

Estimates of Equivalence scale for Iranian Households

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ABSTRACT

Despite its vast natural resources of oil, gas and minerals (mining), dealing with the problem of poverty and inequality is a serious challenge for policy makers. This challenge becomes increasingly acute as the authorities succumb, inevitably, to pressures to liberalise the economy by implementing free market principles and similar reforms. The welfare system in the Islamic Republic of Iran is quite complex with various governmental, non-governmental and para-governmental welfare organizations operating side by side. The Subsidy Targetization Act was the biggest of its kind in the history of the Islamic Republic, and that it is bound to affect the well-being of a large proportion of the population, it is rather surprising that it was introduced in such haste and without thorough planning. An equivalence scale is a measure of the cost of living of a household of a given size and demographic composition relative to the cost of living of a reference household when both households attain the same level of utility or standard of living (Lewbel and Pendakur, 2006). The method of calculating the equivalence scale is based on the Engel curve which can be argued to be a specific, restricted, representation of the Marshallian demand curve where prices are held constant and demand varies with income. We have argued, as an example of application of this approach, that this approach provides a more efficient and equitable way of compensating the consumers for the impact of the removal of price subsidies.

1. Introduction

The welfare system in the Islamic Republic of Iran is quite complex with various governmental, non-governmental and para-governmental welfare organizations operating side by side. Examples of these include the state welfare organization (*Behzisti*), the charitable trusts established mainly after the 1979 revolution which operate independently from the government, e.g.

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The Imam Khomeini Relief Committee (IKRC), The Foundation of the Oppressed, etc. and other government dependent but non-governmental organization such as the Social Security Organization (SSO) and Medical Services Insurance Organization (MSIO). These institutions provide a variety of services, from health care to housing, education and pensions and some financially aid those eligible and so require a system for assessing who should be paid and how much.

The SSO, which has been active for more than 50 years, is the largest social insurance institution in Iran. It covers the greatest proportion of the country's population: 47,890,146¹ people were covered in 2022, which is 45% of the population in that year². According to the country's social security legislations, any person who earns a living by working is entitled to receive coverage for themselves and their dependents through this organization. This includes salaried workers, wage earners and self-employed people. The premium for each insured person is 30% of their total income broken down into contributions made by the employees (7%), their employers (20%) and the government (3%). The SSO covers for unemployment, medical care, pensions, maternity leave, disability and sickness among other things. Retirement benefits (pensions) paid by the SSO are not fixed and pensions are increased almost every year in line with inflation. The amount by which pensions are increased is also based on the minimum and maximum wage set each year by the government. No other factors are taken into account in adjusting the benefits³. The IKRC is one of the country's largest charitable organizations and is overseen directly by the office of Leadership⁴. Its function is to support poor families by providing them with financial assistance and services. According to IKRC's 2020

1. Social Security Organization statistical information for 2005, obtained from their website at <http://www2.tamin.org.ir/web/sso-en/gi/gs>

2. The population for year 2005 was obtained from the economic time series database of the Central Bank of Iran site at <http://tsd.cbi.ir/> and the proportion was calculated.

3. Article 41 the Labor Law

4. Constitutionally the Office of Leadership is the highest official in the Islamic Republic of Iran; Article 113 defines the status of this office and Article 110 outlines Leader's responsibilities and authority.

annual statistical report¹, the institution provided coverage for more than 11 million people across Iran. IKRC's income (revenue) comes from donations made by the Iranian Leader (from funds at the disposal of the Office of Leadership), the public (through, e.g. alms boxes and other donations), government funds and IKRC's own business activities. Approximately, 27.9 % of which came from charity boxes, 5.1% from other donations made by the public, 21.7% revenue from committee's businesses and 45.3% from other sources.

The majority of Iranians are Muslim and as such are under religious obligation to make mandatory donations — *zakat*, *khoms*, and *Fitra*. These are usually paid to the local clergymen or imams and are redistributed among the poor. This is yet another example of the cash distribution in the Islamic state of Iran. Those eligible for payments are decided upon according to the Sharia laws of Islam. However, the amount paid is not specified and is at the discretion of the clergyman in charge. The clergymen are also in a position to use their discretion in distributing any other non-obligatory charitable donations that they receive. In addition to *zakat*, *khoms* and *Fitra*, there is a perpetual form of charity called *Waqf* which is a religious endowment in Islam whereby a person donates an asset, usually a property, to be held and managed (but not sold) by a charitable trust and its proceeds be used for charitable purposes (which may or may not have been specified by the donor). *Waqf* is a common practice in Iran, and its perpetual and redistributive characteristics inspire sustainability.

The above explanations involve examples of direct (either one off or regular) lump-sum payments to households which, in most cases, are discretionary and lack a sound system based on principles of welfare economics. In addition to such direct lump-sum payments, a major component of the welfare system in Iran is based on subsidy schemes whereby the government ensures prices of certain necessities — e.g.

1. All statistical information obtained from the Imam Khomeini Relief Committee annual statistical report (2009), available at <http://www.emdad.ir/gozareshat/amar.asp> (in persian).

foodstuff such as wheat, milk, sugar, rice, etc. and utilities such as fuel (including petrol, gas and gasoline), water, electricity, etc. respectively amounting to 4% and 10% of GDP in 2003, see Hakimian (2008: 20-21) — do not exceed the so called “affordable thresholds”. Until recently, these schemes were implemented by successive regimes/administrations without any compromise and were considered as ‘priority items’ government’s budget.

Given that the Subsidy Targetization Act¹ was the biggest of its kind in the history of the Islamic Republic, and that it is bound to affect the well-being of a large proportion of the population, it is rather surprising that it was introduced in such haste and without thorough planning. The least one would expect of such practices is that they take account of the two most basic household features (i) sizes, and (ii) areas of residence². But an appropriate redistribution policy will have to go beyond this and use the household equivalence scales which are one of the most useful tools developed in welfare economics. This is because they can be used to estimate the amount by which incomes of different types of households ought to be adjusted so as to bring their welfare to the level enjoyed by a reference household type, where socioeconomic and demographic factors are used to classify household types. Equivalence scales can also be used to

1. The process is outlined in detail in the 5th Five-year Development Plan of the Islamic Republic of Iran (pages 549-557), available from <http://www.spac.ir/Portal/File/ShowFile.aspx?ID=90fa4381-ca1c-4d41-885a-8e889d572e3d> (in Farsi). As mentioned in Chapter 2, the structural adjustment policies of the IMF replaced the 1st Five-year Development Plan with recommendation for implementing free market policies. Guillaume et al. (2011) provide a detailed account of the economic and technical issues involved in the planning and implementation of the recent reform that eliminated (or drastically reduced) the subsidise for domestic energy and agricultural prices and recommend, amongst other things, that “*the main immediate challenge facing the authorities is, however, to allow a progressive pass-through of higher energy prices by eliminating administrative price controls and reducing excessive and arbitrarily set import or export tariffs, while controlling inflation by coordinated and tight credit, fiscal, and exchange rate policies. Maintaining macroeconomic stability is essential to avoid a rapid erosion of the benefits of the reform. At the same time, new product prices should reflect the adjustment in product mix from Iranian companies and changes in consumer demand away from products and services requiring a lot of energy towards more energy-efficient goods and services.*” (pp. 21-22)

2. Deaton, A and Muellbauer, J. (1982), “Economics and Consumer Behaviour”, Cambridge University Press

determine how to redistribute a given amount of money among households such that any change in their welfare levels are taken into account for instance, when compensating financially for losses incurred due to implementation of new government policies or as a result of major mishaps or natural disasters, etc. It can therefore be argued that the recent Subsidy Targetization Project in Iran (as well as other welfare-based benefits or payments such as those mentioned above) would be improved by making use of equivalence scales in estimating the amount that each household type receives. In this paper we use the Household Expenditure and Income Surveys (HEIS) of 2010-2020, obtained from the Statistical Centre of Iran (SCI) which is the organization responsible for conducting these surveys. We show that the picture which emerges demographic features such as household size and geographic location and some characteristics of head of household factors are taken into account suggests that the current system of redistribution followed by the Subsidy Targetization Project (which pays the same amount to each member of all types of household regardless of their characteristics) needs to be modified substantially. Since, Rahimi (2013), Rahimi and Molana (2014 and 2015), Rahimi et al (2019) had a estimations from Household welfare in Iran, this paper has extended two steps. According to Pendakur (1999), any country household needs to a new estimation. Of course, they haven't had an estimation from equivalence scale with the Engel approach.

This paper is organized as follows. Section 2 reviews the relevant theoretical studies and gives a summary of a selected number of recent applied studies. Section 3 gives the results which include the augmented Engle curves for rural and urban households. In section 4 the different household equivalence scales are estimated using the Engel approach. Section 5 gives the conclusion and anticipates the analysis carried out in the following paper.

2. The relevant literature

An equivalence scale is a measure of the cost of living of a household of a given size and demographic composition relative to the cost of living of a reference household when both households attain the same level of utility or standard of living (Lewbel and Pendakur, 2006). In other words, an equivalence scale is simply a coefficient showing the ratio of the cost of living of a given household to the cost of living of a reference household as long as both households enjoy the same standard of living or welfare level. Thus, equivalence scales can be used to estimate the monetary amount a certain household would require in order to maintain the same level of welfare as before when its circumstances change. This change in circumstances could be due to an alteration in the demographic features of the household (e.g., a new baby, or even a move from urban to rural area) or might be the result of a new policy affecting the household (e.g., introducing child benefits, eliminating price subsidies, etc.).

The history of equivalence scales dates back to 1895 and Engel's observations of the relationship between households' income and their share of expenditure on food. He suggested that since it was observed that, for any given household composition, richer households on average spent a relatively smaller proportion of their income on food (compared to poorer households), the inverse of food expenditure shares could be taken as a welfare indicator for comparing households. Based on this observation, households of different size or composition which have the same food expenditure shares are taken to have the same level of welfare. Therefore, equivalence scales derived using the Engel method are basically ratios of incomes of two households with the same food expenditure shares. More explicitly, consider two households which are indicated by subscripts $h=1, 2$ with size $s_2 > s_1$ and income $y_2 > y_1$. If these households have the same food expenditure shares, $w_2 = w_1$ then the income ratio $y_2 / y_1 > 1$ can be used as the equivalence scale since it gives the multiplier which adjusts the

income of household 1 when its size grows from s_1 to s_2 so that it can maintain its welfare level intact.

This method of calculating the equivalence scale is based on the Engel curve which can be argued to be a specific, restricted, representation of the Marshallian demand curve where prices are held constant and demand varies with income. The first models of this type proposed for empirical analysis can be found in Working (1943) and Leser (1963) which postulated a general functional form

$$\frac{E_{i,h}}{E_h} = w_{i,h}(\ln E_h, D_h), \quad (1)$$

where the subscript i refers to the category of expenditure (food, etc.), E_i is the actual expenditure on category i , E is the total expenditure on all goods and services, $E_h = \sum_i E_{i,h}$, and D is a vector of socio-demographic variables (size, age of children, location, head of households characteristics such as education and employment status, age, gender, etc.). The shape of the Engel curve for category i would therefore depend on the functional form of w_i . Paris and Houthakker (1955) found that essential goods and luxury goods could be appropriately modelled using a semi-log and a double-log regression equation, respectively, i.e.,

$$E_{1,h} = \alpha_1 + \beta_1 \ln E_h + u_{1,h}, \quad h = 1, \dots, H, \quad (2)$$

$$\ln E_{2,h} = \alpha_2 + \beta_2 \ln E_h + u_{2,h}, \quad h = 1, \dots, H, \quad (3)$$

where subscripts 1 and 2 refer to essential goods and luxury goods respectively and u_i is a random disturbance term. Bewley (1982) proposed using the double-log model in (3) above for all types of goods but reparameterising it so that the dependent variable is expressed as the expenditure share, thus in an N-good case we use

$$\ln E_{i,h} / E_h = \alpha_i + (\beta_i - 1) \ln E_h + u_{i,h}, \quad i = 1, \dots, N; \quad h = 1, \dots, H. \quad (4)$$

Van Ginneken (1982) used the model in (4) for food expenditure and introduced the household size as an additional explanatory variable. Engel's approach has been generalized with respect to the use of share of expenditure on food, by replacing the latter with 'food and clothing', 'adult goods', etc. □ see Watts (1967) and Seneca and Taussig (1971) for details.

One of the main shortcomings of the studies based on Engel's method is that they fail to take account of households' socio-demographic features. In addition, it is argued that Engle's method does not explicitly correspond to any well-defined demand system derived from utility maximization or cost minimization. Hence other methods of constructing equivalence scales have been suggested which are based on well-defined demand systems and involve demographic variables — e.g., Paris and Houthakker (1955), Barten (1964), Gorman (1976), Lewbel (1985) and Pendakur (1999) among others. In more recent literature, preferences and individual inter-household utilities have also been taken into account — see Jorgenson and Slesnick (1987), Lewbel (1989), Blackorby and Donaldson (1993) and Donaldson and Pendakur (2004, 2006).

The latter is clearly the most crucial issue and one of the main distinctions between different studies is what they consider to be a good proxy for households' welfare. Some express welfare index in terms of the (inverse of) expenditure shares of certain essential commodities (e.g., Engel's food expenditure shares, Rothbarth's adult goods expenditure shares, etc.) and others measure welfare in terms of the indirect utility based on expenditure function approach.

3. Modeling Data Set

The SCI that was founded in 1952 and the first survey of household budget from SCI refers to 1963 provided the raw data, but supplied the probability weights for only a limited number of years. The lack of probability weight for a year means that data for that year cannot be used in the analysis. This is because the robustness of any type of statistical analysis depends on the use of

correctly calculated probability weights that eliminate (or reduce) the sampling bias.¹ (We propose a method of constructing the missing probability weights and use this method to construct the weights for the whole period. We saw that for those years that official weights are provided by the SCI, the two weights are identical. They are available on request). The surveys are conducted annually on randomly chosen urban and rural households from all regions across the country. The survey data, which is obtained through questionnaires, contains information on households' demographic features, place of residence features, expenditures and income. The dataset contains information on more than 350,000 households in Iran for a period of 10 years, involving a total of over 170 million data items. In this section we estimate the Engel curve for Iran using the household survey data for the period 2010 to 2020. More specifically, for each year $t=2010, 2012, 2014, 2016, 2018, 2020$, we estimate different versions of the regression equation

$$w_{h,t} = \alpha_t + \beta_t \ln E_{h,t} + u_{h,t}, \quad (5)$$

by allowing for households' characteristics, where w and E as before denote the household-level food expenditure share and total expenditure, respectively, and the effects of the socio-demographic factors which are taken into account are reflected in the coefficient estimates. Table 1 shows our first set of estimates where we use the full sample and do not distinguish between households (i.e. no characteristics dummies or socioeconomic factors are included in the regression equation as additional explanatory variables).

Table 1. Estimates of the general Engel curve coefficients

	2010	2012	2014	2017	2018	2020	pooled
$\hat{\beta}_t$	-0.085218 (13.25)	-0.08391 (16.78)	-0.089525 (14.24)	-0.09281 (18.75)	-0.09805 (22.89)	-0.09705 (19.34)	-0.08999 (18.12)
$\hat{\alpha}_t$	1.7411 (17.72)	1.72035 (19.89)	1.8887 (18.01)	1.9457 (20.98)	2.0193 (25.01)	2.01518 (22.25)	30.9814 (0.011)
R^2	0.1598	0.1799	0.2498	0.2601	0.2898	0.2998	0.2801
N_t	33208	31098	32208	32134	33456	34056	196160

1. See Deaton (1997) for an in depth discussion of the technical issues regarding the microeconomic issues involved in the analysis of survey data.

The estimation method is weighted least squares using the survey probability weights. N_t is the number of households in the sample. The numbers in parenthesis are t-ratios based on cluster and heteroscedasticity robust standard errors. The pooled regressions include, as additional explanatory variable, the logarithm of the consumer price index which captures, to some extent, the impact of inflation across the years (the corresponding coefficient and t-ratio is not reported but are available on request). A year dummy was also included in the pooled regression but its effect was insignificant and hence it was removed.

All of the coefficients are significant and of similar magnitude over the years and, as expected, there is an inverse relationship between the w and $\ln E$: as the total expenditure levels rises the food expenditure share falls, hence confirming the existence of a robust Engel curve relationship. It is worth noting that the estimates for β are not dissimilar to those reported in the literature. For instance, the estimates reported by Liu and Chern (2001) are in the neighbourhood of -0.095, those reported by Deaton & Muellbauer (1986) for Indonesia are around -0.1, and those presented in Deaton (1997) for India and Pakistan are -0.12 and -0.1, respectively. The slight positive trend in the magnitude of estimates for β_t suggests that, *ceteris paribus*, the welfare level of households have improved over the years.

Given that the equivalence scale analysis based on the Engel curve rest on the assumption that food expenditure shares are inversely (and monotonically) related to the welfare levels, in Table 2 below we depict the behavior of food expenditure shares over time, separately for rural and urban households of different sizes. These figures indicate three important points: (i) given they depict a reduction in the food expenditure share over the years, one might take this as a preliminary evidence, based on Engel's observations, for an increase in the welfare levels of households over the period; (ii) the size of household matters, as it shifts the food expenditure shares considerably; and (iii) the urban-rural divide is clearly present, as on

average the rural households of all sizes tend to have a higher food expenditure share than urban households. In fact, as the graphs indicate (on average) the minimum level of food expenditure share for rural households is larger than the maximum food expenditure share of the urban households.

4. Equivalence scales for Iranian households

The Engel curve estimates reported above can be used to construct household equivalence scales is defined as $E_h / E_r = ES(h, r) = \exp[(\hat{\alpha}_r - \hat{\alpha}_h) / \hat{\beta}]$ where E refer to total of expenditure of household subscript h and r refers to one and reference household respectively and $\hat{\alpha}$ and $\hat{\beta}$ are coefficient estimations in a regression equation as (5). The results shows our preliminary estimates of these where $\hat{\alpha}_{h,t}$ and $\hat{\beta}_t$ are those reported in Table 2 which only allow for the size and locality to affect the welfare level of households, that is

$$\hat{w}_{h,t} = \hat{\alpha}_t + \hat{\beta}_t \ln E_{h,t} + \hat{\gamma}_t S_{h,t} + \hat{\phi}_t RU_{h,t} \quad (6)$$

Table 2. Estimates of parameters of equation (6)

The Engel curve coefficients, allowing for household characteristics

	2010	2012	2014	2017	2018	2020	pooled
$\hat{\beta}_t$	-.078156 (17.57)	- .0798074 (15.74)	-.080651 (18.23)	- .0841672 (19.04)	-.087548 (25.28)	- .0899254 (22.35)	- .0852175 (23.34)
$\hat{\gamma}_t$.015584 (12.56)	.016548 (14.01)	.019567 (16.64)	.0194023 (22.79)	.0192817 (19.02)	.0194723 (11.91)	.018297 (18.23)
$\hat{\phi}_t$	-.111201 (13.01)	-.088914 (12.98)	-.079729 (17.21)	-.077918 (15.48)	-.076494 (22.56)	-.07899 (18.12)	-.084993 (21.56)
$\hat{\alpha}_t$	1.683557 (23.01)	1.565827 (21.98)	1.799212 (27.89)	1.918688 (25.11)	1.950128 (34.91)	1.920759 (24.97)	13.93554 (1.01)
R^2	0.3398	0.3189	0.3994	0.4011	0.4189	0.4332	0.4098
N_t	33208	31098	32208	32134	33456	34056	196160

We have chosen to focus on size and locality only since the results help to illustrate better the importance of socio-demographic factors. For each of the years $t=2010, 2012, 2014, 2016, 2018, 2020$, the bar charts in Table 6 show the relevance of the household size relative to the reference household.

The results which emerge from examining the above evidence on equivalence scales (ES) can be summarized as follows: In all cases, ES is increasing with size. However, the impact of the size is (i) less than proportional, and (ii) is larger at higher for bigger households. For example, on average, when the household size increases from 1 to 2 members ES rises by 30% but when it increases from 3 to 6 members ES rises by 90%. One explanation for this could be the possibility that larger households are generally more mature and tend to include older children whose food consumption level is relatively higher. Consequently, the response of ES to size is higher the higher is the household size. On the whole, these results confirm the presence of economies of scale for food consumption in Iranian households¹ which is a crucial factor to be considered by the policy authorities. For urban households, the pattern of ES does not change over the period considered. This evidence of stability across years is an important factor for policy makers as it indicates that significant adjustments are not required over a time span of 10 years.

The main policy implications of the above is that there is a significant urban-rural divide which needs to be addressed both in terms of the welfare levels as well as the different impact of factors such as inflation at regional levels. Also, setting aside the urban-rural issue and focusing on the rural case separately, on the whole a similar policy can be applied to both urban and rural households and the stable pattern of the ES over the years suggests that these policies do not need to be adjusted in the short term to even out the different impact of various factors across the years.

1. This is a somewhat common phenomenon. See, for instance, Deaton (1997) for similar evidence on Indonesia. However, as Deaton stresses, the complexity of the relationship between households' size and their food consumption tends to vary depending on their particular circumstances and factors such as households' poverty level or their rural/farmer status can alter the relationship significantly.

5. Summary and conclusions

Despite its vast natural resources of oil, gas and minerals (mining), dealing with the problem of poverty and inequality is a serious challenge for policy makers. This challenge becomes increasingly acute as the authorities succumb, inevitably, to pressures to liberalize the economy by implementing free market principles and similar reforms. This is because an unavoidable consequence of these reforms is their undesirable initial impacts which hit vulnerable groups. Despite the fact that it may be argued that extensive welfare programs already exist that target such groups, an examination of the existing schemes reveals that in most cases they are ad hoc and are not formulated on the basis of robust economic principles. Our investigation in this paper has shown that the Household Survey Data provides valuable information which can be used to construct systematic and robust measures for tackling the welfare questions that arise in the context of redistribution of resources and/or compensation of consumers. In this paper we have constructed the Engel-curve based equivalence scales indices for food expenditure shares to illustrate the usefulness of this approach as well as to highlight some of intricacies involved. We have argued, as an example of application of this approach, that this approach provides a more efficient and equitable way of compensating the consumers for the impact of the removal of price subsidies for fuel and food-stuff than the current practice of the Subsidy Targetization Project where all citizens receive a given lump-sum cash which is determined in an ad hoc manner. In addition to taking account of economies of scale and the role of households' main characteristics and allowing for factors such that privileges and opportunities to influence the distribution of transfers in general, we have stressed that this approach will enable the authorities to address important issues such as the role of urban/rural divide when compensating households. We acknowledge that the work in this paper is simply a starting attempt which motivates and informs our future research into the formulation of a systematic, efficient and testable

welfare program in connection with projects that are designed to compensate Iranian consumers.

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