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Welfare effects of environmental tax on the low-income Iranian households

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ABSTRACT

The research focused on assessing the effects of escalating food prices on the welfare of low-income households in Iran. The study utilized household cost-income survey data from 2020 and calculated compensatory price elasticities using the quadratic almost ideal demand system. The findings revealed that all food price elasticities were negative and less than one, with the highest elasticity observed in dairy products, while the lowest in oil and fat. The income elasticity of food varied from 0.136% to 1.392%. The welfare impact of food price changes was assessed through the calculation of the welfare index of compensated changes, which indicated that the food Compensated Variation (CV) welfare index for low-income households due to the rise in food prices following the implementation of the pollution tax policy is $46.67, representing 33.22% of their food expenses. This means that the income of Iranian households is expected to increase by 33.22% due to the application of the environmental tax policy. Furthermore, the vulnerability index of households was projected to increase by 8.69% as a result of food price changes, but the provision of cash subsidies could mitigate this vulnerability by 3.54%.

Keywords: Vulnerability, Welfare, Subsidies, Food, Demand system, Tax.
Article type: Research Article.

INTRODUCTION

Preventing air pollution is more effective than controlling it. Governments are transitioning to green energy sources like wind and solar power to reduce reliance on fossil fuels and minimize carbon emissions. They also impose regulations on companies for responsible manufacturing practices to mitigate the negative effects of air pollution (Choudhary & Garg 2013). There are numerous policy instruments available for reducing carbon dioxide emissions. The first type is an administrative order-based policy instrument, which is relatively inflexible and may not effectively contribute to emission reduction. Additionally, it may be challenging to inspire active participation. Another policy instrument is based on economic incentives, categorized into total control measures and price control means such as carbon tax or environmental tax (Bumpus, 2015; Dong *et al.* 2017). Implementing an environmental tax is primarily aimed at internalizing the externalities associated with anthropogenic climate change. Without such a tax, there exists a distorted price system where activities with higher greenhouse gas (GHG) emissions are relatively cheaper, failing to account for the costs imposed on others and future generations. A carbon tax is effective in prompting individuals to consider the full scope of the consequences of their emissions (Xu *et al.* 2023). Research indicates that an environmental tax serves as an effective tool for fostering a sustainable economy with minimal environmental impact (Lu *et al.* 2019; Labeaga & Labandeira 2020). Moreover, it offers a triple dividend by concurrently improving the environment, creating new revenue sources for governments, and reducing unemployment (Bohringer *et al.* 2019). Economists advocate for pollution emissions tax as a means to align private and social prices of products manufactured by polluting industries, while green tax generates positive

externalities for consumers and the economically disadvantaged. Additionally, it incentivizes pollutions to curtail production to avoid higher taxes (Pal & Saha 2015; Zimmer & Koch 2017; Fan *et al.* 2019). The implementation of environmental tax policies may result in an escalation of the prices of goods and services due to the amplified production costs incurred by producers (Xu *et al.* 2023). It is of utmost importance to know how changes in food prices affect the welfare of households (Layani *et al.* 2021). In all nations worldwide, the prioritization of food safety and food security in policy decisions is paramount (Nomura 2010; Azzam & Rettab 2012; Wood *et al.* 2012). Access to food is considered a fundamental human right, making it imperative to comprehend the impact of food price increases, particularly on vulnerable households. Such understanding bears significant implications for the development of supportive policies (Fallahi *et al.* 2014) and is essential in mitigating the adverse effects of rising prices, thereby contributing to the overarching goal of achieving food security. Analyzing the economic impact of various policies on societies has always been a crucial aspect of public policy. Countries often implement policy measures to mitigate the effects of food price fluctuations on local markets, particularly on vulnerable population segments (Laborde *et al.* 2019). Understanding the root causes of food price shocks and their significant impact on developing nations is essential for evaluating the effectiveness and suitability of policies and for proposing appropriate policy options (Abbotta & Battisti 2011). Governments often use subsidies as a policy tool to mitigate the impact of market price shocks on low-income households. Subsidies aim to prevent poverty and social crisis and promote justice, even if it means sacrificing some economic efficiency. However, poor subsidy payment methods can cause inefficiency and injustice (Sohaili *et al.* 2017). There is currently a heated debate among economists and policymakers about the link between targeting subsidies and poverty reduction (Amegashie 2006). From one point of view, replacing subsidies for the whole society with targeted subsidies is an effective policy to achieve these goals. Another perspective on reducing poverty is by utilizing income redistribution policies, which differ greatly from the approach of providing targeted subsidies. Iranian policymakers proposed replacing universal subsidies with targeted subsidies, along with support policies for vulnerable groups. The targeted subsidy reform program aimed to replace generous energy subsidies with direct cash payments deposited monthly into designated household accounts. Initially representing 22% of median income in 2011, these payments decreased to 5% by 2019. While the poor initially benefited from the monthly transfers, high inflation quickly eroded their real value (Hosseini *et al.* 2017). In 2018, government welfare payments totaled $35.4 but decreased significantly to $19.8 in 2019. This reduction in funding was primarily attributed to economic sanctions and a decline in government revenue, leading to a reduced ability to assist those in need (Salehi Isfahani 2020). Therefore, it is essential to assess the effectiveness of governmental aid policies designed to alleviate the vulnerability of impoverished households to determine the appropriate allocation of future support disbursements. Analyzing welfare and poverty indices is essential for assessing public sector policies. Governments must consider how policy changes and price adjustments affect households' welfare and resource allocation (Sadeghi *et al.* 2018). The impact of policy changes on consumer welfare can be studied by analyzing consumer behavior and estimating their demand function. Understanding demand structure and household consumption patterns is essential for policy analysis, providing valuable insights for predicting future scenarios (Layani *et al.* 2021). Food prices have risen significantly in both Iran and the global market, leading to inflation for some staple goods according to FAO's 2021 report (FAO 2021). The issue of rising food prices has become a global concern. While the COVID-19 pandemic caused many food products to become more expensive (Elleby *et al.* 2021), the trend of increasing food prices began in 2018, before the pandemic. Due to disruptions in food supply chains caused by lockdown regulations imposed by governments, food prices have continued to rise during the pandemic (Panzone *et al.* 2021). In addition, according to Farajzadeh (2018) and Shakerin *et al.* (2024), the implementation of a pollution tax policy has been associated with an increase in the prices of various goods and services, including food. So, the adverse effects of food price shocks on welfare can be substantial, particularly for disadvantaged households with limited financial means (Alem & Söderbom 2012). There has been a growing body of literature regarding the impact of price shocks on household vulnerability and welfare effects across various countries in recent years (e.g. Benfica 2014; Rischke 2015; Aziz *et al.* 2016; Arfini & Aghabeygi 2018; Adekunle *et al.* 2020; Lugo *et al.* 2022). Ivanic & Martin (2008) conducted research on the correlation between the escalation of global food prices and poverty in low-income countries. This study took into account not only the assumption that world prices would be completely transferred to the domestic food market but also local prices and their impact on poverty. Arfini & Aghabeygi (2018) analyzed the impact of increasing prices of food imports on the welfare of Italy. The results indicated that the Compensated Variation (CV), index in the entire food group

amounted to 1061.48 billion USD in terms of welfare index. Notably, the meat group exhibited the most CV, while the fruit group showed the least. In a recent study by Layani *et al*. (2020), the impact of food price fluctuations on the food poverty index in rural households of Iran was examined. Results showed that the vulnerability index of rural households is 2.52% due to price increases and that 10.63% of these households fall below the poverty line as a result of rising food prices. These findings highlight the significant impact of food price changes on rural households in Iran and suggest that measures should be taken to mitigate the effects of such fluctuations. The study conducted by Anindita *et al*. (2022) utilized LA-AIDS, CV, and Equivalent Variation (EV) methods to investigate the impact of increasing prices and income on demand and welfare in urban Indonesia. The findings revealed that the beef was found to be a substitute for sea fish and eggs, while it complemented chicken meat and milk. All animal food items were considered luxury goods except for sea fish, which was classified as a normal good. In general, EV compensation is more effective than CV compensation. Rossen *et al*. (2022) have conducted a study that examines the effect of price shocks on different household groups based on income and age. Their research found that households with lower income and older individuals experience more significant welfare losses and a decrease in tax burdens compared to lower-income households with younger individuals. This study highlights the importance of considering demographic factors when analyzing the impacts of price shocks on households. The research aims to analyze the impact of fluctuations in food prices on the welfare of low-income households and assess the effectiveness of government support policies in mitigating the vulnerability of these households. In addition to examining the average annual changes in food prices in Iran's agricultural market, this study also incorporates scenarios of food price increases resulting from the implementation of environmental tax policies, as outlined in Farajzadeh (2018) and Shakerin *et al*. (2024). Evaluating the impact of such taxes on consumption patterns and household welfare can offer valuable insights for policymakers seeking to implement effective environmental tax policies.

MATERIALS AND METHODS

In the welfare literature, various indexes are used to measure welfare changes due to different policies. Criteria such as consumer surplus (CS), Compensated Variation (CV), and Equivalent Variation (EV) are used to determine how changing economic conditions affect consumer utility. In the context of rising food prices, CV represents the minimum amount consumers are willing to accept to tolerate higher prices, while EV represents the maximum amount they are willing to pay to avoid higher prices. The focus of CV is on the welfare level before the price increase, while the focus of EV is on the subsequent welfare level after the increase. The study utilized Compensated Variation according to Cranfield (2007), Azzam & Rettab (2012), Tefera (2012), and Layani *et al*. (2021). The CV model with multiple price changes begins with the consumer's goal of minimizing spending on N food items while maintaining a specific level of utility, u^0. By substituting the optimal Hicksian quantities into the expenditure equation, we can derive the minimized expenditure function (Azzam & Rettab 2012).

$$E = E(P_1.P_2.\ldots.P_3.U^0) \qquad \textbf{(1)}$$

$$= p_1 q_1^H(P_1.P_2.\ldots.P_3.U^0) + p_2 q_2^H(P_1.P_2.\ldots.P_3.U^0) + \cdots + p_N q_N^H(P_1.P_2.\ldots.P_3.U^0)$$

where Pi for i = 1, 2, . . ., N are the respective prices of the N commodities, and the superscript H stands for Hicksian. Denoting the initial and the subsequent periods by superscripts ‘‘0’’ and ‘‘1’’, respectively, consumer WTA to tolerate higher prices is given by:

$$CV = E(p_1^1.p_2^1.\ldots.p_{\mathrm{N}}^1.U^0) - E(p_1^0.p_2^0.\ldots.p_N^0.U^0) \qquad \textbf{(2)}$$

Using (2), we can expand (3) as follows:

$$CV = p_1^1 q_1^H(p_1^1.p_2^1.\ldots.p_N^1.U^0) - p_1^0 q_1^0 + p_2^1 q_2^H(p_1^1.p_2^1.\ldots.p_N^1.U^0) - p_2^0 q_2^0 + \cdots + p_N^1 q_N^H(p_1^1.p_2^1.\ldots.p_N^1.U^0) - p_N^0 q_N^0 \qquad \textbf{(3)}$$

Direct measurement of CV using (3) is not possible because the Hicksian demand functions $q_i^H(.)$ for i = 1, 2,…, N depend on the utility level U0, which is unobservable. However, as shown by Huang (1993), if the respective changes in prices and Hicksian quantities are defined as (Azzam & Rettab 2012):

$$dp_i = p_i^1 - p_i^0 \; for \; i = 1.2. \ldots . N \quad \textbf{(4)}$$
$$dq_i^H = q_i^H - q_i^0 \; for \; i = 1.2. \ldots . N$$

and substituted into (3), CV can be approximated by

$$CV = p_1^0 q_1^0 \left(\frac{dp_1}{p_1^0} + \frac{dq_1^H}{q_1^0} + \frac{dp_1}{p_1^0}\frac{dq_1^H}{q_1^0}\right) + p_2^0 q_2^0 \left(\frac{dp_2}{p_2^0} + \frac{dq_2^H}{q_2^0} + \frac{dp_2}{p_2^0}\frac{dq_2^H}{q_2^0}\right) + \cdots + p_N^0 q_N^0 \left(\frac{dp_N}{p_N^0} + \frac{dq_N^H}{q_N^0} + \frac{dp_N}{p_N^0}\frac{dq_N^H}{q_N^0}\right) \quad \textbf{(5)}$$

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,. . ., N i.e.,

$$\begin{aligned}
\frac{dq_1^H}{q_1^0} &= \epsilon_{11}^H \frac{dp_1}{p_1} + \epsilon_{12}^H \frac{dp_2}{p_2} + \cdots + \epsilon_{1N}^H \frac{dp_N}{p_N} \\
\frac{dq_2^H}{q_2^0} &= \epsilon_{21}^H \frac{dp_1}{p_1} + \epsilon_{22}^H \frac{dp_2}{p_2} + \cdots + \epsilon_{2N}^H \frac{dp_N}{p_N} \\
&\vdots \\
\frac{dq_N^H}{q_N^0} &= \epsilon_{N1}^H \frac{dp_1}{p_1} + \epsilon_{N2}^H \frac{dp_2}{p_2} + \cdots + \epsilon_{NN}^H \frac{dp_N}{p_N}
\end{aligned} \quad \textbf{(6)}$$

where ϵ_{ij}^H is the Hicksian price elasticity for i = 1, 2, …, N and j = 1, 2, …, N. To estimate the Hicksian price elasticities outlined in equation 6, we utilize a Quadratic Almost Ideal Demand System (QAIDS) model for N commodities. This involves imposing standard restrictions such as adding-up, homogeneity, and symmetry.

$$S_i = \alpha_i + \sum_{j=1}^N \gamma_{ij} log p_j + \beta_i log\left[\frac{M}{f(p)}\right] + \frac{\lambda_i}{g(p)}\left\{log\left[\frac{M}{f(p)}\right]\right\}^2 \quad \textbf{(7)}$$

where S_i is the Share of food group i in total expenditure on the N food groups, for i=1,2,.., N; and p_j is a vector of prices; M is total expenditure and Z Vector of statistical variables dependent on household characteristics. Also *f(p)* is the Laspeyres Price Index define by $log f(p)^* = \sum_i s_i log p_i$.

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

$$e_{ij}^h = \left(\frac{u_{ij}}{s_i} - \delta_{ij}\right) + \left(1 + \frac{u_i}{s_i}\right) s_j \quad \textbf{(8)}$$

$$u_i = \frac{\partial s_i}{\partial lnm} = \beta_i + \frac{2\lambda_i}{g(p)}\left[log\left[\frac{M}{f(p)}\right]\right] \quad \textbf{(9)}$$
$$u_{ij} = \frac{\partial s_i}{\partial lnp_j} = \gamma_{ij} - \left(\beta_i + \frac{2\lambda_i}{g(p)}\left[log\left[\frac{M}{f(p)}\right]\right]\right)(\alpha_j + \sum_{i=1}^k \gamma_{ji} log p_i) - \frac{\lambda_i \beta_i}{g(p)}\left[log\left(\frac{M}{f(p)}\right)\right]^2$$

where δ_{ij} is the Kronecker delta taking the value $\delta_{ij} = 1$ if i = j and $\delta_{ij} = 0$ if i ≠ j. In terms of the u_i, the formula for Income elasticities can be written as:

$$e_i = 1 + \frac{u_i}{s_i} \quad \textbf{(10)}$$

Negative cross-price elasticities indicate a complementarity relationship and the positive values for cross-price elasticities indicate substitutability. Also, the positive (negative) values for expenditure elasticity indicated non-inferior (inferior). The evaluation of the efficacy of providing subsidies to low-income households is determined by comparing the ratio of the Compensated Variation (CV) index to the per capita income with the ratio of cash subsidies to monthly income (Eq. 11).

$$Vulnerability\ \ index\ \text{after}\ subsidy\ \ policy = \frac{CV}{monthly\ \ income} - \frac{\text{cash subsidy}}{monthly\ \ income} \quad \textbf{(11)}$$

where CV is the household's welfare index as a result of different price shocks. the ratio of the Compensated Variation (CV) index to the monthly income is known as the vulnerability index (Azzam & Rettab 2012).

$$Vulnerability\ index\ before\ subsidy\ policy = \frac{Welfare\ effects\ of\ \ price\ shock}{monthly\ \ income} \quad (12)$$

Food Price Shock Scenarios

To analyze the impact of changes in food prices on household spending, it is important to establish specific scenarios. There are various methods for defining a price increase scenario. One approach is to utilize data from previous studies to predict the impact of rising food prices due to environmental taxes on welfare. Another method involves using time series data for food prices. This entails calculating the price growth of food over specific years for each group, determining the average rate of price growth, and using this as the scenario for food price change. As future food price fluctuations are uncertain, this rate of price fluctuation is assumed to occur in the next year, and its impact on household expenditure is calculated accordingly. The specific scenarios for increasing food prices in this study are detailed in Table 1.

Table 1. Different food prices shock scenarios (%).

Food	First scenario	Second scenario
Cereals	34.5	15.31
Meat	45.2	16.26
Dairy	20.5	15.56
Oil and fat	31.1	9.60
Fruit	29.7	11.96
Vegetables	24.3	30.22
Sugar	25.8	19.03
Tea and coffee	34.1	10.09

RESULTS

After estimating the coefficients of the systems of equations based on the equations presented in the previous section, the price and income elasticities were obtained. In the following, the consumption pattern of consumers is examined based on the elasticities obtained for the households under study. First, the characteristics of the samples used in the study were examined in terms of consumption and proportion of expenditure on different types of meat, as well as the social and economic characteristics of the households (Table 2).

Table 2. Socio-economic characteristics of the studied households.

Variables	Average
Age of household head (year)	52.32
Education of household head (year)	5.27
Family size	3.89
Per capita Food expenditure ($)	14.18
Per capita income per month ($)	53.65

Source: Household Expenditure and Income Survey (HEIS).

The compensated own-price and cross-price elasticities of food are shown in Table 3. All compensated elasticities of the studied food are negative, as expected, consistent with the behavior that maximizes the utility of rational consumers. The highest own-price elasticity is related to oil, and the lowest is related to dairy. For example, a 1% increase in cereal prices can reduce demand for this commodity by 0.398%. The own-price elasticity of meat is calculated as -0.529%. The own-price elasticity of oil and fat is -0.729%, and for dairy products, it is -0.006%. Own-price elasticity of fruits, vegetables, and sugar are very close in terms of absolute value at -0.634%, -0.608%, and -0.633%, respectively. According to cross-price elasticities, there is a poor complementary relationship between cereals and other food groups. The effect of changes in cereal prices on demand for other foods is more pronounced. For example, the effect of rising dairy prices on cereal demand is negative, indicating a complementary relationship between the two products. However, households also add cereals to their food portfolio as a substitute for dairy products. Additionally, the effects of meat price change on the demand for oil and fat, fruit, tea and coffee are negative, indicating the complementarity of meat for these food groups. The cross-elasticity between oil and fat and other food groups such as meat, dairy, fruits, vegetables, and sugar are negative and it shows the existence of a complementary relationship between oil and fat with other food. However, the increase in oil and fat prices leads to an increase of 0.048 %, 0.065 %, 0.021 %, 0.068% and 0.043 % demand for meat, dairy, fruits, vegetable, and sugar, respectively. The cross-elasticity of other commodities with oil and fat suggests a substitution relationship between them. The highest substitute for fruit is tea and coffee (cross price

elasticity is 0.560). In addition, the highest complementary relationship between fruit and dairy products was obtained (cross price elasticity is -0.385). The compensated cross-sectional elasticity of vegetables indicates a substitution relationship with other food groups (except tea and coffee). The highest and lowest substitution relationships are for vegetables-meat (0.199%) and vegetables-sugar (0.067%) respectively. Vegetables are considered complementary for oil, fat (elasticity - 0.048 %), and fruits (elasticity - 0.054 %). Increasing the price of vegetables reduces the demand for oil, fat, and fruits. The income elasticities provided in Table 3 demonstrate consistently positive values across all eight commodities. Notably, cereals (e=1.303), oil for cooking (e = 1.210), and fruits (e = 1.392) exhibit notably higher values compared to the others. This suggests a substantial responsiveness of demand for these food groups to changes in total food expenditure. Specifically, the demand for cereals, oil for cooking, and fruits proves to be elastic concerning total food expenditure. Conversely, the estimated income elasticities for meats, dairy, vegetables, sugar, tea, and coffee are less than unity, indicating that these goods are relatively inelastic in response to changes in total food expenditure.

Table 3. Price and income elasticities for each food groups.

	Cereals	**Meats**	**Dairy**	**Oil cooking**	**Fruits**	**Vegetables**	**Sugar**	**Tea and coffee**
Cereals	-0.398	0.086	-0.093	0.073	0.065	0.016	0.005	0.321
Meats	0.196	-0.529	0.175	0.048	0.084	0.119	0.061	-0.071
Dairy	0.177	0.715	-0.006	0.065	0.203	0.523	0.367	-1.044
Oil cooking	0.285	-0.106	-0.382	-0.729	-0.001	-0.048	-0.082	0.565
Fruits	0.258	-0.026	-0.385	0.021	-0.633	-0.054	-0.060	0.560
Vegetables	0.144	0.199	0.188	0.068	0.069	-0.608	0.068	-0.035
Sugar	0.159	0.236	0.284	0.043	0.088	0.175	-0.633	-0.219
Tea and coffee	0.206	-0.147	-0.429	0.011	-0.071	-0.117	-0.093	-0.243
Income Elasticities	**1.303**	**0.918**	**0.136**	**1.210**	**1.392**	**0.998**	**0.774**	**0.836**

* Source: Authors' calculations.

Table 4 illustrates the impact of food price shocks on household expenditures. Under the first price scenario, the CV welfare index ranges from 1.52% to 15.04%. The highest CV index pertains to meat, while the lowest is associated with tea and coffee. The total Compensated Variations index for this scenario is 46.67%, indicating that household food expenditure would increase by $46.67 due to the price changes. This translates to a 33.22% increase in expenditure to maintain the same food basket. Under the second price scenario, the total welfare index of Compensated Variations is $23.49, representing 16.74% of the baseline food expenditure. The CV index for food items in this scenario fluctuates between 0.45% and 6.45%.

Table 4. Welfare Effect of Multiple Food Price Shocks.

Food Groups	**Average monthly food expenditure ($)**	**Scenario 1**				**Scenario 2**			
		Price change (%)	**CV Welfare Index ($)**	**CV Welfare Index (%)**	**Proportion of CV (%)**	**Price change (%)**	**CV Welfare Index ($)**	**CV Welfare Index (%)**	**Proportion of CV (%)**
Cereals	41.699	34.5	14.53	10.35	31.14	15.31	6.45	4.60	27.46
Meats	33.045	45.2	15.04	1.71	32.22	16.26	5.41	3.86	23.03
Dairy	16.238	20.5	3.32	2.36	7.11	15.56	2.52	1.80	10.73
Oil cooking	8.591	31.1	2.33	1.89	5.69	9.60	0.82	0.59	3.49
Fruits	12.506	29.7	3.70	2.63	7.93	11.96	1.49	1.07	6.34
Vegetables	16.297	24.3	3.95	2.81	8.46	30.22	4.91	3.50	20.90
Sugar	7.600	25.8	1.95	1.39	4.18	19.03	1.44	1.03	6.13
Tea and coffee	4.504	34.1	1.52	1.08	3.26	10.09	0.45	0.32	1.92
Total	140.478	-	46.67	33.22	100	-	23.49	16.72	100

* *Source:* Authors' calculations.

The vulnerability index of impoverished households ranges from 4.37% to 8.69% under two different price scenarios. The highest vulnerability index is observed under the first price scenario, while the lowest is seen under the second scenario. With an average monthly income of $536.54 for poor households, the total welfare loss due

to increasing food prices equates to 8.69% of the average household income under the first scenario, indicating the vulnerability of households to multiple food price shocks. This index decreases to 4.37% in the second scenario. To alleviate the situation and promote social justice, the Iranian government provides a cash subsidy of approximately $19 per person per month to the head of the household's account. This subsidy amounts to 3.54% of the average monthly income of the households, indicating that the government has managed to reduce the vulnerability of low-income households by 3.54% through this policy. Consequently, following the implementation of the targeted subsidy policy and support for low-income groups, the vulnerability index of households will range from 0.79% to 5.11% under two price scenarios.

Table 5. Households vulnerability index.

Average monthly income ($)	**536.54**	
	Scenario 1	**Scenario 2**
Compensated Variation ($)	46.67	23.49
Vulnerability index before subsidy policy (%)	8.69	4.37
Vulnerability index after subsidy policy (%)	5.11	0.79

* Source: Authors' calculations.

DISCUSSIO

Measuring changes in economic welfare has always been a fundamental topic in economics. Government economic policies have a direct impact on the welfare of economic households. Analyzing demand structure and household consumption patterns are crucial for policy analysis, enabling policymakers and planners to predict future situations. Moreover, studying the effectiveness of economic policies, such as subsidy policies and price changes on food security, society members' health, and consumer welfare is essential. This effectiveness can be measured by observing consumer reactions to these policies. Agricultural producers, food processors, and other market participants need to anticipate the demand for agricultural products to plan and shape their production and sales. Therefore, understanding demand trends is important. In this study, we aimed to investigate the effectiveness of subsidizing poor households to reduce their vulnerability. For this purpose, we utilized the household expenditure and income survey of low-income households as well as employing the Quadratic Almost Ideal Demand System (QUAIDS) model and the compensated variation (CV) welfare index. The CV indicated the reduced welfare of low-income households in Iran under different price shock scenarios. The welfare index of compensated variations for low-income households fluctuated between $23.49 and $46.67 under two scenarios, indicating a worsened situation in terms of welfare and increased expenditure. Similar findings were reported by Arfini & Aghabeygi (2018) for Italian consumers and Layani *et al*. (2020) for Iranian urban households. The most significant decline in household welfare due to price changes was observed in cereals and meat. Roosen *et al.* (2022) demonstrated that a general rise in the value-added meat tax from 7% to 19% led to a welfare loss of 0.83 euros per household per month in Germany. Our results indicated that the studied households lost an average of about 8.69% and 4.37% of their income in 2020 due to different price shock scenarios. Comparing these findings with other studies, such as Layani *et al.* (2020), confirms the greater vulnerability of low-income households. The government's efforts to support vulnerable households through assistance programs or subsidies to mitigate the impact of price increases were found to offset only a small portion of the welfare loss. Therefore, if the government aims to support vulnerable households, regulating the market for these products can play a crucial role in food security and support implementation. The demands for various types of meat, cereals, dairy products, and other food products are expected to increase due to reasons such as population growth. This demand can be met through domestic production or foreign sources. Given the significant effects of changes in global prices on household expenditure, supporting domestic production appears to be the most logical policy. If food production does not keep pace with population growth, per capita food production will decrease, necessitating increased food imports or reduced exports, or both measures. Increasing food imports may lead to greater dependence on foreign sources, resulting in financial, economic, social, and political challenges, including the impact of global price fluctuations on the domestic market. Given the rising trend of global food prices and the welfare losses due to this price increase, accurately identifying vulnerable households and providing support is crucial. Supporting domestic production has proven to be more effective in offsetting the impact of price increases and supporting vulnerable households. Considering the impact of rising food prices on the well-being of the population and the need to respond to the increased demand for food resulting from price hikes, improving the quality of people's diets through measures such as increasing the production of suitable foods and diversifying food production, especially

for items that constitute a significant portion of household food expenditures, becomes important for ensuring food security and addressing welfare concerns.

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