

2 **Economies of Scale of Household Consumption Expenditure in Iran**

3 **Saeed Mehrjou¹, and Mohammad Bakhshoodeh^{1*}**

4 ¹ **Department of Agricultural Economics, School of Agriculture, Shiraz University, Shiraz,**
5 **Islamic Republic of Iran**

6 ***Corresponding author; e-mail: bakhshoodeh@hotmail.com**

7
8 **ABSTRACT**

9 Household-scale economics can plausibly be attributed to shared household public goods that make
10 larger households better off at the same level of per capita resources. This paper examines the role
11 of food and housing in the allocation of Iranian household expenditure, considering co-residence
12 and economies of scale. Using a seemingly unrelated regression model for 2011 and 2021, we
13 predict that in the presence of shared food and housing, our method (solely) exploits preference
14 information revealed by a cross-section of household observations while accounting for fully
15 unobserved preference heterogeneity. Our findings indicate that scale economies changed
16 significantly from 2011 to 2021 for expenditure categories of food and housing, but not all trends
17 in scale economies are consistent with theoretical predictions. The results show that economies of
18 scale are recognized to be higher in the housing group than in the food group in both periods.
19 However, it has decreased within a decade and intensified due to the lack of appropriate
20 government policy. In this context, the government's policies to encourage population growth have
21 failed, and the population has encountered a low growth rate. Thus, providing support and welfare
22 policy packages such as increasing income policy and household support insurance, as well as
23 assistance in providing housing, are prioritized due to the economies of scale in housing.

24 **Keywords:** Economies of Scale, Household Consumption, Welfare, Food, Housing, Iran

25
26 **INTRODUCTION**

27 The population and its desirable growth have been discussed as a main and highly influential factor
28 in the development and progress of any country. In this context, the fundamental question is what
29 direct and indirect approaches and policies should be adopted by politicians to increase (control)
30 the population according to the prevailing conditions and to reach maximum productivity and
31 social welfare.

32 Population heterogeneity occurs all over the world more than before at the beginning of the 21st
33 century and the world is facing a wide range of population issues and socio-economic challenges.
34 The issues related to population have occupied the human mind for a long time. Politicians and
35 thinkers have always discussed issues such as the desired population size, the necessity of adopting
36 population increase policies, or population control by considering the political, military, economic,
37 and social considerations. Is a large population an opportunity or a threat to a country? What
38 should be the desired annual population growth rate for a country? Should we merely pay attention
39 to the quantitative growth of the population or should we consider the qualitative growth as well?
40 And what population policies should be adopted for each country? These are among the questions
41 that have always been considered by different groups such as economists and politicians.

42 The supply of basic needs such as food and housing depending on the per capita expenditure of the
43 household, the price of food and housing, and their budget share in the household are the most
44 important prerequisites for the population growth or the household size in Iran. However, the
45 growth rate of Iran's population increased from 1.3% in 2011 to 0.57% in 2021 and the average
46 household size decreased from 4 to 3 people. In addition, it is predicted that the population will
47 experience negative growth in the next two decades (SCI, 2022). Based on the FAO Food Price
48 Index, the price of food has increased from 1.98 in 2020 to 7.125 in 2021 (FAO, 2022). In this
49 regard, households pursue their future decisions on having children based on their expenditure
50 share relative to the change in food and housing prices, which will affect the population policies of
51 the country. Hence, one of the basic questions is related to the way households react to the
52 consumption of basic goods such as food and housing due to the changes in household size.

53 Consumption is considered one of the key concepts in macroeconomics, which plays a critical role
54 in improving the quality of life and the level of well-being in society as the largest and most stable
55 component of the Gross National Production and the most significant component of the household
56 expenditure. In general, it is assumed that the consumption of a particular product by the members
57 of the household is the same, and the amount consumed by the household is divided by the number
58 of members of that household to calculate the per capita consumption of a food item in the
59 household. This method indicates the average consumption of the household and a general
60 understanding of this phenomenon at the household level. Such an attitude cannot provide data on
61 the nature and manner of consumption of each family member about each other due to their age

62 and gender differences. The consumption of a food item by household members depends on the
63 household size, as well as the age and gender of the household members (Kakwani et al., 2005).
64 Economies of scale in production have mainly been considered in economics, however,
65 consumption has an important position in the field of welfare economics and has created a new
66 horizon in this field according to the above-mentioned factors. In this way, if we regard more
67 prosperity simply in the form of more use of goods and services, the presence of economies of
68 scale can provide the possibility of joint use of goods and services. The joint use of goods and
69 services increases the potential for the usefulness of such goods and services without the need to
70 increase the amount of goods and services. In this regard, economies of scale through capacity
71 building lead to higher welfare for the consumer. In welfare economics, economies of scale are an
72 obvious example of the effect of household size on household welfare. Defining welfare as more
73 use of goods and services, the diseconomies of scale in housing and food cannot provide the
74 possibility of joint use of other goods and services. The joint use of goods and services increases
75 the potential of creating the usefulness of such goods and services without the need to increase the
76 amount of goods and services. If there is no increase in desirability and welfare in Iranian
77 households after a decade, the reason should be sought in welfare policies in the population
78 structure. Previous studies showed that the per capita demand for food decreases with an increase
79 in household size regardless of whether the countries are rich or poor (Deaton & Paxson, 1998;
80 Gibson & Kim, 2007). Moreover, a study conducted in the US revealed that a household of two
81 adults consumes 31-35% less than two households with one adult each at a fixed income level
82 (Lazear & Michael, 1981). Therefore, sharing opportunities can result in saving some services such
83 as food preparation and also in buying a part of food for such households. Accordingly, the
84 economies of scale in consumption emphasize that the household's consumption expenditure
85 changes by adding a family member, leading to the reduction of the per capita expenditure for each
86 member compared to the previous status as regarded in the concept of economies of scale in
87 consumption. Thus, economies of scale provide the standard level of life of each family member
88 (Kakwani, 1977).

89 90 **Literature review**

91 The concept of economic scale exists more in the discussion of production scale (Hoang et al.,
92 2021; Houedjofonon et al., 2020; Jetté-Nantel et al., 2020), but it is considered less in consumption.
93 The economies of scale in consumption have been developed on Engel's and Barten's models.

94 According to Engel law, the more affluent the households, the lower their proportion of food share
95 would be (Dudek, 2014a; Soon, 2022). Engel's method has been dominantly applied in household
96 size economies estimation due to its simplicity, using food share as a welfare indicator of different-
97 sized households (Deaton & Muellbauer, 1980; Lanjouw & Ravallion, 1995). (Deaton, 1997)
98 indicated that the Engel method works but makes no sense. (Deaton & Paxson, 1998) draw from
99 Barten's model in their attempt to estimate the household scale. (Gan & Vernon, 2003) and
100 (Gibson, 2002) estimated the household economies scale.

101 Economies of scale in household consumption generally occur as a result of joint consumption of
102 public goods. In order to analyze this phenomenon expenditure shares on housing, which
103 can be treated as a representative of the public good, and expenditure shares on food
104 - representing private goods - are examined (Dudek, 2014b; Perali, 2003). Thus, determining the
105 economies of scale in households according to the characteristics and conditions prevailing in each
106 household is of great significance in developing the fare and population growth strategies. Few
107 studies consider the economic scale of the household, while this article is in using this concept to
108 evaluate the government's policy. Therefore, the contribution of this article is to evaluate the
109 efficiency of population growth policies by measuring the role of the scale of food and housing
110 expenditure.

111 Household size is a pivotal demographic feature shaping individual economic decisions (Curtis et
112 al., 2017). Extensive studies have revealed within-household economies of scale (also referred to
113 as household scale economies) for multiple commodities (Ellsworth-Krebs, 2020; Nelson, 1988;
114 O'Neill & Chen, 2002).

115 Among them, electricity has larger scale effects since it is more sharable than other goods
116 (Underwood & Zahran, 2015), such as food or clothing. Reducing scale effects due to smaller
117 households could have negative impacts on ecological /environmental sustainability, such as
118 increased CO2 emission (Ala-Mantila et al., 2016; Fremstad et al., 2018; Underwood & Fremstad,
119 2018; Underwood & Zahran, 2015) and resource consumption (Huang, 2015; Longhi, 2015; O'Neill
120 & Chen, 2002), as well as on biodiversity (Bradbury et al., 2014; Yu & Liu, 2007).

121 Researchers and policymakers believe that the growth of an economy correlates with the
122 consumption pattern of households as consumption patterns make welfare analysis easier (Akram,
123 2020; Ullah, 2018). The consumption patterns of households are also useful in business progress
124 as the whole investment setup relies on the consumption patterns of a country (Akram, 2020).

125 After reviewing the above literature, we found that many researchers concluded that changes in
126 income and price of a product and its substitutes have a significant influence on product demand.
127 The Possible justification behind this notion is that when a change occurs in the price of a product,
128 consumers tend to reduce the quantity demanded (QD) as per the law of demand (Al Rawashdeh,
129 2022).

130 The present study is organized as follows first, the expenditures and income of Iranian households
131 are presented during 2011-2021. Then, the economies of scale for two time periods are conducted
132 for the food and housing group by estimating the expenditure share relationships for the group of
133 foods, housing and other goods. Finally, the results and the role of changes in household size and
134 per capita expenditure on food and housing are investigated and the corresponding policies are
135 proposed. The question of how household adjusts their consumption patterns in response to changes
136 in size encourages several researchers to conduct studies in different contexts to observe the
137 behavioral pattern of consumers.

138 **MATERIALS AND METHODS**

139 The conceptual model of the study is as Fig 1.

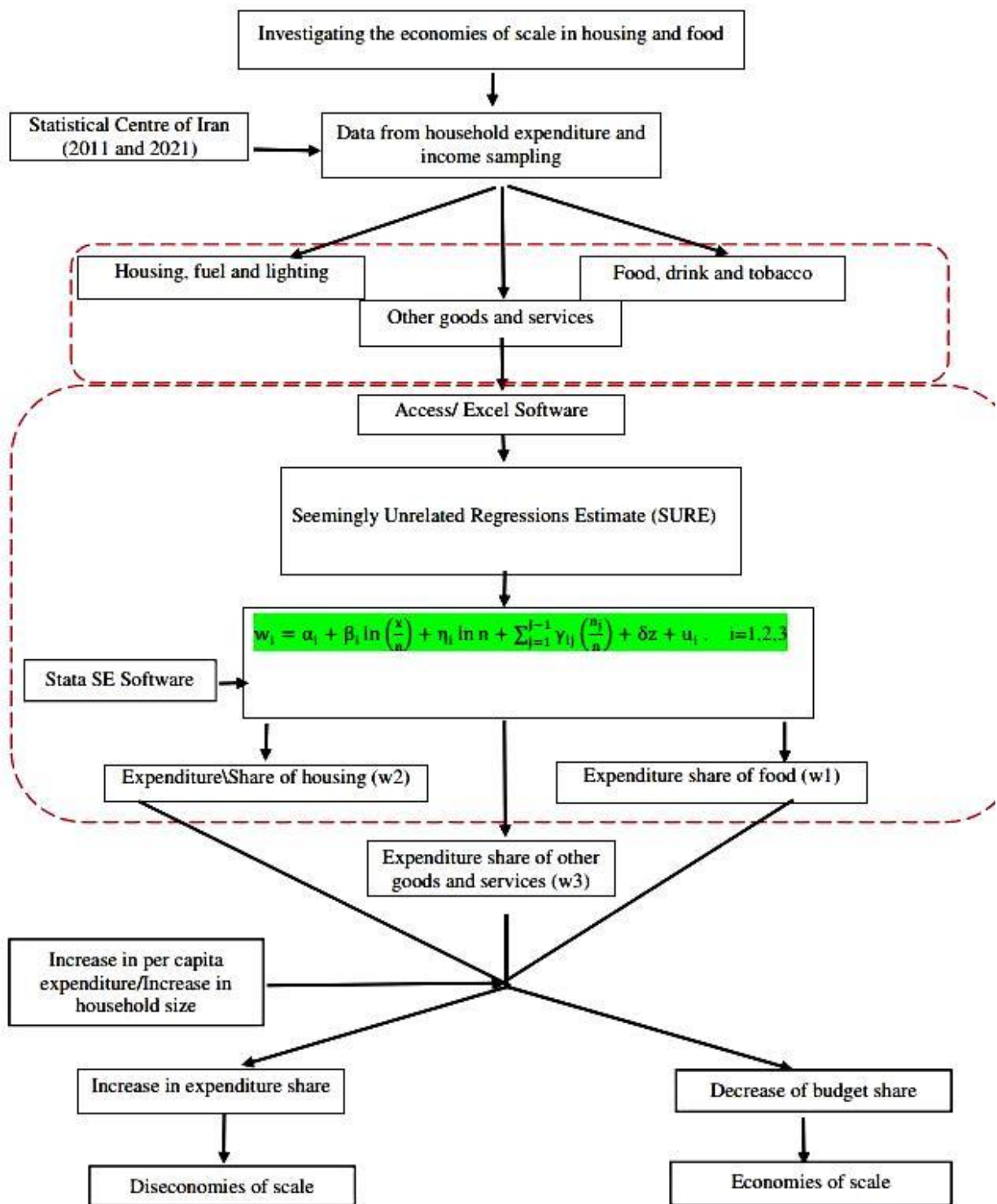


Fig. 1. Conceptual model of the study.

140

141

142

143

144 **Seemingly Unrelated Regressions Estimate (SURE)**

145 To determine the economies of scale in the consumption of goods and services the scale function
146 is defined as equation (1) (Mok et al., 2010; Mok et al., 2011):

$$147 \quad \phi(n) = n^{1-\sigma} \quad (1)$$

148 where n represents the number of household members and σ indicates the elasticity of the scale
149 that is calculated as equation (2) (Mok et al., 2010; Mok et al., 2011):

$$150 \quad \sigma = 1 - \frac{\partial \ln \phi(n)}{\partial \ln n} \quad (2)$$

151 If the scale elasticity is zero, the scale function equals the number of household members. In other
152 words, there are no economies of scale in the consumption of goods in the household. In addition,
153 any increase in the household size is compensated by an increase equivalent to the per capita
154 consumption of the good. In this regard, the consumption of the household members remains at the
155 same level as before. Accordingly, the goods used in the household are purely private and cannot
156 be shared. If the elasticity of scale equals one, the scale function becomes equal to one and there
157 will be economies of scale in consumption at the household level. Therefore, the consumption is
158 compensated by less than a 1% increase in the consumption of goods with a 1% increase in the
159 household size so that the consumption of the household members remains at the same level as
160 before. Such a good is pure public and can be used by all members without adverse effects.

161 The effect of household size on changes in per capita food consumption with a certain income level
162 was tested by dividing the sample into quartiles and examining the coefficient of $\ln n$. To check
163 the economies resulting from the scale of households, the equation (3) was used (Deaton &
164 Muellbauer, 1980; Mok et al., 2010; Mok et al., 2011):

165 **LA/AIDS Model**

166 The general form of the Almost Ideal Demand System (AIDS) with linear approximation (LA) is
167 given by (Govindaraj et al., 2012):

$$168 \quad \omega_i = \alpha_i + \sum_j \gamma_{ij} \ln p_j + \beta_i \ln \left(\frac{X}{P} \right) + v_i$$

169 Where, w_i = expenditure share of the i^{th} commodity

170 p_j = Price of the j^{th} commodity

171 X = is the total expenditure

172 v_i = error term

173 P = is the price level

174 The theoretical demand restrictions in terms of adding up, homogeneity in prices and income, and
 175 the symmetry of cross effects of demand functions are given below

176 Adding up $\sum_{i=1}^n \alpha_i = 1$ $\sum_{i=1}^n \gamma_{ij} = 0$

177 Homogeneity $\sum_j \gamma_{ij} = 0$

178 Symmetry $\gamma_{ij} = \gamma_{ji}$

179

180 **Calculation of Elasticities using LA/AIDS model**

181 The uncompensated price elasticity of commodity i with respect to commodity j is given by

182
$$e_{ij} = \frac{\gamma_{ij}}{\bar{\omega}_i} - \frac{\beta_i \bar{\omega}_j}{\bar{\omega}_i} - \delta_{ij}$$

183 Where $\delta_{ij} = 1$ if $i = j$ and $\delta_{ij} = 0$ if, $i \neq j$.

184 The expenditure elasticity will be estimated by

185
$$e_i = 1 + \frac{\beta_i}{\bar{\omega}_i}$$

186 Using slutsky model, the compensated price elasticities “ e_{ij} ”, can be computed from,

187
$$e_{ij}^* = e_{ij} + w_j e_i$$

188 In the following, in order to examine the degree of economies of scale of households from the
 189 system of equations it was used below (Deaton & Muellbauer, 1980).

$$\begin{aligned} w_1 &= \alpha_1 + \beta_1 \ln \left(\frac{x}{n} \right) + \eta_1 \ln n + \sum_{j=1}^{J-1} \gamma_{1j} \left(\frac{n_j}{n} \right) + \delta z + u_1 \\ w_2 &= \alpha_2 + \beta_2 \ln \left(\frac{x}{n} \right) + \eta_2 \ln n + \sum_{j=1}^{J-1} \gamma_{2j} \left(\frac{n_j}{n} \right) + \delta z + u_2 \\ w_3 &= \alpha_3 + \beta_3 \ln \left(\frac{x}{n} \right) + \eta_3 \ln n + \sum_{j=1}^{J-1} \gamma_{3j} \left(\frac{n_j}{n} \right) + \delta z + u_3 \end{aligned} \quad (3)$$

190 where w_1 , w_2 , and w_3 show the share of food, housing and other goods and services from the total
 191 household expenditure, x indicates the total expenditure of the above-mentioned product groups,
 192 and n represents the household size. In addition, $\frac{x}{n}$ shows the per capita expenditure of household
 193 members, $\ln n$ is considered as the effect of the economies of scale, and $\frac{n_j}{n}$ indicates the relative
 194 composition of the household members in terms of the age of the household members. Since the
 195 total share of the households' consumption basket for goods is equal to one, the elimination of each
 196 of the equations can be arbitrary. Among the equations of the system, the equation related to the
 197 group or subgroup that is less significant than other groups is eliminated (Gundimeda & Köhlin,

198 2008). In this research, because the focus is on food and housing, other goods and services were
199 removed from the equation. Therefore, there are no results of the third equation in the tables
200 (SURE¹ method).

201

202 **Data and Information**

203 The cost and income survey data published annually by the Statistical Centre of Iran is one of the
204 most significant and widely used sources of information for household studies in Iran and its 2011-
205 2021 issue is applied in this study. Moreover, Access, Excel, SPSS and Stata SE software were
206 used for data analysis.

207

208 **RESULTS AND DISCUSSION**

209 **Socio-economic characteristics of the studied sample**

210 As shown in Table 1, the average household size has decreased after a decade and Iran faces a
211 relatively older population. The average household size was 4 In 2011 and it decreased to 3 in
212 2021. Thus, the policies for encouraging population growth have not been highly effective. The
213 significant point of comparing two periods of time separated by a decade is that the share of food
214 and housing in 2021 has shown a significant increase compared to 2011. Share of food and housing
215 in the household expenditure was 47.96 and 24.25, respectively which has been increased to and
216 56.76 and 32.12 to 2021. During the last decade, Macroeconomic shocks, climate change, global
217 supply shocks, and sudden political changes, are all from among the factors that can affect the price
218 of food. In other words, prices. They depend on different sources and governments are looking for
219 policy options to reduce price fluctuations (Amolegbe et al., 2021).

220 According to the data of the Iranian Statistics Center from the urban areas of the country, the share
221 of housing in household expenses has increased during the last decade.

222 Things like the shock of sanctions, inflammation in the field of foreign exchange, increase in
223 inflation and the influx of capital demands to the housing sector, this sector also faced a sharp jump
224 in prices and as a result, the purchasing power of households lagged behind the price of housing.
225 Therefore, the share of housing in the total household expenditures (food and non-food) increased.

226

227

228

¹. Seemingly Unrelated Regressions Estimate

Table 1. Socio-economic characteristics of the studied sample for 2011 and 2021.

| Item | 2011 | | 2021 | |
|--|-------|-------|-------|-------|
| | Mean | SD | Mean | SD |
| Number of households | 19739 | --- | 20136 | --- |
| Household size (person) | 4 | 1.85 | 3 | 3.76 |
| Share of men in household headship (percentage) | 86.86 | --- | 75.52 | --- |
| Age of head of household (year) | 51.13 | 16.11 | 57.34 | 18.98 |
| Share of new-born babies-4 years old male members in the household (percentage) | 3.01 | 8.37 | 2.02 | 4.12 |
| Share of 5- 10 year old male members in the household (percentage) | 4.36 | 9.82 | 3.32 | 6.22 |
| Share of 11-15 year old male members in the household (percentage) | 3.82 | 9.07 | 2.61 | 7.55 |
| Share of 16-60 year old male members in the household (percentage) | 28.66 | 20.99 | 34.73 | 32.76 |
| Share of male members over 60 years old in the household (percentage) | 8 | 17.60 | 12.05 | 9.50 |
| Share of female new-born babies up to four years old in the household (percentage) | 3.05 | 8.37 | 2.04 | 2.34 |
| Share of 5- 10-year-old female members in the household (percentage) | 4.20 | 9.70 | 3.28 | 4.10 |
| Share of 11 -15 year old female members in the household (percentage) | 3.44 | 8.58 | 2.41 | 5.16 |
| Share of 16-60 year old female members in the household (percentage) | 31.51 | 20.16 | 41.67 | 43.67 |
| Share of female members over 60 years old in the household (percentage) | 9.90 | 23.74 | 11.13 | 10.15 |
| Share of illiteracy in the heads of households (percentage) | 41.99 | 0.49 | 34.45 | 53.82 |
| Share of employment in the heads of households (percentage) | 73.27 | 0.44 | 61.22 | 55.38 |
| Share of marital status in the heads of households (percentage) | 85.64 | 0.35 | 71.43 | 63.42 |
| Share of household food expenditure (percentage) | 47.96 | 13.43 | 56.76 | 31.16 |
| Share of household housing expenditure (percentage) | 24.25 | 12.97 | 32.12 | 21.13 |
| Share of household other goods and service expenditure (percentage) | 27.79 | 13.71 | 11.12 | 18.76 |

230 Source: research findings.

231

232 **The economies of scale of goods and services in households' consumption basket**

233 Tables 2 and 3 indicate the economies of scale for goods and services (food and housing) of the
 234 sample households studied in 2011 and 2021, respectively. As shown, per capita expenditure and
 235 household size have negative effects on the expenditure share of food and housing among the
 236 significant variables in the system equations for food in 2011. In this regard, the per capita share
 237 of food and housing decreases with the increase in per capita expenditure or the size of the
 238 household. The household food expenditure share was reduced by 0.053 as a result of a 1% increase
 239 in the per capita expenditure. In addition, the household housing expenditure share decreases by

240 approximately 0.34 and 0.33 with a 1% increase in the per capita expenditure and the household
241 size (Table 2). This phenomenon is considered one of the aspects of economies in the household
242 in 2011. Increasing the per capita expenditure of households and reducing the share of food or
243 housing in the total household expenditure can increase the context for more use of goods and
244 services in the household. So, welfare improvement is considered as more use of goods and
245 services. Therefore, it can lead to an increase in the well-being of the whole household. However,
246 the per capita expenditure and household size indicate a positive effect on the share of food and
247 housing in the household expenditure in 2021. The share of the food household expenditure
248 increases by 0.45 and 0.010 with a 1% increase in per capita expenditure and household size (Table
249 2). Further, the share of the housing household expenditure increases by 0.30 and 0.28 concerning
250 a 1% increase in per capita expenditure and household size (Table 3). In other words, the share of
251 the household expenditure in food and housing increases with an increase in per capita expenditure
252 or household size, indicating the absence of economies of scale in this year.

253 The first rule is the parasite law itself, which states that the share of food in the budget decreases
254 with an increase in income or total expenses. The second rule is that with constant resources, the
255 share of food increases with the increase in household size.

256 (Deaton & Paxson, 1998) tested (Barten, 1964) model and surprisingly found the exact opposite
257 pattern where food consumption decreases as the household grows. The results of the present
258 research confirm this fact. The issue of economies of scale is more evident in the case of housing
259 (public good) than food. The results of the present research show that over time, the economy of
260 scale in food decreases compared to housing. This is also true for per capita consumption
261 expenditure. Similarly, using the US Consumer Expenditure Survey, (Nelson, 1988) found large
262 economies of scale in shelter and small economies of scale in furniture, maintenance, food, and
263 transportation. Similarly, using the US Consumer Expenditure Survey, (Nelson, 1988) found large
264 economies of scale in shelter and small economies of scale in furniture, maintenance, food, and
265 transportation.

266 Researchers used cross-sectional household income data from ten developed countries, and on the
267 other hand, other scientists (Cutler & Katz, 1992) using household expenditure data in England to
268 the sensitivity of poverty and inequality in They found the estimation of economy of scale in
269 consumption and the use of equivalent scales in the comparison of welfare.

270 It can be said that in the studied sample households, there is an economy of scale in food
 271 consumption, but this phenomenon is greater in the use of housing because housing is more
 272 common than food.

273 The correctness of the Engel law states that among households with the same population
 274 composition, those with a higher share of food generally have less income, so with other conditions
 275 being constant, they have a lower level of well-being. But this is nothing more than the retelling of
 276 the parasite law itself because the presence of other minors increases the share of household food.
 277 The addition of children indeed moves the budget in the same direction as the decrease in income,
 278 but this is very different from arguing that increasing income to the extent that it keeps the share
 279 of food constant is the exact amount needed for Compensation for additional expenditures incurred
 280 by Children. All members of the household do not have the same allocation and logically, the
 281 elderly consume specific and fewer goods. This issue can affect the economy of scale due to less
 282 consumption.

283
 284 **Table 2.** Estimation results of the model for determining the economies of scale in the Food
 285 household consumption.

| Food model | 2011 | | | 2021 | | |
|--|-------------------|---------------|---------------------------------|------------------|---------------|--------------------------------|
| | Coefficient | SD | Elasticity | Coefficient | SD | Elasticity |
| The logarithm of household expenditure per capita | -0.0253*** | 0.0016 | -0.0529^{(1)***} | 0.0223*** | 0.0062 | 0.4552^{(1)***} |
| The logarithm of household size | -0.0288*** | 0.0031 | -0.0604^{(1)***} | 0.0052 | 0.0071 | 0.0106^{(1)***} |
| The proportion of male members less than 4 years old | -0.0058 | 0.0155 | -0.0003 | -0.0179 | 0.0376 | -0.0009 |
| The proportion of male members aged 5 - 10 years old | -0.0115 | 0.0132 | -0.0007 | 0.0093 | 0.0299 | 0.0007 |
| Proportion of male members aged 11 - 15 years old | 0.0243* | 0.0144 | 0.0014* | 0.0547* | 0.0329 | 0.0038* |
| The proportion of male members aged 16-60 years old | -0.0044 | 0.0046 | -0.0032 | -0.0059 | 0.0134 | -0.0046 |
| The proportion of female members less than 4 years old | 0.0076 | 0.0152 | -0.0004 | 0.0171 | 0.0359 | 0.0008 |
| The proportion of female members aged 5 - 10 years old | 0.0138 | 0.0134 | 0.0009 | 0.0039 | 0.0309 | 0.0003 |
| Proportion of female members aged 11 - 15 years old | -0.0026 | 0.0153 | -0.0002 | 0.0132 | 0.0325 | 0.0009 |

| | | | | | | |
|---|-------------|--------|------------|-------------|--------|------------|
| The proportion of female members aged 16-60 years old | -0.0006 | 0.0052 | -0.0004 | 0.0276 | 0.0167 | 0.0184* |
| Gender of the head of the household | -0.0034 | 0.0047 | -0.0062 | 0.0018 | 0.0078 | 0.0026 |
| Age of the head of the household | 0.0003*** | 0.0007 | 0.0317*** | -0.0003 | 0.0002 | -0.0281 |
| Literacy status of the head of the household | -0.0382*** | 0.0024 | -0.0478*** | -0.0469** | 0.0062 | -0.0362*** |
| Employment status of the head of the household | 0.0345*** | 0.0027 | 0.0487*** | 0.0191*** | 0.0058 | 0.0194*** |
| Marital status of the head of the household | 0.0281*** | 0.0045 | -0.0007 | 0.0292*** | 0.0077 | 0.0382*** |
| y-intercept | 0.8332*** | 0.0247 | --- | 0.1783** | 0.0835 | --- |
| Number of observations | 19739 | --- | --- | 20136 | --- | --- |
| Chi ² statistics | 813.1100*** | --- | --- | 144.3200*** | --- | --- |
| Breusch-Pagan test | 4567.6224 | --- | --- | 2603.8750 | --- | --- |

286
287
288
289
290

Source: Research findings

Note: *, ** and *** indicate levels of significance at 10%, 5% and 1%, respectively.

Table 3. Estimation results of the model for determining the economies of scale in the Housing of the household consumption.

| Housing model | 2011 | | | 2021 | | |
|--|-------------------|---------------|---------------------------------|-------------------|---------------|---------------------------------|
| | Coefficient | SD | Elasticity | Coefficient | SD | Elasticity |
| The logarithm of household expenditure per capita | -0.0772*** | 0.0015 | -0.3352⁽¹⁾*** | -0.0914*** | 0.0058 | -0.3075⁽¹⁾*** |
| The logarithm of household size | -0.0753*** | 0.0029 | -0.3271⁽¹⁾*** | -0.0835*** | 0.0067 | -0.2811⁽¹⁾*** |
| The proportion of male members less than 4 years old | -0.0026 | 0.0139 | 0.0003 | -0.0387 | 0.0359 | -0.0033 |
| The proportion of male members aged 5 - 10 years old | 0.0158 | 0.0118 | 0.0022 | 0.0051 | 0.0286 | 0.0007 |
| Proportion of male members aged 11 - 15 years old | -0.0146 | 0.0130 | -0.0018 | -0.0504 | 0.0314 | -0.0061 |
| The proportion of male members aged 16-60 years old | -0.0030 | 0.0042 | -0.0044 | -0.0229* | 0.0128 | -0.0295* |
| The proportion of female members less than 4 years old | 0.0151 | 0.0137 | 0.0014 | -0.0101 | 0.0344 | -0.0008 |
| The proportion of female members aged 5 - 10 years old | -0.0104 | 0.0120 | -0.0014 | -0.0481 | 0.0296 | -0.0062 |
| Proportion of female members aged 11 - 15 years old | -0.0016 | 0.0137 | -0.0002 | -0.0233 | 0.0311 | -0.0029 |
| The proportion of female members aged 16-60 years old | 0.0019 | 0.0046 | 0.0026 | -0.0353** | 0.0161 | -0.0393** |

| | | | | | | |
|--|--------------|--------|------------|-------------|--------|------------|
| Gender of the head of the household | 0.0047 | 0.0043 | 0.0182 | -0.0027 | 0.0075 | -0.0066 |
| Age of the head of the household | 0.0005*** | 0.0001 | 0.1086 | 0.0009*** | 0.0002 | 0.1853*** |
| Literacy status of the head of the household | 0.0309*** | 0.0022 | 0.0784*** | 0.0343*** | 0.0059 | 0.0458*** |
| Employment status of the head of the household | -0.0232*** | 0.0024 | -0.0779*** | -0.0146*** | 0.0056 | -0.0277** |
| Marital status of the head of the household | -0.0179*** | 0.0041 | -0.0685*** | -0.0209*** | 0.0074 | -0.0497*** |
| y-intercept | 1.4116*** | 0.0224 | --- | 1.608*** | 0.0815 | --- |
| Number of observations | 19739 | --- | --- | 3866 | --- | --- |
| Chi ² statistics | 4010.0100*** | --- | --- | 789.0400*** | --- | --- |
| Breusch-Pagan test | 5783.7270 | --- | --- | 1703.9880 | --- | --- |

291 Source: Research findings.

292 Note: *, ** and *** indicate levels of significance at 10%, 5% and 1%, respectively.

293
294 In evaluating the elasticity in the two groups of food and housing model, the increase in the
295 household size has a much more highlighted role in the share of housing than the share of household
296 food expenditure regardless of the type and direction of influence. Thus, the same change in the
297 household dimension has an almost five times higher effect on the share of housing compared to
298 the share of food (0.32 vs. 0.06 for 2011 and 0.28 vs. 0.01 for 2021). The increase in the household
299 size through the economies of high scale in housing can overshadow the economies of smaller scale
300 in food and the increase of household size results in the economies of scale.

301 The age and gender of household members are other significant issues causing the economies of
302 scale at the household level. Increasing the percentage of 11-15-year-old children causes the
303 economies of scale and the increase of other age groups to households had no effect and was not
304 significant in creating the economies of scale in food consumption. This is adverse in the case of
305 housing. Therefore, different age combinations in both gender groups of household members had
306 no significant effect on the share of the household housing expenditure. The age group of 16- 60
307 years, male and female, had a significant effect on the share of household housing expenditure in
308 2021.

309 The other significant issues in the field of economic efficiency at the household level include the
310 socio-economic characteristics of the head of the household such as their gender, age, literacy
311 status, and employment status. In the field of food, increasing the literacy level of the head is a
312 factor in creating economies in the consumption of goods. However, the increasing age and
313 employment of the head can negatively affect this issue. In the field of housing, increasing the age

314 and literacy level of the head impedes economies at the household level and being employed and
315 married results in economies at the household level.

316 The results indicated that the socio-economic characteristics of household heads, age, and gender
317 of household members have various effects on the occurrence or non-occurrence of economies at
318 the household level. Due to the heterogeneity of the effects related to this category for household
319 characteristics, it is impossible to focus only on the characteristics of household heads, as well as
320 the age and gender of household members' inappropriate policies to increase the welfare of
321 households. In this regard, welfare economy policymakers should focus on the centrality of the
322 household size and per capita expenditures of household members.

323 324 **CONCLUSIONS**

325 In general, the change in per capita expenditure not only failed to reduce the expenditure share of
326 food items in the household after a decade in 2021, but also the household housing expenditure
327 failed to experience a noticeable decrease. The reason for such an event is attributed to the increased
328 price of basic food items in the global and Iranian markets. On the other hand, housing has become
329 a luxury commodity due to runaway inflation in Iran in the last decade and most people in different
330 income deciles cannot buy a house. In other words, such developments indicate that the economic
331 savings caused by per capita spending on food and housing have not occurred and the household's
332 welfare has faced problems in using other goods and services assuming the household size is
333 constant. Each household should deal with the exorbitant cost of food staples and housing
334 compared to the past. In the case of food staples and the variable effect of household size, the
335 diseconomies caused by the household size have intensified after a decade (comparing 2011 to
336 2021). The household food expenditure staples are assumed to be constant with an increase in the
337 number of household members by assuming constant per capita of expenditures more than a two-
338 fold increase. The reason for this issue is attributed to international sanctions, trade restrictions due
339 to the coronavirus and other factors, high inflation, and wage laws in Iran. Although housing is
340 considered more public goods than food, the increased household size and the subsequent increase
341 in income due to the active and working population in the household could not cope with the jump
342 in housing prices. As a result, the share of the housing expenditure has decreased in the household
343 much less than a decade ago. Due to the role of household size in the household expenditure share
344 in 2021, the policies that follow population growth cannot be successful regardless of the role of
345 the household size in the expenditure share of the household consumption basket.

346 The results of the study in the field of food are consistent with Engel's law. In addition, the results
347 are in line with the view of (Deaton & Paxson, 1998) in the case of housing. Based on Engel's law,
348 the share of food increases with an increase in the size of the household. However, Engel's law is
349 not applicable in the case of housing according to (Deaton & Paxson, 1998). The share of housing
350 in the household expenditure not only does not increase significantly but sometimes even decreases
351 with an increase in the household size. Thus, there are no economies of scale in food consumption,
352 but this phenomenon can be observed in the case of housing. The results of this study are consistent
353 with the findings of (Kakwani et al., 2005; Logan, 2011; Nelson, 1988), indicating that the
354 economies of scale in different household consumption goods are different from each other and
355 depend on the characteristics of those goods. More general goods such as housing have provided
356 economies of scale for households compared to food. Nevertheless, there is no such advantage in
357 food consumption. In the food preparation process where one food item is prepared for several
358 people at the same time, the economies of scale are an expected phenomenon (Gibson & Kim,
359 2007; Kakwani, 1977). However, this phenomenon was not observed in practice based on the
360 results of the study. Perhaps, the reason for such a case in Iran is the role of women in the food
361 preparation process. Meanwhile, the results indicated that women have no role in the changes
362 related to the share of food. Due to the privacy of food staples, what is common in Iran is the
363 diseconomies of scale in the food group. If the government looks for welfare improvement policies
364 with the maximum effectiveness rate at the household level as a result of increasing the household
365 size from the welfare perspective, providing housing or assistance for households with a larger
366 population has priority due to the economies of scale. The diseconomies of scale in the current
367 conditions of Iran have also caused the aging of the population. From a demographic perspective,
368 the aging of the population will reduce fertility and the power of regeneration. From an economic
369 perspective, human power is one of the basic factors in economic growth, especially in the
370 knowledge-based economy. In addition, the country's economic workforce decreases with the
371 aging of the population. Although the current economy is more dependent on oil, the role of
372 manpower in economic growth becomes more significant with the end of oil reserves. The failure
373 of policies to encourage population growth is of great importance. Among these policies, subsidies
374 can be granted to each child, facilities with low interest rates can be dedicated to the number of
375 more children, and cars can be allocated in the lottery to mothers with two or more children.
376 However, reforming income policies and supporting population deciles through insurance can

377 produce much better results in improving Iran's population structure. The concern about the state
378 of food security and the access of people in the community to shelter during recent years is proof
379 of this claim.

380 Thus, it is suggested that the policies of population increase in each country should be adjusted
381 based on the reactions of the households to the changes made in their expenditure share at each
382 period so that the effectiveness of the policies can be anticipated.

383

384 **Limitations and future research directions**

385 Due to the problem of access to data and information, it was not possible to investigate in
386 different geographical regions of the country.

387 Since health and food security are among the strategic goals of the country's 20-year vision
388 document, to examine the health effects of the results and change the appropriate policy, it is
389 suggested that the present research be carried out separately and by the city of the province. In
390 addition, I can compare an issue in urban and rural areas. In addition, conducting research in
391 different income deciles can be used as a suitable indicator for changing household food support
392 policies.

393 **REFERENCES**

394 Akram, N. (2020). Household's demand for food commodities in Pakistan: issues and empirical
395 evidence. *Estudios de economía*, 47(1), 127-145.

396 Al Rawashdeh, R. (2022). Estimating short-run (SR) and long-run (LR) demand elasticities of
397 phosphate. *Mineral Economics*, 1-15.

398 Ala-Mantila, S., Ottelin, J., Heinonen, J., & Junnila, S. (2016). To each their own? The greenhouse
399 gas impacts of intra-household sharing in different urban zones. *Journal of Cleaner
400 Production*, 135, 356-367.

401 Amolegbe, K. B., Upton, J., Bageant, E., & Blom, S. (2021). Food price volatility and household
402 food security: Evidence from Nigeria. *Food Policy*, 102, 102061.

403 Barten, A. P. (1964). Consumer demand functions under conditions of almost additive preferences.
404 *Econometrica: Journal of the Econometric Society*, 1-38.

405 Bradbury, M., Peterson, M. N., & Liu, J. (2014). Long-term dynamics of household size and their
406 environmental implications. *Population and Environment*, 36, 73-84.

- 407 Curtis, C. C., Lugauer, S., & Mark, N. C. (2017). Demographics and aggregate household saving
408 in Japan, China, and India. *Journal of Macroeconomics*, 51, 175-191.
- 409 Cutler, D. M., & Katz, L. F. (1992). Rising Inequality? Changes in the Distribution of Income and
410 Consumption in the 1980s. In: National Bureau of Economic Research Cambridge, Mass.,
411 USA.
- 412 Deaton, A. (1997). *The analysis of household surveys: a microeconomic approach to*
413 *development policy*. World Bank Publications.
- 414 Deaton, A., & Muellbauer, J. (1980). An almost ideal demand system. *The American economic*
415 *review*, 70(3), 312-326.
- 416 Deaton, A., & Paxson, C. (1998). Economies of scale, household size, and the demand for food.
417 *Journal of political economy*, 106(5), 897-930.
- 418 Dudek, H. (2014a). Do shares of food expenditure in the European Union converge? A country-
419 level panel data analysis. *Economic Computation and Economic Cybernetics Studies and*
420 *Research*, 48(4), 245-260.
- 421 Dudek, H. (2014b). Economies of scales in EU household consumption—some remarks based on a
422 country-level analysis. *Metody Ilościowe w Badaniach Ekonomicznych*, 15(2), 74-83.
- 423 Ellsworth-Krebs, K. (2020). Implications of declining household sizes and expectations of home
424 comfort for domestic energy demand. *Nature Energy*, 5(1), 20-25.
- 425 FAO. (2022). <https://www.fao.org/faostat/en/#data>
- 426 Fremstad, A., Underwood, A., & Zahran, S. (2018). The environmental impact of sharing:
427 household and urban economies in CO2 emissions. *Ecological economics*, 145, 137-147.
- 428 Gan, L., & Vernon, V. (2003). Testing the Barten model of economies of scale in household
429 consumption: Toward resolving a paradox of Deaton and Paxson. *Journal of political*
430 *economy*, 111(6), 1361-1377.
- 431 Gibson, J. (2002). Why does the Engel method work? Food demand, economies of size and
432 household survey methods. *Oxford Bulletin of Economics and Statistics*, 64(4), 341-359.
- 433 Gibson, J., & Kim, B. (2007). Measurement error in recall surveys and the relationship between
434 household size and food demand. *American Journal of Agricultural Economics*, 89(2), 473-
435 489.

- 436 Govindaraj, G., Suryaprakash, S., & Sivaramane, N. (2012). Present status of edible oil
437 consumption and household demand projection for Tamil Nadu (India). *Journal of*
438 *Agricultural Sciences (Belgrade)*, 57(1), 41-56.
- 439 Gundimeda, H., & Köhlin, G. (2008). Fuel demand elasticities for energy and environmental
440 policies: Indian sample survey evidence. *Energy Economics*, 30(2), 517-546.
- 441 Hoang, V.-N., Nguyen, T. T., Wilson, C., Ho, T. Q., & Khanal, U. (2021). Scale and scope
442 economies in small household rice farming in Vietnam. *Journal of Integrative Agriculture*,
443 20(12), 3339-3351.
- 444 Houedjofonon, E. M., Adjovi, N. R. A., Chogou, S. K., Honfoga, B., Mensah, G. A., & Adegbi,
445 A. (2020). Scale economies and total factor productivity growth on poultry egg farms in
446 Benin: a stochastic frontier approach. *Poultry science*, 99(8), 3853-3864.
- 447 Huang, W.-H. (2015). The determinants of household electricity consumption in Taiwan: Evidence
448 from quantile regression. *Energy*, 87, 120-133.
- 449 Jetté-Nantel, S., Hu, W., & Liu, Y. (2020). Economies of scale and mechanization in Chinese corn
450 and wheat production. *Applied Economics*, 52(25), 2751-2765.
- 451 Kakwani, N. (1977). On the Estimation of Consumer Unit Scales. *The Review of Economics and*
452 *Statistics*, 59, 507-510.
- 453 Kakwani, N., Soares, F. V., & Son, H. H. (2005). Conditional cash transfers in African countries.
454 *Brasilia: International Poverty Centre, United Nations Development Programme*.
- 455 Lanjouw, P., & Ravallion, M. (1995). Poverty and household size. *The economic journal*, 105(433),
456 1415-1434.
- 457 Lazear, E. P., & Michael, R. T. (1981). *Family size and the distribution of per capita income* (0898-
458 2937).
- 459 Logan, T. D. (2011). Economies of scale in the household: Puzzles and patterns from the American
460 past. *Economic Inquiry*, 49(4), 1008-1028.
- 461 Longhi, S. (2015). Residential energy expenditures and the relevance of changes in household
462 circumstances. *Energy economics*, 49, 440-450.
- 463 Mok, P. T.-Y., Maclean, G., & Dalziel, P. (2010). Estimating Household Economies of Scale for
464 the Poor in Malaysia. 51st New Zealand Association of Economists Annual Conference,
- 465 Mok, T. P., Maclean, G., & Dalziel, P. (2011). Household Size Economies: Malaysian Evidence.
466 *Economic Analysis & Policy*, 41(2).

- 467 Nelson, J. A. (1988). Household economies of scale in consumption: theory and evidence.
468 *Econometrica: Journal of the Econometric Society*, 1301-1314.
- 469 O'Neill, B. C., & Chen, B. S. (2002). Demographic determinants of household energy use in the
470 United States. *Population and development review*, 28, 53-88.
- 471 Perali, F. (2003). *The behavioral and welfare analysis of consumption: The cost of children, equity*
472 *and poverty in Colombia*. Springer Science & Business Media.
- 473 SCI. (2022). [https://www.amar.org.ir/english/Iran-Statistical-Yearbook/-Iran-Statistical-](https://www.amar.org.ir/english/Iran-Statistical-Yearbook/-Iran-Statistical-Yearbook-2021-2022)
474 [Yearbook-2021-2022](https://www.amar.org.ir/english/Iran-Statistical-Yearbook/-Iran-Statistical-Yearbook-2021-2022)
- 475 Soon, J.-J. (2022). Quantile analysis of the aspirational middle class in Malaysia: spending
476 behaviour emulation or dissociation? *International Journal of Social Economics*, 49(7),
477 993-1008.
- 478 Ullah, I. (2018). Food consumption in Pakistan: Applications of linear approximate almost ideal
479 demand system (LA/AIDS).
- 480 Underwood, A., & Fremstad, A. (2018). Does sharing backfire? A decomposition of household
481 and urban economies in CO2 emissions. *Energy Policy*, 123, 404-413.
- 482 Underwood, A., & Zahran, S. (2015). The carbon implications of declining household scale
483 economies. *Ecological economics*, 116, 182-190.
- 484 Yu, E., & Liu, J. (2007). Environmental impacts of divorce. *Proceedings of the National Academy*
485 *of Sciences*, 104(51), 20629-20634.
- 486