

Meat demand structure and welfare effects of price liberalization: toward socio-demographic policy recommendations

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Abstract

This study attempts to investigate the welfare effects of the multiple meat price shocks in consumers' different income and age groups due to the price liberalization policy. This is achieved by using Compensating Variation welfare index (CV) and Hicksian price elasticities, based on the Almost Ideal Demand System (AIDS) and the cost-income data of 17931 urban households in Iran. The results showed that the difference in meat's own-price elasticity for consumers of different ages decreases with the improvement of consumers' income status. The absolute own-price elasticity of poultry varied between 0.072-0.559 percent. The highest sensitivity of poultry meat demand to price changes was observed in high-income consumer groups. As well as the red meat demand sensitivity to price changes for all age groups declines along with raised income. The fish own-price elasticity for all consumers was more than one and their differences were more significant for low-income consumers. The CV index of consumers varied between 29 and 78% and confirmed the hypothesis of difference in the consumers' vulnerability in different age and income groups. Separating the welfare effect by consumer groups based on income and age indicated that low-income and younger consumers experience a higher welfare loss compared to low-income and older consumers. Finally, to accurately target the subsidies, the government can pay a certain amount of subsidy to each person according to the economic and social characteristics to prevent the wastage of resources and reach the desired goal.

Keywords: Meat Demand, Welfare, Food Security, Compensating Variation, Price Liberalization.

Introduction

Food price shocks can have a significant negative welfare effect on society, especially on poor and low-income households (Alem and Söderbom, 2012). Developing countries are more affected by food price fluctuations due to their economic structure. Because these countries are often in a

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30 period of economic transition, rising prices lead to many problems in these countries (Pawlak and
31 Kołodziejczak, 2020). Iran is also one of the developing countries facing double-digit inflation
32 rates for many years, and most of the government's efforts have always been focused on
33 identifying and eliminating the roots of inflation (Ilias, 2010).

34 For various reasons, such as the nature of the agricultural sector, higher risk than other sectors,
35 and food security, support for the agricultural sector has always been the focus of governments
36 (Nematollahi *et al.*, 2013; Ehlers *et al.*, 2021). Government interventions in pricing, revenue
37 protection, production control, customs restrictions on imports, and export subsidies to
38 agricultural products are among the policies of governments to protect consumers and producers
39 of agricultural products (Mockshell and Birner, 2015; Bellmann, 2019). Despite the positive
40 effects of the liberalization of economic activity in the world, the Iranian government still has a
41 significant contribution to the country's economy. However, almost all economists agree on the
42 low efficiency of government economic activities. Restricting government intervention in
43 agricultural activities is a measure suggested by the World Bank and other global economic
44 organizations, especially in recent decades (Bakhshoodeh, 2002). The most important goals of
45 market liberalization are to prevent the use of production facilities in the low-efficient production
46 sector, increase production and encourage competition (Arya *et al.*, 2018). [About price
47 liberalization, Tabatabaei and Asef \(2021\) examined how price liberalization affects energy
48 consumption intensity. They found that price liberalization can enhance productivity, energy
49 consumption management, and consumption reform, ultimately resulting in reduced energy
50 intensity. Norouzi *et al.* \(2021\) conducted a study on how energy cost liberalization policies
51 impact the cost-effectiveness of wind farms versus gas power plants. In food market, Dorosh *et al.*
52 \(2023\) examined how market liberalization and global price fluctuations affect wheat price
53 policies in Sudan. A study by Ghencea *et al.* in 2022 found that liberalization and globalization
54 in Moldova's food retail industry have led to better access to high-quality food products and
55 reasonable prices for consumers. Competition has also increased access and diversification. Iran's
56 economic policies are also aimed at diminishing government hands and liberalizing economic
57 activities, especially in the agricultural market. Although this policy can bring economic benefits
58 to society, its effects should also be taken into consideration by policymakers, and the
59 liberalization policy should be well-defined and implemented.](#)

60 [To protect Iranian households from vulnerability caused by price liberalization, the government
61 provides additional subsidies to consumers and eliminates cash subsidies for high-income groups.](#)

62 However, the success of this policy depends on accurately determining the appropriate amount of
63 subsidies to be paid. To make well-informed decisions, policymakers must comprehend the
64 potential impact of price shocks on household expenditure. Evaluating the impact of price shocks
65 on consumer welfare can provide valuable insights into the effectiveness of government support
66 policies aimed at reducing poverty and vulnerability (Layani *et al.*, 2020). Based on
67 microeconomics theories, whenever an economic change occurs (e.g. the price shocks) an
68 individual moves from one equilibrium point to another equilibrium point. This means that they
69 move from one indifference curve to another indifference curve. The change in welfare is
70 measured by the difference in utility (Chipman and Moore, 1980). Economists try to convert
71 changes in utility into observable indexes like money. Hicks (1942) defined Compensating
72 Variation (CV) as the deduction (or addition) required from an individual's income to maintain
73 the initial level of welfare (initial situation.) after a change in price and income. To calculating
74 CV, estimating the demand functions and calculating the price and income elasticities of different
75 goods for consumers in different groups play an essential role (Azzam and Rettab, 2012).

76 There is a large volume of published studies that worked on examining the structure of
77 commodity demand and determining their price and income elasticities. Deaton and Mulbaer
78 (1980) for Great Britain; Blanciforti *et al.* (1986) for the United States; Karagiannis *et al.* (2000)
79 for Greece; Abdulai (2002) for Switzerland; Mazzocchi *et al.* (2004) for Italy; Tefera (2010) for
80 Ethiopia; Ahn *et al.* (2018) for Korea; and Yuzbashkandi and Mehrjo (2020) for Iran are some
81 examples. In recent years, there has been an increasing amount of literature on welfare effects and
82 household vulnerability to price shocks in different countries (e.g., Fujii, 2013; Layani and
83 Bakhshoodeh, 2016; Renner *et al.*, 2019). Determining the vulnerability of households in the
84 United Arab Emirates (UAE) as a result of multiple price changes of imported food products
85 investigated by Azzam and Rettab (2012). The focus of this study was to determine the welfare
86 effects of multiple commodity price changes. Recently, Layani *et al.* (2020) have evaluated the
87 poverty line changes in urban households as a result of simultaneous price changes to understand
88 the extent of Iranian consumers' vulnerability.

89 Considering all of this evidence, what is less clear is the different reactions of households with
90 varying characteristics to changes in commodity prices. Consumers with varying income and age
91 groups may react differently to price changes. This means that the price elasticity of consumers
92 with different economic and demographic backgrounds can vary. The impact of price shocks on
93 the welfare of consumers can be influenced by this issue. This issue was considered by Khoiriyah

94 *et al.* (2019); Nikmatul *et al.* (2020); Kharisma *et al.* (2020); Ur Rahman (2021). In these studies,
95 the price and income elasticities of commodities were calculated in different income groups. Then
96 the welfare effects of price shocks for different groups of households were evaluated. Very little
97 was found in the literature to consider the socio-demographic characteristics of households in the
98 calculation of consumers' reactions to price shocks. Currently, Rossen *et al.* (2022) by
99 disentangling the impact of price shocks by household group according to income and age,
100 showed that lower-income and older households experience greater welfare losses and lower tax
101 burdens than their income compared to lower-income and younger households. Also, Nur Hamzah
102 (2022) found that regional heterogeneity plays an important role in explaining the most strategic
103 food consumption pattern in Indonesia.

104 Research has shown that accurately calculating the impact of price changes on consumers with
105 varying economic and demographic backgrounds can help governments develop targeted poverty
106 reduction policies. To do this, it's important to understand consumer behavior in the market and
107 calculate their price and income elasticity. Therefore, this study set out with the aim of assessing
108 the importance of socio-demographic characteristics and consumer demand structure in meat
109 demand structure in Iran. This study takes into consideration the necessity of analyzing consumer
110 behavior for different income and age groups, while, to the best of our knowledge, this point has
111 not been considered adequately. To enhance the government's cash subsidy payment policy, we
112 need to assess the impact of price hikes on consumers' welfare, considering their income and
113 demographic features. Therefore, In comparison to other studies, we report price and expenditure
114 elasticities by socio-economic group. Finally, the welfare effects of the price shock caused by the
115 price liberalization policy are evaluated for urban meat consumers in Iran in different income and
116 age groups.

117 Within this context, the rest of the paper is structured as follows: The next section introduces the
118 methodology of the AIDS model and the welfare Index. Own- and cross-price elasticities of meat
119 and welfare effects of price shocks are presented in the results section. The final section offers
120 discussion and conclusions.

121

122 **Methodology**

123A) **Welfare Index**

124 There are various indexes for measuring welfare changes due to the implementation of
125 different policies (Gohin, 2005). Compensated Variation (CV), is the adjustment in income that

126 returns the consumer to the original utility after an economic change has occurred. EV is the
 127 adjustment in income that changes the consumer's utility equal to the level that would occur if the
 128 event had happened (Varian, 2000). According to the study by Azzam and Rettab (2012) and
 129 Tefera (2012), Compensated Variation was used in this study:

$$CV = \sum_{i=1}^3 p_i^0 x_i^0 \left(\frac{dp_i}{p_i^0} + \frac{dx_i^*}{x_i^0} + \frac{dp_i}{p_i^0} \frac{dx_i^*}{x_i^0} \right) \quad (1)$$

130 Where p_i^0 and x_i^0 correspond to price and quantities before price shock and dx_i^* is the
 131 compensated quantity change in demand following the price shock using the compensated
 132 elasticities. The percentage change of x_i^* is not available. However, by the total differential of the
 133 Hicksian demand functions $X_i^*(.)$ for $i = 1, 2, \dots, N$ i.e., an approximation of the change is
 134 obtained.

$$\begin{aligned} \frac{dX_1^*}{X_1^0} &= \epsilon_{11}^H \frac{dp_1}{p_1} + \epsilon_{12}^H \frac{dp_2}{p_2} + \dots + \epsilon_{1N}^H \frac{dp_N}{p_N} \\ \frac{dX_2^*}{X_2^0} &= \epsilon_{21}^H \frac{dp_1}{p_1} + \epsilon_{22}^H \frac{dp_2}{p_2} + \dots + \epsilon_{2N}^H \frac{dp_N}{p_N} \\ &\vdots \\ \frac{dX_N^*}{X_N^0} &= \epsilon_{N1}^H \frac{dp_1}{p_1} + \epsilon_{N2}^H \frac{dp_2}{p_2} + \dots + \epsilon_{NN}^H \frac{dp_N}{p_N} \end{aligned} \quad (2)$$

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

136 B) Hicksian price elasticities of demand

137 To estimate the Hicksian price elasticities, an AIDS model for N commodities by imposing the
 138 usual restrictions: adding-up, homogeneity, and symmetry have been estimated (Deaton and
 139 Muelbauer, 1980). The AIDS model is:

$$S_{ih} = a_i + \sum_{j=1}^N g_{ij} \ln P_{jh} + b_i \ln \left(\frac{\sum_{h=1}^H M_h}{f(p)} \right)^{\frac{1}{\sigma}} + n_{ih} \quad (3)$$

140 Where S_{ih} is the expenditure share of meat groups $i=1,2,3$ for household h ; M_h is the household's
 141 total meat expenditure; P is a vector of prices and n_{ih} denotes the error term. Also, $f(p)$ is the
 142 Stone Price Index defined by $\log f(p)_{ih} = \sum_i s_{ih} \log p_{ih}$.

143 We impose the theoretical properties of demand by:

$$\text{Adding up:} \quad \sum_{i=1}^N a_i = 1; \quad \sum_{i=1}^N b_i = 0; \quad \sum_i g_{ij} = 0$$

$$\text{Homogeneity of degree zero:} \quad \sum_{j=1}^N g_{ij} = 0 \quad i = 1, 2, \dots, N$$

Symmetry: $g_{ij} = g_{ji}$

144 But one of the problems we face when using cross-sectional data at the household level and
 145 dividing the food group into several smaller groups is the phenomenon of zero budget share. In
 146 other words, some households report zero consumption, and some others spend a non-zero share.
 147 Therefore, the variable is censored. To solve this problem, based on the Bakhshoodeh (2010)
 148 study, we use the following equation instead of equation (4).

149

$$S_{ih} = F_{ih} \left[\sum_{j=1}^N g_{ij} \ln P_{jh} + b_i \ln \frac{M_h}{f(p)} + q_j \right] + e_{ih} \quad (4)$$

150 Where F_{ih} is the cumulative distribution function, and j_{ih} is the probability density function for
 151 purchase in each product group per household. For calculation F_{ih} and j_{ih} we have adopted the
 152 two-step approach from Shonkwiler and Yen (1999).

153 The respective formulas for computing the uncompensated own, and cross-price elasticities for
 154 N meat groups are:

$$e_{i ih}^M = F_{ih} \left[\frac{\partial g_{ii}}{\partial S_{ih}} - b_i \frac{\partial}{\partial} - 1 \right] \quad (5)$$

$$e_{ijh}^M = F_{ih} \left[\frac{\partial g_{ij}}{\partial S_{ih}} - b_i \frac{\partial S_{jh}}{\partial} \right] \quad (6)$$

155 The formula for Income (expenditure) elasticities can be written as:

$$e_{ih} = F_{ih} \frac{b_i}{S_{ih}} + 1 \quad (7)$$

156 Compensated price-elasticities:

$$e_{ijh}^H = e_{ijh}^M + s_{jh} \cdot e_{ih} \quad (8)$$

157

158 Data and Information

159 This study is based on an urban household's income-expenditure survey (2020) of the Iranian
 160 Statistics Center (17931 urban households) for computing price and expenditure elasticities. To
 161 define the price increase scenario, the information related to the price of various types of meat
 162 and the inflation index of food prices in Iran were reviewed. The food price inflation in Iran was

163 equal to 7.98% in January 2010, which increased to 42.79% in 2022. The average annual change
164 of this index is 57.46%. Examining the cost-income information of Iranian urban households
165 shows that 21% of the total food expenditure is devoted to meat. So that the share of red, poultry,
166 and fish meat from the total food expenditure is equal to 11.31%, 7.41%, and 2.23%, respectively
167 (Iranian Statistics Center, 2020). The producer price index of the meat group had an upward trend
168 during 2010-2021 (FAO, 2022). The average annual growth of this index over the past decade is
169 26.80%. Considering the 27% share of food expenditure from the total household expenditure, it
170 is expected that this food price inflation will have adverse welfare effects on Iranian households
171 (Iranian Statistics Center, 2020). We have gathered data on meat prices before and after the
172 liberalization of prices and the decrease in subsidies for agricultural inputs. Our statistics indicate
173 that there have been positive changes in the prices of meat in Iran in recent year. Specifically, the
174 increases were 35.9% for red meat, 68.4% for poultry, and 77.7% for fish (Iranian Statistics
175 Center, 2022). In this study, to investigate the welfare effects of the price shock in the Iranian
176 meat market for Iranian households, the changes in the meat price have been defined as a price
177 shock scenario to calculate the changes in the expenditure of consumers in different age and
178 income consumer groups.

179 **Result**

181 **A. Meat demand data and descriptive statistics**

182 The share of poultry expenditure for younger consumers in the low-income group is more than
183 the other meat groups (in Table 1). As the age of the consumer in this group increases, the poultry
184 expenditure share is reduced, and the red and fish expenditure share is increased. For younger
185 consumers, the red and fish expenditure share is estimated to be below 10%. The share of poultry
186 expenditure is more than the share of red meat and fish in the second income group. But compared
187 to the first income group, the share of poultry expenditure is at a lower level and the share of red
188 meat and fish expenditure is at a higher level. The results show that for different age groups of
189 consumers in these two income groups, fish is not the priority of consumption. By moving from
190 the first to the second income group, poultry expenditure share is reduced and red meat
191 expenditure share is increased. With the increase in income, in the third income group, the share
192 of red meat expenditure increases noticeably. So that for young consumers, the share of red meat
193 expenditure increases to 33% and the share of poultry expenditure decreases to 56%. For
194 consumers aged 20-40 years, the share of red meat expenditure exceeds the share of poultry meat
195 expenditure and reaches 52%. For the 41-60 years age group, the expenditure share of red, poultry,

196 and fish meat is equal to 52%, 44%, and 4%, respectively. For the elderly, it is more important to
 197 consume poultry meat than red meat and fish. With the increase in the age of consumers in the
 198 high-income group, the expenditure share of red meat has increased and reached 65% for people
 199 over 61 years old. The expenditure share of fish meat also indicates less consumption of this type
 200 of meat than red meat and poultry in this income group.

201

202

203 **Table 1.** Social Characteristics and Share of Meat Types among the Urban Consumers.

| Household Income Specification | Age profile | Meat Type | Household meat expenditure share (%) | Per capita consumption (Kg/month) | Number of households | Average education (year) | Average household size |
|--------------------------------|---------------|-----------|--------------------------------------|-----------------------------------|----------------------|--------------------------|------------------------|
| Low Income | 25 ≥ Age | Red meat | 0.035 | 0.009 | 62 | 10.72 | 3.16 |
| | | Poultry | 0.949 | 0.641 | | | |
| | | Fish | 0.016 | 0.011 | | | |
| | 26 ≤ Age ≤ 40 | Red meat | 0.040 | 0.012 | 1529 | 9.77 | 3.89 |
| | | Poultry | 0.917 | 0.751 | | | |
| | | Fish | 0.044 | 0.018 | | | |
| | 41 ≤ Age ≤ 60 | Red meat | 0.067 | 0.022 | 1706 | 7.94 | 4.34 |
| | | Poultry | 0.896 | 0.747 | | | |
| | | Fish | 0.038 | 0.018 | | | |
| | 61 ≤ Age | Red meat | 0.034 | 0.013 | 573 | 3.47 | 3.55 |
| | | Poultry | 0.933 | 0.819 | | | |
| | | Fish | 0.033 | 0.015 | | | |
| Middle Income | 25 ≥ Age | Red meat | 0.120 | 0.079 | 58 | 9.18 | 2.66 |
| | | Poultry | 0.850 | 1.498 | | | |
| | | Fish | 0.030 | 0.029 | | | |
| | 26 ≤ Age ≤ 40 | Red meat | 0.259 | 0.154 | 1456 | 10.54 | 3.63 |
| | | Poultry | 0.689 | 1.237 | | | |
| | | Fish | 0.052 | 0.063 | | | |
| | 41 ≤ Age ≤ 60 | Red meat | 0.283 | 0.167 | 1912 | 8.65 | 3.95 |
| | | Poultry | 0.668 | 1.167 | | | |
| | | Fish | 0.049 | 0.058 | | | |
| | 61 ≤ Age | Red meat | 0.177 | 0.133 | 876 | 3.49 | 2.94 |
| | | Poultry | 0.796 | 1.325 | | | |
| | | Fish | 0.026 | 0.042 | | | |
| Relatively high income | 25 ≥ Age | Red meat | 0.338 | 0.416 | 60 | 10.88 | 2.46 |
| | | Poultry | 0.562 | 2.159 | | | |
| | | Fish | 0.101 | 0.313 | | | |
| | 26 ≤ Age ≤ 40 | Red meat | 0.518 | 0.589 | 1379 | 11.65 | 3.47 |
| | | Poultry | 0.419 | 1.617 | | | |
| | | Fish | 0.064 | 0.156 | | | |
| | 41 ≤ Age ≤ 60 | Red meat | 0.517 | 0.498 | 1987 | 9.54 | 3.83 |
| | | Poultry | 0.439 | 1.388 | | | |
| | | Fish | 0.044 | 0.091 | | | |
| | 61 ≤ Age | Red meat | 0.441 | 0.463 | 1041 | 4.48 | 2.90 |
| | | Poultry | 0.512 | 1.536 | | | |
| | | Fish | 0.047 | 0.101 | | | |
| High Income | 25 ≥ Age | Red meat | 0.617 | 1.558 | 64 | 11.58 | 2.22 |
| | | Poultry | 0.318 | 2.133 | | | |
| | | Fish | 0.064 | 0.333 | | | |
| | 26 ≤ Age ≤ 40 | Red meat | 0.651 | 1.425 | 1188 | 12.87 | 3.11 |
| | | Poultry | 0.283 | 1.933 | | | |
| | | Fish | 0.066 | 0.292 | | | |
| 41 ≤ Age ≤ 60 | Red meat | 0.660 | 1.575 | 2289 | 1.64 | 3.34 | |

| | | | | | | |
|---------|----------|-------|-------|------|------|------|
| | Poultry | 0.289 | 2.142 | | | |
| | Fish | 0.051 | 0.258 | | | |
| | Red meat | 0.656 | 1.923 | | | |
| 61 ≤Age | Poultry | 0.310 | 2.709 | 1752 | 6.10 | 2.32 |
| | Fish | 0.034 | 0.208 | | | |

204

205 B. Demand elasticity across socio-demographic groups

206 We divide households along socio-demographic characteristics and calculate price and income
207 elasticities to consider the effects of price liberalization. Key questions are the impact of meat
208 price shocks on different income and age groups. Accordingly, we derive and compare elasticity
209 values for (1) low-income, middle-income, relatively high-income, and high-income households
210 and (2) four age group households. All own-price elasticities of meats are negative. In terms of
211 absolute values, the highest own-price elasticity is related to fish, and the lowest own-price
212 elasticity is related to poultry. There is a competitive (and complementary) relationship between
213 commodities if cross-price elasticities are positive (and negative). The Cross-price elasticities
214 presented in Table 2 also show that red meat and fish have a competitive relationship together,
215 while red meat and poultry are competitive. This study supports evidence from previous
216 observations (e.g. Roosen *et al.* 2022 and Kharisma *et al.*, 2020; Khoiriyah *et al.*, 2020).

217 **Table 2.** Hicksian Price Elasticity of Meat in Different Income-Age Consumer Groups.

| Household Income Specification | Age profile | Meat Type | Red meat | Poultry | Fish |
|--------------------------------|---------------|-----------|---------------|---------------|---------------|
| Low Income | 25 ≥Age years | Red meat | -0.284 | -1.918 | 0.670 |
| | | Poultry | -0.247 | -0.136 | 0.345 |
| | | Fish | 1.853 | 3.554 | -5.408 |
| | 26 ≤Age ≤40 | Red meat | -0.310 | -1.562 | 0.529 |
| | | Poultry | -0.253 | -0.251 | 0.447 |
| | | Fish | 0.937 | 1.873 | -2.810 |
| | 41 ≤Age ≤60 | Red meat | -0.372 | -1.070 | 0.388 |
| | | Poultry | -0.224 | -0.294 | 0.433 |
| | | Fish | 1.168 | 2.067 | -3.235 |
| | 61 ≤Age years | Red meat | -0.218 | -2.065 | 0.682 |
| | | Poultry | -0.262 | -0.207 | 0.428 |
| | | Fish | 1.264 | 2.526 | -3.790 |
| Middle Income | 25 ≥Age years | Red meat | -0.354 | -1.111 | 0.422 |
| | | Poultry | -0.145 | -0.072 | 0.402 |
| | | Fish | 1.141 | 2.199 | -3.058 |
| | 26 ≤Age ≤40 | Red meat | -0.308 | -0.978 | 0.360 |
| | | Poultry | -0.305 | -0.231 | 0.609 |
| | | Fish | 1.155 | 1.940 | -2.864 |
| | 41 ≤Age ≤60 | Red meat | -0.269 | -0.969 | 0.389 |
| | | Poultry | -0.219 | -0.212 | 0.515 |
| | | Fish | 1.282 | 2.113 | -3.148 |
| | 61 ≤Age years | Red meat | -0.282 | -1.195 | 0.464 |
| | | Poultry | -0.122 | -0.103 | 0.402 |
| | | Fish | 1.069 | 1.992 | -2.775 |
| Relatively high income | | Red meat | -0.247 | -0.501 | 0.223 |

| | | | | | |
|--------------------|------------------|----------|---------------|---------------|---------------|
| | 25 ≥Age years | Poultry | -0.261 | -0.326 | 0.666 |
| | | Fish | 1.151 | 1.530 | -2.358 |
| | 26 ≤Age ≤40 | Red meat | -0.206 | -0.466 | 0.240 |
| | | Poultry | -0.481 | -0.448 | 0.781 |
| | | Fish | 1.341 | 1.631 | -2.781 |
| | 41 ≤Age ≤60 | Red meat | -0.202 | -0.506 | 0.257 |
| | | Poultry | -0.458 | -0.439 | 0.747 |
| | | Fish | 1.355 | 1.672 | -2.848 |
| | 61 ≤Age years | Red meat | -0.203 | -0.531 | 0.264 |
| | | Poultry | -0.318 | -0.365 | 0.662 |
| | | Fish | 1.199 | 1.515 | -2.451 |
| High Income | 25 ≥Age years | Red meat | -0.174 | -0.398 | 0.209 |
| | | Poultry | -1.181 | -0.522 | 1.199 |
| | | Fish | 1.313 | 1.371 | -2.571 |
| | 26 ≤Age ≤40 | Red meat | -0.150 | -0.410 | 0.218 |
| | | Poultry | -1.005 | -0.560 | 1.110 |
| | | Fish | 1.401 | 1.463 | -2.762 |
| | 41 ≤Age ≤60 | Red meat | -0.138 | -0.440 | 0.233 |
| | | Poultry | -1.030 | -0.559 | 1.110 |
| | | Fish | 1.412 | 1.474 | -2.793 |
| | 61 ≤Age years | Red meat | -0.131 | -0.439 | 0.241 |
| | | Poultry | -0.883 | -0.545 | 1.012 |
| | | Fish | 1.291 | 1.292 | -2.471 |

218

219 Looking at the age profile (fig. 3), it becomes apparent that the differences in reaction to price

220 changes for different age categories. The sensitivity of red meat demand to price changes in the

221 age group between 26 to 40 and 41 to 60 years is more than in the other age groups. The own

222 price elasticity of red meat for the middle-aged low-income group is more than for the young and

223 very high-age groups. With the increase in income, the absolute value of the red meat own-price

224 elasticity increases for consumers under 25 years old and over 60 years old, and decreases for

225 consumers between 25 and 60 years old. According to the result, the red meat demand sensitivity

226 to price changes for all age groups decreases along with increased income.

227 Examining the own-price elasticity of poultry meat in different income and age groups indicates

228 that the highest sensitivity of demand to price changes is related to households with high income.

229 The absolute price elasticity of poultry meat for consumers varies between 0.072-0.559 percent.

230 By moving towards lower-income groups, the difference in price elasticities of poultry meat

231 increases in different age groups. The highest absolute price elasticity of poultry meat is related

232 to age groups 26-40 and 41-60 years old. The own-price elasticity of fish meat for low-income

233 households is higher than for high-income groups. In the low-income group, younger consumers

234 have the highest absolute price elasticity and the consumers in the 26-40 age group have the lowest

235 absolute price elasticity.

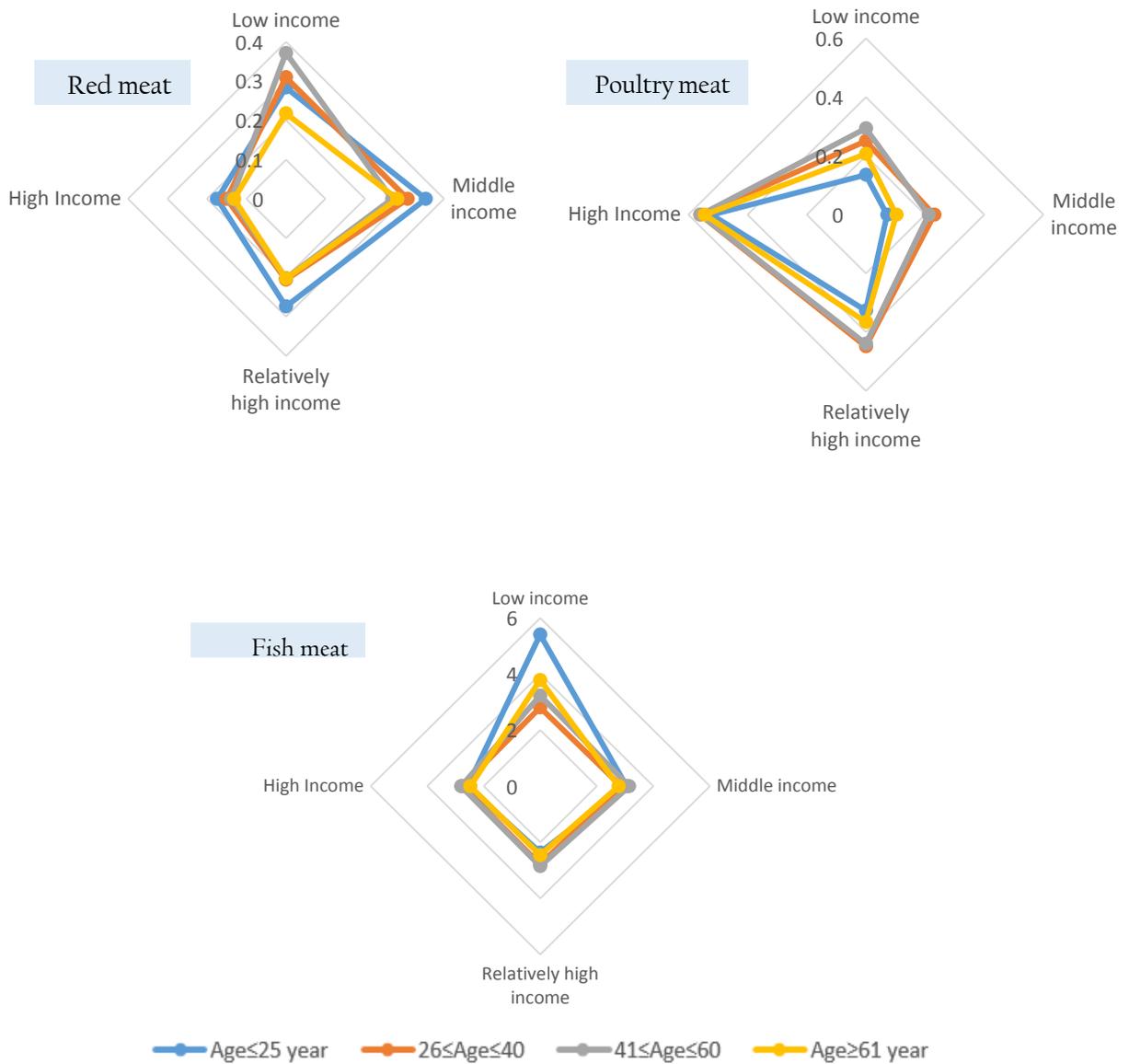


Fig. 3. The absolute value of own-price elasticity.

236 The expenditure elasticity of red meat varies between 1.906-1.489 percent for low-income
 237 consumer groups (fig. 4). The highest and lowest expenditure elasticity in this group is related to
 238 people under 25 years old and 26-40 years old, respectively. The sensitivity of red meat demand
 239 to income changes for low-income households is higher than in other groups. By moving towards
 240 higher income groups, the amount of expenditure elasticity decreases. Also, for all income-age
 241 groups of people, the expenditure elasticity of red meat is higher than one, which shows that red
 242 meat is considered a luxury good.

243

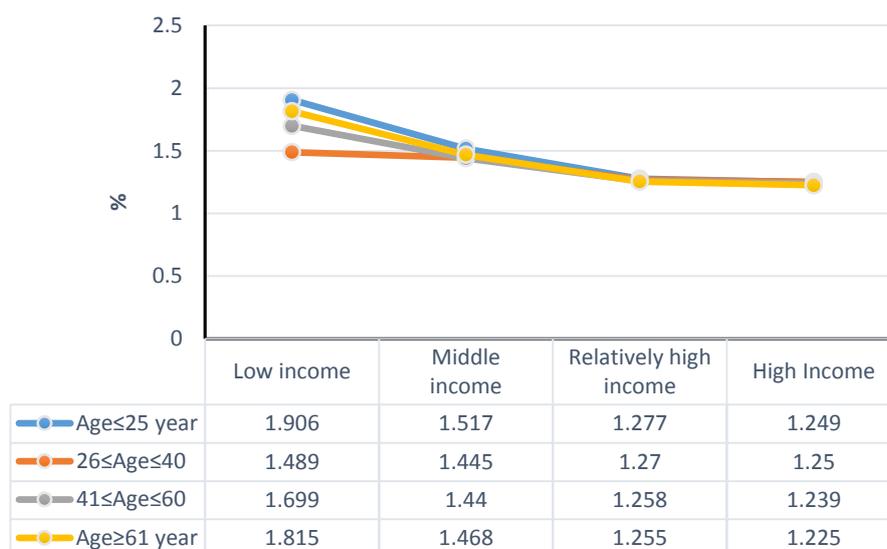


Fig. 4. Expenditure elasticity of red meat for different income-age groups.

244 The expenditure elasticity of poultry meat for different income-age groups is positive and smaller
 245 than one. Therefore, this type of meat is considered an essential good. For younger people, the
 246 expenditure elasticity of poultry meat varies between 0.214-0.720 percent. In general, with the
 247 increase in income, the sensitivity of poultry meat demand to changes in income decreases. In the
 248 high-income group, the expenditure elasticity of people over 61 years old is equal to 0.077% and
 249 for people under 25 years old, it is equal to 0.214%. Meanwhile, in the low-income group, the
 250 expenditure elasticity of people over 61 and under 25 years old is equal to 0.728% and 0.716%,
 251 respectively.

252

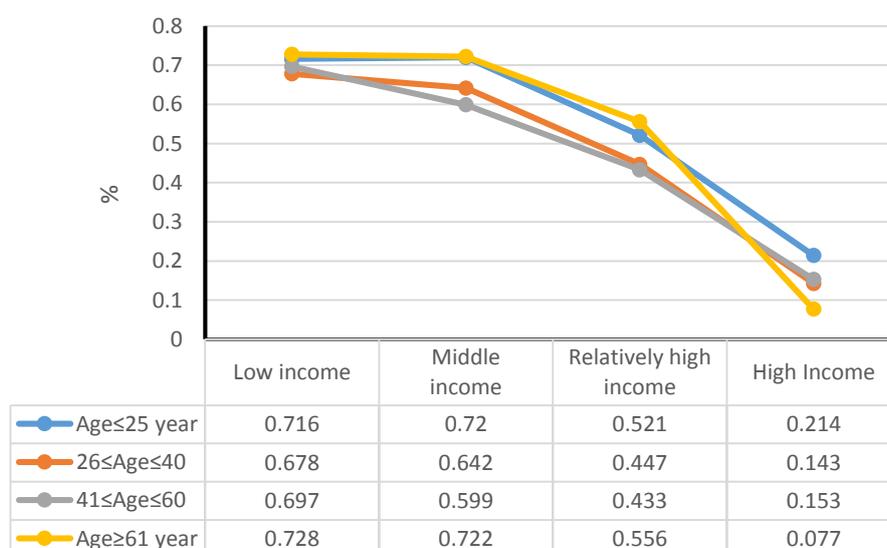


Fig. 5. Expenditure elasticity of poultry for different income-age groups.

253 Based on the expenditure elasticity of fish meat, this type of meat is considered a luxury good. In
 254 the low-income group of consumers, the highest and lowest expenditure elasticity has been
 255 obtained for people over 60, and 41-60 years old. With the increase in income, the expenditure
 256 elasticity of fish meat for people over 60 years old decreases to 1.106 percent. For younger
 257 consumers, the expenditure elasticity of fish meat varies between 1.18% (low-income group) and
 258 1.098% (high-income group).

259

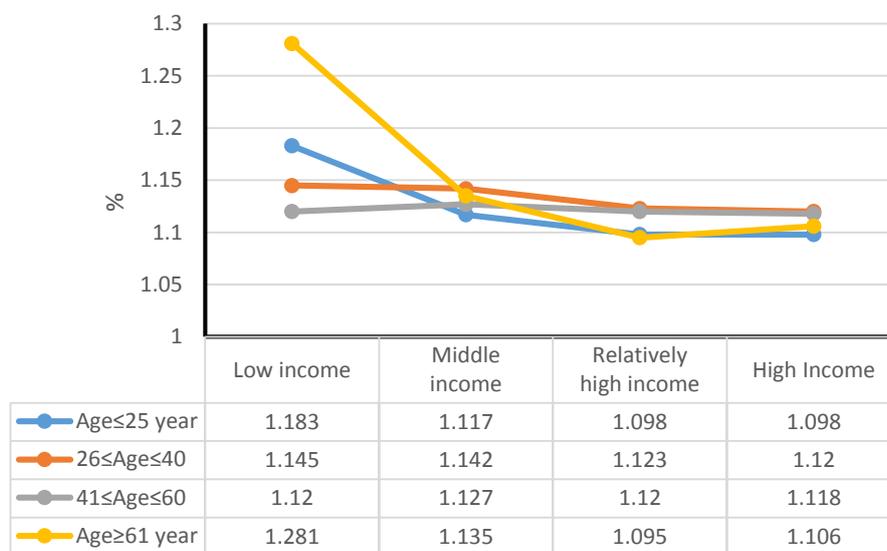


Fig. 5. Expenditure elasticity of fish for different income-age groups.

260 C. Welfare effect of multiple price shock

261 The welfare effects of meat price increase as a result of the price liberalization policy are reported
 262 in Table 3. For different age groups, along with the increase in consumer income, meat
 263 expenditure changes increase due to the price shock. The CV index for young people in different
 264 income groups varies between 30.58-69.80 percent. In more detail, for the consumer under 25
 265 years old, the CV index in the low-income group is equal to 69.80% per person, and this index
 266 decreases to 30.58% for high-income consumers. With the increase in the age of consumers to 26-
 267 40, the CV index decreased for most income groups. The change in consumer meat expenditure
 268 due to the price shock varies between 29.27-70.76 percent in this age group of consumers. So that
 269 for high and relatively high-income groups, the CV index is equal to 29.27 and 38.26%,
 270 respectively. For the 41-60 years age group, as a result of the simultaneous meat price increase,
 271 62.18%, 50.59%, 38.04%, and 29.25% will be added to the initial consumer meat expenditure.
 272 Finally, for old consumers, the CV index in different income groups varies in the range of 32.06-

70.39 percent. The biggest change in expenditure happens to consumers with low income. On average, younger Iranian urban consumers need to be compensated with approximately 58.54% of initial meat expenditure to accommodate the adverse impact of food price changes they faced due to price liberalization. This index, on average, is equivalent to 52.02% for older consumers.

Table 3. Per-capita Welfare Effect of Multiple Meat Price Shocks.

| Age profile | Welfare index | Low Income | Middle Income | Relatively high income | High Income |
|-------------------------|--------------------------------|-------------|---------------|------------------------|--------------|
| 25 years \geq Age | Initial meat expenditure (USD) | 3.37 | 8.28 | 19.41 | 38.28 |
| | CV (%) | 69.80 | 78.24 | 55.06 | 30.58 |
| 26 \leq Age \leq 40 | Initial meat expenditure (USD) | 3.71 | 8.57 | 18.13 | 35.16 |
| | CV (%) | 70.76 | 56.64 | 38.26 | 29.27 |
| 41 \leq Age \leq 60 | Initial meat expenditure (USD) | 3.85 | 8.53 | 15.03 | 38.13 |
| | CV (%) | 62.18 | 50.59 | 38.04 | 29.25 |
| 61 years \leq Age | Initial meat expenditure (USD) | 3.95 | 8.58 | 15.29 | 46.04 |
| | CV (%) | 70.39 | 61.20 | 44.44 | 32.06 |

Discussion and Conclusion

In this paper, we have investigated the welfare effect of multiple price shocks, as a result of agricultural market liberalization, for urban households in Iran. An initial objective of the study was to identify the price and expenditure elasticity of meat in different income and age groups of consumers. Therefore, both the price and expenditure elasticities of meat are evaluated for consumers grouped into four income groups as well as four age groups. Analysis of the data obtained from the Iranian Statistics Center (2021) showed that the poultry expenditure's share for most income groups is higher than the share of red meat and fish. This result may therefore point to the effect discussed by Cotterill and Samson (2002) and Rossen *et al.* (2022) that low-income households may be already buying type of meat with lower price. In the lower income groups, as consumer age, the poultry expenditure's share decreases, and the red meat expenditure's share increases. For consumers in the third quartile, by increasing in age the consumer's tendency to consume red meat increases. The current study found that the sensitivity of high-income households' poultry meat demand is higher than lower-income households. This finding was also reported by Rossen *et al.* (2022). On the contrary, for red and fish, low-income households react more elastically to price changes compared to high-income households. This finding is consistent with that Ni Mhurchu *et al.* (2013) for New Zealand, who reports higher own-price elasticities in

296 low-income groups. Another important finding was that the difference in price elasticities between
297 different age groups of consumers is noticeable. For instance, by moving toward low-income
298 groups, the difference in price elasticities of poultry meat increases in different age groups. As
299 well as, the sensitivity of red meat demand to price changes in the age group between 26 to 40
300 and 41 to 60 years is more than in the other age groups. It is interesting to note that in all absolute
301 own-price fish elasticities for the different age and income groups are more than one. For high-
302 income consumers, the absolute value of the fish's own-price elasticities is reduced. Considering
303 the importance of fish meat consumption for age groups over 60 years old, it can be expected that
304 a price shock in the meat market can have a significant impact on the demand for fish meat and
305 people's health. Another important finding was that the expenditure elasticity of red and fish meat
306 for urban households in Iran is greater than one. This implies a fairly large response of demand
307 for these food groups to changes in total food expenditure. Therefore, these types of meat are
308 considered luxury goods. These results agree with those obtained by Layani *et al.* (2020) for Iran
309 and Syrovátka (2007) for Czech. We also obtain higher red meat expenditure elasticities for
310 younger households compared to older households. The estimated expenditure elasticity of
311 poultry is less than unity, so this good is fairly inelastic concerning total food expenditure. For
312 most income groups, the results of this study show that poultry expenditure elasticity is higher for
313 older consumers compared to younger consumers, although this difference is not very evident.
314 Akin *et al.* (2019) also concluded a statistically significant relationship exists between gender,
315 income level, monthly food budget, and the amount of monthly budget allocated to meat.

316 It is interesting to note that the difference in welfare effects of meat price shocks is noticeable
317 among different income groups. The greatest CV is related to high-income groups and the lowest
318 is related to lower-income consumers. The low-income consumer already consuming lower meat.
319 So, the change in meat expenditure as a result of its price shock for these consumers is less than
320 for high-income consumers. But the change in expenditure due to the price shock for low-income
321 consumers accounts for a larger share of these consumers' total meat expenditures. Therefore,
322 these consumers are more vulnerable than higher-income consumers. As well as the CV index
323 increases as the age of consumers increases. This finding was also reported by Rossen *et al.*
324 (2022). Tekindal *et al.* (2020) showed that the quality of life has a significant relationship with
325 the increase in the monthly income of students. Increased income was associated with improved
326 scores on physical role limitation, emotional role limitation, energy/spirit/vigor, mental health,

327 bodily pain, and general health perception. This statistically significant improvement must be
328 arising out of the rising level of welfare.

329 The results of CV suggest that Iranian urban consumers need to be compensated with
330 approximately 29%-78% to accommodate the adverse impact of meat price changes they faced as
331 a result of price liberalization. The lowest value of the CV index is related to the high-income
332 consumers between 41-60 years old and the highest CV index is for middle-income consumers
333 under 25 years old. Generally, meat price shocks have had differential effects on consumers of
334 different ages and incomes. The results of this study can be effective for planning to support
335 vulnerable households in society. One of the most important consumer protection policies in Iran
336 in the last 40 years has been the payment of subsidies for goods and services. This policy was
337 implemented with the aim of controlling and stabilizing prices, supporting vulnerable groups,
338 reducing poverty, and distributing income fairly. But in recent years, there have been many
339 criticisms of this policy and its implementation. So that despite the implementation of this policy
340 since 1970, the poverty rate in Iran is still high and this policy has not been able to have the
341 necessary effectiveness in reducing poverty and food security. As such, this instrument is seen as
342 inefficient given its high budget costs, as a potential source of market distortions, and as
343 benefitting some groups who do not need to be supported (e.g. target groups are not identified and
344 households receive the same subsidy) (Azzam and Rettab, 2012; Bakhshoodeh, 2010; Tefra,
345 2012). The subsidy payments of 1.56 USD per month for each person have been constant without
346 considering inflation over the last two decades. These untargeted subsidy payments to the
347 households, regardless of considering their vulnerability and their income level, in addition to
348 being costly for the government, do not improve welfare indicators at the national level.
349 Identification of vulnerable households and determining the amount of subsidy paid to the target
350 groups is one of the most important challenges that policymakers in Iran are facing. In this regard,
351 after the implementation of the price liberalization policy, the government pays \$13.92 per person
352 for the first three income deciles and \$10.44 per person for the next six deciles and removes the
353 tenth income decile from receiving direct subsidies. This direct payment to consumers is the same
354 for different people with different social characteristics. The results of the present study showed
355 that the level of vulnerability of consumers in different social-economic groups is different from
356 each other. Therefore, to accurately target the subsidies, the government can pay a certain amount
357 of subsidy to each person according to the economic and social characteristics to prevent the
358 wastage of resources and reach the desired goal. In the same way, to achieve goals such as food

359 security and reducing welfare losses caused by price shocks, it is necessary to implement policies
360 such as increasing wages and paying subsidies to vulnerable households. Of course, it is necessary
361 to consider the inflationary effects of the implementation of these policies. Finally, to reduce the
362 vulnerability of low-income households, it is necessary to identify the factors affecting the price
363 of meat, so that food price shocks can be avoided through appropriate policies. Controlling
364 exchange rate fluctuations and thus the price of imported inputs (Mat *et al.*, 2020; Arican *et al.*,
365 2022) can play an effective role in controlling meat price shocks in the agricultural market.
366 Domestic market prices of feed raw materials interact with the global market at the dollar
367 exchange rate. Knowing the direction of the relationship between the price of the product and the
368 price of input in animal husbandry would lead to adopting effective courses of action and forming
369 efficacious policies to support the industry beginning from the sub-industries.

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