 | 0.57 |
| Meats | 2773.18 | 29.81 | 1914.57 | 0.69 |
| Beverages | 1047.37 | 11.71 | 827.58 | 0.79 |
| Dairy | 1981.35 | 19.66 | 1440.88 | 0.73 |
| Fruits | 703.22 | 6.18 | 681.29 | 0.97 |
| Vegetables | 1261.46 | 10.62 | 1245.61 | 0.99 |
| Total | 9268.55 | 100 | 6797.83 | 0.73 |

***Source: Food and Agriculture Organization (FAO)***

**Results and Discussion**

The estimated results by using Eviews 9 Software, regarding demand system coefficients have been presented in table 2. It is difficult to interpret the demand system parameters directly. The five systems of equations were estimated based on Eq. (7) using Seemingly Unrelated Regression

(SUR) estimation method. 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 expenditure shares was excluded in each system. The results have been presented in the following sections.

**Table 2. Estimated Parameters of the AIDS Model for Individual Groups**

| | $\alpha_i$ | $\gamma_{1j}$ | $\gamma_{2j}$ | $\gamma_{3j}$ | $\gamma_{4j}$ | $\gamma_{5j}$ | $\gamma_{6j}$ | $\beta_i$ |
|---|---|---|---|---|---|---|---|---|
| Cereals | 2.83<br>(0.18) | 0.09<br>(0.03) | -0.04<br>(0.02) | -0.04<br>(0.01) | -0.05<br>(0.01) | -0.01<br>(0.01) | -0.06<br>(-0.08) | -0.21<br>(0.02) |
| Meats | 0.72<br>(0.12) | | -0.04<br>(0.01) | -0.01<br>(0.01) | -0.02<br>(0.01) | 0.09<br>(0.01) | -0.01<br>(0.01) | 0.06<br>(0.01) |
| Beverages | -0.21<br>(0.11) | | | 0.01<br>(0.01) | 0.04<br>(0.01) | -0.01<br>(0.01) | 0.0<br>(-0.04) | 0.02<br>(0.01) |
| Dairy | -0.64<br>(0.09) | | | | 0.03<br>(0.01) | -0.03<br>(0.01) | 0.03<br>(0.01) | 0.06<br>(0.01) |
| Fruits | 0.62<br>(0.11) | | | | | -0.08<br>(0.01) | 0.05<br>(0.01) | -0.04<br>(0.01) |
| Vegetables | -0.88<br>(0.39) | | | | | | -0.13<br>(0.10) | 0.23<br>(-0.15) |

*The Numbers in Parenthesis are Standard Deviation

** Source: Authors' calculations by using Eviews 9.*

According to the price elasticities of the AIDS model, all own-price elasticities are negative. In terms of absolute values, the highest own-price elasticity is related to fruits (2.23%) and the lowest own-price elasticity is related to cereals (0.38%). It means that, demand of fruits is highly responsive to any change in the price. The estimated own price elasticities of meat (-0.70%), beverages (-0.88%) and dairy (-0.63%) are approximately close to each other and less than one. In fact demand for these three groups has little response to changes in their relative prices.

Cross-price elasticities shown competitive or complementary relations among products. Positive cross-price elasticities indicate competitive relations, while negative cross-price elasticities indicate complementary relations. The cross-price elasticities shown in table (3) shown that most of the selected goods have substitution relationships with each other. It means that, for cereal group, if the global price of vegetable and meat increased in one percentage, it caused to increase the demand of cereal to 0.36% and 0.12% respectively.

The estimated total income elasticities in table (3) have the expected positive signs in all six commodities. For vegetable (e=3.16%) and dairy (e=1.32%) are much greater than others. This implies a fairly large response of demand for these food groups to changes in total import expenditure. Actually, the demand for vegetable and dairy are elastic with respect to total import expenditure. The estimated income elasticities of fruit and cereals are less than unity, so these goods are fairly inelastic with respect to total import expenditure.

**Table3. Price and Income Elasticities of Different Food Groups(1961-2013)**

| | Cereals | Meats | Beverages | Dairy | Fruits | Vegetables |
|---|---|---|---|---|---|---|
| Cereals | -0.38 | 0.12 | -0.07 | -0.03 | 0.06 | 0.36 |
| Meats | 0.09 | -0.70 | 0.07 | 0.12 | 0.36 | 0.06 |
| Beverages | -0.14 | 0.19 | -0.88 | 0.56 | 0.06 | 0.21 |
| Dairy | -0.03 | 0.18 | 0.33 | -0.63 | -0.11 | 0.26 |
| Fruits | 0.22 | 1.72 | 0.12 | -0.35 | -2.23 | 0.87 |
| Vegetables | 0.75 | 0.18 | 0.23 | 0.68 | 0.51 | -2.14 |
| **Income Elasticities** | 0.07 | 1.21 | 1.18 | 1.32 | 0.34 | 3.16 |

***Source: Authors' calculations***

After obtaining compensated own and cross price elasticities, in this section we examine the welfare impacts of changing in selected food items price. Following some recent literature we estimate the change in welfare using by compensating variation (CV). The compensating variation is the amount needed to compensate for increasing in price, in order to remain at the same utility level after a price change. We define price shock scenarios based on average annual changes in global food prices presented by FAO (2013) for period of 1961-2013.

Results of Compensating Variation (CV) shown that welfare losses from the price increases in cereals, meats, dairy, beverages, fruits and vegetable, is amount 1061.48 billion USD (table4). In other words, Italian import need to be compensated with approximately 4.39% of their 2013 total import expenditures on food in order to accommodate the adverse impact of food price changes they faced between 1961 and 2013. The highest amount of CV as result of the increase of prices is obtained for meat. The amount of CV for Fruits is estimated at 261.42 billion USD, which is equivalent to 1.08% of the average import expenditures in 2013. Also, the CV index of dairy is estimated 221.73 billion USD, equivalent to 0.92% of the average import expenditure in 2013. Thus, with an increase of 4.55% in the price of cereals (considering simultaneous prices change), import expenditures increase and welfare decrease. The last column of Table (4) shown the weight of the calculated compensating variation index for each food groups from the total welfare index. According to the results, the amount of CV of meat (24.63%), dairy (20.89%) and cereals (18.18%), constitutes a highest share of the total CV index.

**Table 4. Welfare Impacts of Price Changes(1961-2013)**

| | Average Annual food import(1000Ton) | Price Change (%) | Quantity Change (%) | Compensated Variation (Billion USD) | Compensated Variation (%) | Proportion of CV (%) |
|---|---|---|---|---|---|---|
| Cereals | 7906.49 | 4.55 | 0.74 | 192.96 | 0.80 | 18.18 |
| Meats | 967.00 | 4.29 | -0.15 | 261.42 | 1.08 | 24.63 |
| Beverages | 421.16 | 5.02 | -1.17 | 115.29 | 0.48 | 10.86 |
| Dairy | 1933.41 | 2.81 | 1.67 | 221.73 | 0.92 | 20.89 |
| Fruits | 923.93 | 3.83 | 4.72 | 184.12 | 0.76 | 17.35 |
| Vegetables | 1530.63 | 6.05 | -3.77 | 85.97 | 0.36 | 8.10 |
| **Total** | 13682.62 | - | - | 1061.48 | 4.39 | 100 |

***Source: Authors' calculations***

Table (5) represents the welfare effects of rising global food prices in Italy. The highest amount of loss of welfare, due to rising in global food price is related to meat group (1556.36 billion USD).

It means that according to share of import expenditure of meat group (29.81%), after rising global food price, welfare would decrease and the import expenditure to compare last year will increase. In dairy group, to compensate welfare that lost and to be in same level of previous utility after increasing global food price, 1023.19 billion USD should be add to total expenditure in this group. For fruit, vegetable and beverages groups, approximately lost welfare shown are the same.

**Table 5. The Welfare Effects of Rising Global Food Prices for Consumers in Italy (1961-2013)**

| | **Cereals** | **Meats** | **Beverages** | **Dairy** | **Fruits** | **Vegetables** |
|---|---|---|---|---|---|---|
| Average annual import expenditure (Billion USD) | 1501.94 | 2773.18 | 1047.37 | 1981.35 | 703.22 | 1261.46 |
| Average import expenditure share (%) | 22.03 | 29.81 | 11.71 | 19.66 | 6.18 | 10.62 |
| The weight of the welfare effect of each commodity group | 0.18 | 0.25 | 0.11 | 0.21 | 0.17 | 0.8 |
| lost welfare* (Billion USD) | 658.57 | 1556.36 | 330.13 | 1023.19 | 365.51 | 340.11 |
| Share of lost welfare ** (%) | 15.41 | 36.42 | 7.72 | 23.94 | 8.55 | 7.96 |

***(weight of the welfare effect * Average annual import expenditure)**

**** total lost welfare is equal to 4273.88 Billion USD**

***Source: Authors' calculations***

## Conclusion

While the main focus of the empirical works in Italy has been on the effects of removal of food subsidies, 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. This study considering import demand for the main imported food products by using AIDS model and by taking into account the welfare impact of an increase in global prices of the six main food groups. For this aim, Compensate Variation (CV) used, based on changes in global food prices between 1961 and 2013. Substitution effects among food items estimated by including own and cross price elasticities obtained through the estimation of an AIDS demand system. According to the demand theory, all the estimated price and expenditure elasticities are acceptable (negative for own elasticities and positive for expenditure elasticities). Increasing food price causes import welfare loses and increasing import expenditures. Also, the result of CV suggests that consumer welfare of 1061.48 Billion USD approximately 17.67% of the total import expenditure of the six food groups in 2013. Although the food price changes have had differential effects for each food groups, to reach food security and food safety goals, the Italian government should compensate, lost welfare by implementing different trade supportive policies.

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