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Relative Cost of Child Rearing for Iranian Households: Estimates of Child Equivalence Scales for Iran

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Abstract

Following a recent speech (in July 2012) by the Iranian Supreme Leader in which he criticized the existing birth-control programs in Iran and warned that such programmers would lead Iran to facing an aging population, the health authorities were reported to have started cutting family planning budgets. It was also reported that the Iranian Parliament was considering the amendment of the 1993 family planning law which limited public benefits for larger families and called for education about family planning in schools. If they succeed, these attempts will bring about a baby-boom in Iran. On the 20th of February 2013 the Iranian Parliament amended this law thus removing all the restrictions which were previously placed for having children[1]. But a baby-boom policy ought to be assessed, in advance, against a number of yardsticks prominent amongst which is the relative cost of child rearing to households. In this paper we argue that the existing child benefit system in Iran, which disregards a number of crucial features of households, is inadequate for delivering a fair outcome, especially in the event that a baby-boom policy succeeds. One way to overcome this inadequacy is to use, as basis for compensating households for the expenses of an additional child, the equivalence scales principle. We use Iran's Household Expenditure and Income Surveys datasets for 1984-2007

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1 See http://www.icana.ir/NewsPage.aspx?NewsID=220454 for the Islamic Consultative Assembly News Agency report.

(compiled annually by the Statistical Centre of Iran) to estimate the child equivalence scales – based on both Engle's and Rothbarth's methodology – for different household types. We find that households' main features (size and geographic location) as well as their demographic characteristics such as the number of existing children and their age influence the cost of a new child. He compensation profile that emerges from our estimates suggests the need for redesigning Iran's child benefit system.

Key words: *Cluster regression, cost of child, demographic features, Engel curve, Rothbarth curve, Child equivalence scale, Iran*
JEL Classification: *C51, D03, D12, R20.*

1. Introduction

This chapter focuses on issues regarding the child benefit system in Iran. We explain how the existing system functions and move on to provide an analysis of compensating households for the expenses of an additional child on the basis of the welfare theory stemming from equivalence scales principle and its application to the household survey data.

The official, systematic, child benefit system in Iran currently only covers the public sector employees.[1] According to the State Services Management Act (Ghanoon-e Modiriyat-e Khadamat-e Keshvari[2]), government employees, i.e. those employed in the public sector, are entitled to receive financial help with child rearing costs. The amount paid for each child constitutes a part of the employee's salary which is calculated using a points-based system. According to the updated version of this Act (Sep 2007), 200 points are awarded for each child and for a maximum of 3 children provided they are below 25 years of age, in full time education and not in employment (Article 68, Section 4). These points are then added to those awarded for qualification, expertise, years in employment, employee's circumstances (e.g. marital status, veterans), etc. and the final number of points is multiplied by a coefficient (in rials) that is set by the government annually

1 Although the Social Security regulations require private sector employers to apply the same terms when determining employees pay, this aspect of private sector employment is not fully monitored and employees normally end up with an overall salary inclusive of the relevant benefits.

2 .http://www.dadkhahi.net/law/Ghavanin/Gh_edari_estekhdami/gh_modiriyat_khadamat_keshvari.htm (in Farsi).

(Article 64) — e.g. 700[1] rials (0.05[2] $US) in 2011 or 805 rials (0.06 $US) in 2012 — to calculate an employee's salary. As mentioned in the previous chapter, there are also other ad hoc benefit transfers that concern the children and apply to all households regardless of their employment status. For example, the government decided to make a one off payment of ten million rials[3] (1017 $US[4]) for each child born after 21.03.2010, although no payments have been made since 22.06.2010[5]. The above mentioned are examples of the types of monetary transfers by the state to households with children. It is however not clear whether these government practices have any economic basis, i.e. if the value of these payments is guided by the relevant economic theory considerations and evidence. It does appear that, since every household gets paid the same amount per child, factors such as households' income, number of children, and other relevant socioeconomic and demographic factors have not been taken into consideration.

Two main approaches are used in calculating the cost of children, the "per capita" methodology and the "marginal cost" methodology. In the per capita approach, the total household expenditure is divided by the number of people in the household to obtain each member's share of the total expenditure, which is the same for all (adults and children). In the marginal cost approach, the cost of a child is deemed to be the difference in expenditures between two equally well-off families, a couple with child and a couple without. The Engel and the Rothbarth methods of estimating the cost associated with children fall within the latter approach. The Engel method uses food share expenditure as explained in the previous chapter while the Rothbarth method employs the expenditure on an adult specific good as the measures of welfare, and thus equally well-off households are identified accordingly. In this chapter we shall use the Rothbarth approach in

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1 http://rc.majlis.ir/fa/law/show/792282 (in Farsi).

2 The exchange rate is 12260 rials per 1 $US, obtained from CBI on http://www.cbi.ir/exrates/rates_en.aspx.

3 See more details in http://www.bbc.co.uk/persian/iran/2010/08/100815_ka_iran_population_majlis.shtml (in Farsi).

4 The exchange rate obtained from http://www.cbi.ir/ExRates/rates_fa.aspx for 21.03.2010.

5 This information was personally obtained from the Central Bank of Iran. More details can be found at http://www.khabaronline.ir/news-173029.aspx (in Farsi).

conjunction with the household survey dataset for Iran to examine how various socioeconomic and demographic factors contribute to child benefit payments. In Section 2 we estimate Rothbarth's model and in Section 3 we use these estimates to construct Rothbarth's equivalence scales and the associated cost of children are then explained in Section 4. In Section 5 we measure Engel's cost of children and provide a comparison between the costs based on the two approaches. Section 6 concludes the chapter.

2. The Rothbarth Approach

The Rothbarth approach of estimating equivalence scales is an objective method based on Erwin Rothbarth's work in 1943 where he takes the consumption of adult goods as the indicator of welfare level and assumes that two households are equally well-off if they spend the same exact amount on an adult-specific good, i.e. commodities used exclusively by adults such as tobacco, alcohol or adult clothing. Rothbarth assumes that, for any given level of income, the arrival of a child will result in a reduction in the consumption of adult-specific goods so as to enable the household to meet the additional costs it incurs. Consequently, this reduction in the consumption of adult-specific goods is argued to cause a fall in the level of adult welfare, and hence the household welfare on the whole will be lower after a child is added to its members. Therefore, in order to maintain the welfare level at the 'pre-child-arrival' level, the household's income needs to increase to allow the same level of adult goods consumption as before. This increase in income is commonly interpreted as the cost of the new child, and Rothbarth-based equivalence scales are constructed on the basis of this principle using the ratio of the nominal incomes of two differently sized or composed households, e.g. the ratio of income of a three-member household (a couple with one child) to that of a two-member household (a couple with no children) when both households spend the same absolute amount on a specific adult good. Figure 1 illustrates this where the two lines represent the consumption lines (which depict the demand functions in terms of income holding relative prices constant) for an adult-specific good for the two types of households. Assuming that both households spend E1 on the good in question, C1C2 is the cost of the child and OC2/OC1 is the corresponding measure of equivalence scale.

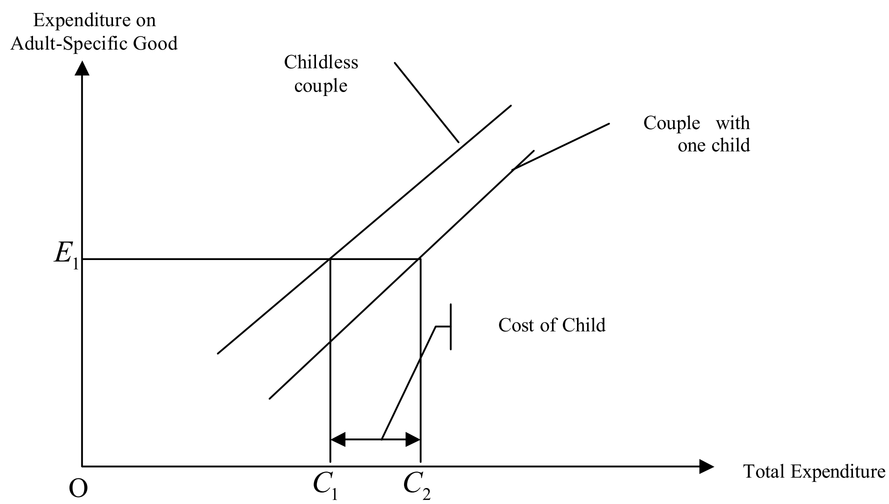


Figure 1- Estimating equivalence scales using the Rothbarth method

In terms of the demand function, let $q_h = q(y_h, n_h)$ denote the demand for adult-specific good for household *h*, where *q*, *y* and *n* are the quantity of the adult-specific good, income or total expenditure, and the number of children of the household respectively. If we can find the amount *c* such that $q(y_h + c, n_h + 1) = q(y_h, n_h)$, then *c* is the amount that the household requires in addition to its current income in order to maintain its adult-specific consumption after it has a new child. Hence, the concept of equivalence scale in this context is captured by the ratio $(y_h + c)/y_h$ since this is the index by which income should be raised to compensate the cost of a new child.

The Rothbarth method outlined above relies on the following assumptions:

- As household income (or total expenditure) increases, expenditure on adult goods will increase, i.e. there is a positive relationship between income and consumption of adult goods.
- Consumption of adult goods is an indicator of welfare.

- Consumption of adult goods is only (or mainly) affected by income.
- The relative price of adult goods, with respect to other goods, remains constant.
- The additional costs associated with the presence of children would result in less expenditure on adult specific goods and hence a lower level of welfare for a given level of income. In other words, with the arrival of every child welfare would decrease unless income is increased to maintain the previous consumption level of adult goods, and other factors associated with the presence of children, i.e. the utility gained from their presence and their utility are not taken into account in the measure of welfare.
- Parents' consumption preferences and patterns are unaffected by the arrival of children (constant preferences), in other words families will not change their preferences or the way they divide their spending across consumption items when they have children.
- There is adequate separability between the utility from adult goods and that from other goods which are affected by demographic characteristics (demographic separability).

The Rothbarth method of estimating equivalence scales is similar to Engel's approach, the only difference being the proxy for the welfare level; Engel takes food expenditure share while Rothbarth uses the consumption of a typical (category of) adult good. Therefore, the same general equation used in Chapter 4 can still be used except that the dependent variable is now expenditure on adult goods instead of share of expenditure on food. The conventional form of the regression equation used in the literature is based on the semi-log specification

$$q_h = \alpha_h + \beta \ln y_h + u_h \tag{1}$$

where q is the quantity of the adult-specific good, y is real income or total expenditure in real terms and the subscript h refers to the household. Note that while β, the coefficient of income, is the same for all households, the intercept is allowed to vary across households to reflect the impact of socio-demographic factors. Equivalence scales can therefore be calculated by following the same steps as those in the Engel approach, explained in the previous chapter.

In the existing literature various studies have used other variations of the above equation. The notable ones are Howard White et al. (2002) who employ the expenditure share (rather than level) as the dependent variable and experiment with a specification similar to (1) above as well as with an alternative specification that uses the inverse of income ($1/y$ rather than $\ln y$). Betson (2010), on the other hand, use a constant elasticity specification where the dependent variable is the logarithm of the expenditure share of the adult good and the explanatory variable is the logarithm of total expenditure — see the explanations below for details.

3. Application of Rothbarth's regression model to data from Iran

In this Section we have estimated the Rothbarth curve for the time period 1997 to 2007, the same period as that used in the previous chapter. We have chosen to work with the constant elasticity specification and the general form of the regression equation used in the analysis can be written as[1]

$$\ln G_{h,t} = \alpha_t + \beta_t \ln E_{h,t} + \gamma_t NCl8_{h,t} + \theta_t NC8\_18_{h,t} + \delta_t RU_{h,t} + u_{h,t} \qquad (2)$$

where subscripts h and t refer to the household and year respectively, and

$\ln G$: Logarithm of adult good expenditure

$\ln E$: Logarithm of total expenditure

NCl8: Number of children less than 8 years old in household

NC8_18: Number of children between 8 and 18 years old in household

RU: place of residence (*RU*=0 if rural and *RU*=1 if urban)

u: a well-behaved disturbance term satisfying the required properties

The existing studies have used different measures for the adult good: Betson used a bundle of adult goods (adult clothing, tobacco and alcohol) in his 1990 study to derive his Rothbarth estimates; in his later studies (2001, 2006, 2010) only adult clothing was considered; Deaton and Muellbauer (1986) considered all none-food items for their Rothbarth measurements of child cost estimates for Sri Lanka and Indonesia; Lancaster and Ray (1998) gave Rothbarth estimates for both adult clothing and adult education; Van der Ven (2003) considered food outside the home as the adult good in his Rothbarth calculations. In our analysis in the chapter we have chosen a bundle that includes annual expenditures on housing, tools, health care,

1 We used the more general specification which included logarithm of household size as an explanatory variable but in all cases the coefficient of this term turned out to be statistically insignificant and hence it was dropped from the model at the outset.

durable goods, household investment, communications and eating out. Given the nature of the survey data, we think that this bundle is the closest we can get to a satisfactory measurement.

Table 1 shows the coefficient estimates for the regression equation (2). All the coefficients are statistically significant and, as expected (i) the sign of the regression coefficient for total expenditure is positive; (ii) the number of children in the household have a negative impact; and (iii) ceteris paribus, urban households have a higher expenditure. That the coefficients for the number of children in both age groups are negative implies that household welfare level decreases with the addition of children regardless of children's age.

Table 1. Estimates of parameters of equation (2)
The Rothbarth curve coefficients, allowing for household characteristics

	1997	1999	2001	2003	2005	2007	pooled
$\hat{\beta}_t$	1.02501 (47.65)	1.082028 (104.82)	1.106599 (98.36)	1.129124 (131.50)	1.146643 (122.69)	1.136012 (133.01)	1.104421 (131.14)
$\hat{\gamma}_t$	-.0679906 (-7.81)	-.0579795 (-7.59)	-.0624111 (-9.17)	-.0578391 (-11.29)	-.0524242 (-8.19)	-.0520191 (-7.29)	-.0599291 (-12.35)
$\hat{\theta}_t$	-.0393933 (-5.99)	-.048516 (-14.02)	-.051494 (-14.43)	-.0584217 (-25.94)	-.0581509 (-20.44)	-.0600833 (-16.43)	-.0512503 (-18.76)
$\hat{\delta}_t$	.4177333 (15.58)	.3037443 (14.00)	.243411 (16.70)	.2426006 (15.16)	.2376829 (20.41)	.2302968 (15.58)	.2748952 (19.70)
$\hat{\alpha}_t$	-1.422709 (-4.67)	-2.191996 (-14.57)	-2.530049 (-14.39)	-2.950239 (-19.33)	-3.243944 (-18.39)	-3.057116 (-18.51)	-2.638957 (-28.36)
R^2	0.8409	0.8703	0.9040	0.9023	0.9214	0.9314	0.9283
N_t	18446	23003	23119	19919	23348	27381	248560
R^2_R	0.8075	0.8537	0.8941	0.8913	0.9119	0.9228	0.9192
F	1657.26 d.f: 3,23 P_F : 0.000	4574.51 d.f: 3,25 P_F : 0.000	3407.84 d.f: 3,25 P_F : 0.000	4475.85 d.f: 3,25 P_F : 0.000	3576.44 d.f: 3,27 P_F : 0.000	3848.69 d.f: 3,27 P_F : 0.000	12674.71 d.f: 4,26 P_F : 0.000

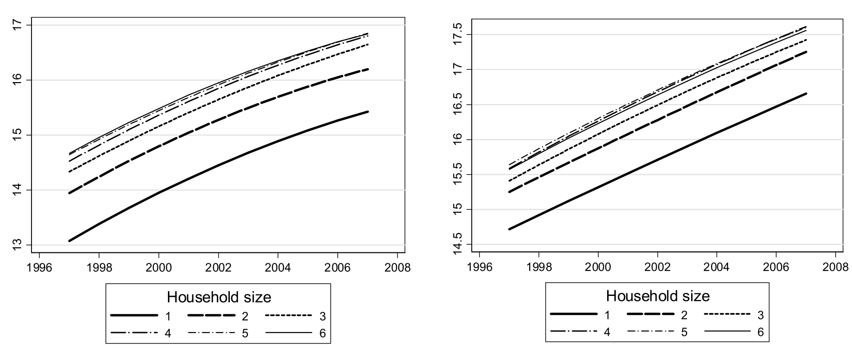
Estimation method is survey least squares using probability weights. N_t is the number of households in the sample. The numbers in parenthesis are t-ratios based on cluster and heteroscedasticity robust standard errors. The pooled regressions include, as additional explanatory variable, the logarithm of the consumer price index to capture the impact of inflation across the years (the corresponding coefficient and t-ratio is not reported but is available on request).

R_R^2 is for the restricted regression and F in the row below is the value of F statistic for the joint restrictions (ru=0) with the corresponding degrees of freedom (d.f) and P-values (P_F). The restrictions are rejected with high confidence in all cases and the unrestricted regression is therefore considered more appropriate.

In Table 2 we illustrate the expenditure on adult goods over the period for urban and rural households of different sizes separately. As it can be seen, the expenditure on adult goods has increased for all household sizes and in both urban and rural areas from 1997 to 2007. Based on Rothbarth's approach, which takes adult good to be an indicator of welfare, this signifies an increase in household welfare through these years. Although the increase in adult good expenditure through these years could indicate an increase in welfare based on Rothbarth's approach, this increase is more likely to be due to inflation in the case of Iran. Also, as can be seen from these figures, the difference in Rothbarth's welfare measure, i.e. logarithm of adult good expenditure, between rural and urban households is not that marked, the range being approximately between 13 and 17 for rural and 14.5 and 17.5 for urban areas through the years for different household sizes.

Table 2. The Rothbarth Welfare Index
(Logarithm of adult good expenditure), 1997-2007

F1: Rural households F2: Urban households

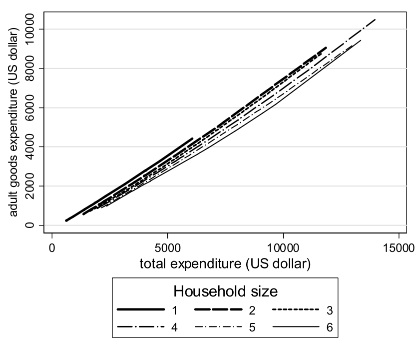


Note: the above graphs show the non-linear fits for the corresponding scatter-plots.

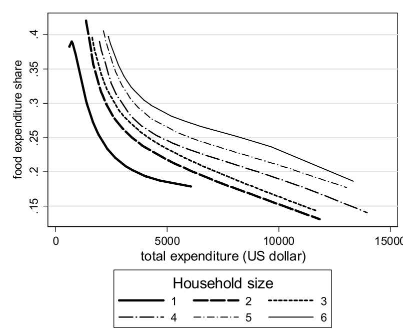
In Table 3 we illustrate the Rothbarth and the Engel curves for households of different sizes, irrespective of their locality. As can be seen, the shapes are as expected and, consistent with the underlying theory, an increase in household size shifts the Rothbarth curve downwards and to the right and the Engel curve upwards and to the right.

Table 3. Rothbarth and Engel Curves for Iranian Households, 1997-2007

F1: The Rothbarth Curve



F2: The Engel Curve



Note: the above graphs show the non-linear fits for the corresponding scatter-plots.

4. Rothbarth's equivalence scales and estimates of cost of children

4.1. Background

As mentioned previously, the Rothbarth and Engel methodologies can be used to obtain an estimate for the cost of children. In both cases, the cost of children is determined by the difference between the total expenditures of two equally well-off but differently sized households. In the Engel-based approach, two households are considered to be equally well-off if they spend the same proportion of their income on food while in the Rothbarth-based approach if they spend equal amounts on an adult-specific good. Therefore, what makes these methods different is simply their specific indicator of welfare. However, as most studies in this area have argued, the Engel methodology overstates and the Rothbarth methodology understates the actual cost of child. Given that it is not possible to directly measure the true cost of a child, the corresponding estimates can be taken as useful indications of the upper and lower limits of the cost when deciding on a benchmark value.

Engel's approach was first used by Thomas Espenshade (1984) to develop estimates of child costs for a US national study. Many states in the US initially based their child support guidelines on Esphenshade-Engel estimates as it was the most authoritative study available at the time (**CPR, 2010, p10)**[1]. However, it has since become widely accepted that the Engel-based approach overestimates the cost of children because food consumption is thought to constitute the main bulk of the cost associated with a new child and even if a household is fully compensated, the arrival of a child will push up the food budget share. Thus, because Engel's approach relies on food consumption and aims to maintain the food expenditure share as before, it will lead to a higher amount than what is actually required. As a result, an alternative approach of measuring child costs based on Rothbarth's methodology was employed by David Betson. Since 1990, Betson has conducted four studies in estimating child rearing costs for the USA, based on different approaches including Engel and Rothbarth's methodologies, each study using more recent data[2].

Deaton and Meullbauer (1986) conducted a study for Sri Lanka and Indonesia, estimating the cost of child based on Rothbarth's approach. Lancaster and Gray (1998) estimated child equivalence scales for Australia using both Rothbarth and Engel's methodologies. Van der Ven (2004) also calculated equivalence scales based on both Rothbarth and Engel estimation methods for the UK and Australia. Gray and Stanton (2010) carried out a meta-analysis of the results from Australian studies to derive consensus estimates for the cost of a child in Australia based on different methodologies, including Engel's and Rothbarth's.

4.2. Estimating equivalence scales using the Rothbarth's method

The procedure to estimate equivalence scales using the Rothbarth methodology is similar to that of Engel's, as mentioned in the previous chapter. However, the dependent variable is adult good expenditure instead of food expenditure share. The equivalence scale of a household would be its total expenditure divided by the total expenditure of the reference household,

1 Centre for Policy Research (CPR) (2010), "Economic Basis of Updated Georgia Child Support Schedule", website.

2 Centre for Policy Research (CPR) (2010), "Economic Basis of Updated Georgia Child Support Schedule", website

when their expenditures on an adult good are equalised (see Section 2, Fig 1). To illustrate this, consider equations 3 and 4 below which correspond to the reference household (childless couple) and a household consisting of the parents and a number of children respectively, denoted by subscripts *r* and *h* respectively

$$\ln G_r = \hat{\alpha}_r + \hat{\beta} \ln E_r \tag{3}$$

$$\ln G_h = \hat{\alpha}_h + \hat{\beta} \ln E_h + \hat{\gamma}_h CH_h \tag{4}$$

where G , E and CH respectively refer to expenditure on adult good, total expenditure and the number of children in the household, and a '^' denotes the estimated value based on the full sample. The equivalence scale for household *h* would thus be calculated using

$$ES = \frac{E_h}{E_r} = \exp\left(\frac{\hat{\alpha}_r - \hat{\alpha}_h - \hat{\gamma}_h}{\hat{\beta}}\right) \tag{5}$$

which is derived by setting CH=1 and $\ln \hat{G}_h = \ln \hat{G}_r$.

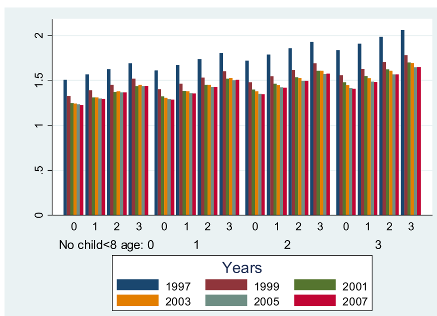
The results of child equivalence scales based on the above approach and using the estimates reported in Table 1 above are given in Table 4. In each Figure in the Table, the horizontal axis represents the number of children and is divided into 4 groups. In all groups *NC8_18* varies between 0 and 3 whilst *NCl8*=0 for the first group (second from the left), *NCl8*=1 for the second group (second from the left), *NCl8*=2 for the third group (third from the left), and *NCl8*=3 for the last group.

The reference household for the left panel (F1 and F2) is an urban couple household with no child. For the right panel, the reference household is a rural couple household for rural estimates (F3) and an urban couple household for urban estimates (F4).

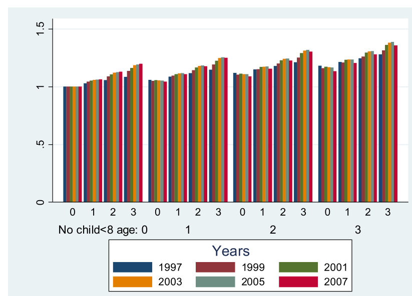
We can see that the equivalence scale estimates increase with increase in the number of children for all the years for both rural and urban households in both panels. In the left panel rural households have higher equivalence scale estimates across the years for all numbers of children compared to their corresponding urban households. This indicates that the cost of child is lower in rural areas and consequently they need a higher compensatory amount to reach the same level of welfare as urban households with similar numbers of children. In the right panel, there is little difference between the equivalence scales of rural and urban households. Another point to mention is that there is not much difference in the equivalence scale estimates between F1 and F3 indicating that although the cost of child is lower in rural areas, and hence the larger ES in rural households (F1) in comparison to their corresponding urban households (F2), this difference is small and thus it appears that the pattern of child cost in urban and rural areas is alike.

Table 4. Child Equivalence Scales, 1997-2007 (Rothbarth approach)

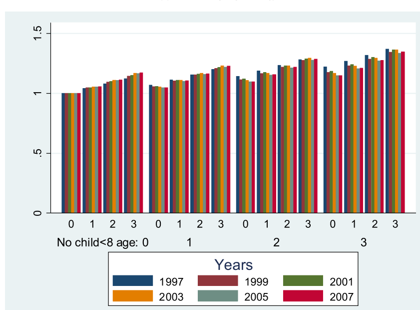
F1: Rural households
Reference household: urban couple household with no child



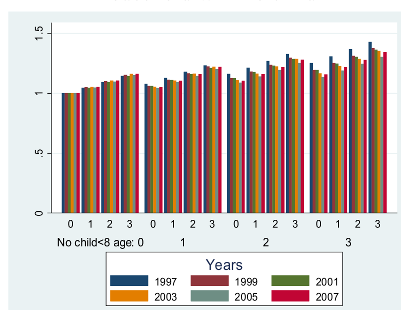
F3: Rural household
Reference household: Rural couple household with no child



F2: Urban households
Reference household: urban couple household with no child



F4: Urban households
Reference household: urban couple household with no child



Note: F1 and F2 are based on the same regressions as reported in Table 1 above while F3 and F4 are calculated using separate regressions for rural and urban households which exclude the RU dummy.

Based on Rothbarth's approach and using data from 2007, for urban household's in Iran, the equivalence scale for one child (under 8 or 8-18 yrs) is 1.05 and for two children (irrespective of their age group) is 1.10 (Table 6). For rural household's the equivalence scale for one child under 8 is 1.04, one child between 8 and 18 is 1.06, two children under 8 is 1.09, two children between 8 and 18 is 1.13 and two children one under 8 and one between 8 and 18 is 1.11. The above results are based on the reference household being a couple urban household for urban estimates and a couple rural household for rural estimates. Estimates have also been calculated for other years (1997-2007), other numbers of children and using different reference households (i.e. single adult, urban couple household for both urban and rural estimates). These are available on request. The implications of the variations in equivalence scale estimates are discussed below.

In order to compare our findings for Iran with the evidence reported in the literature, consider the following:

(a) Using adult clothing as a proxy, Lancaster and Ray (1998) provide estimates of Rothbarth equivalence scales for households with two adults and one, two and three children respectively as estimates are 1.15, 1.32 and 1.52.

(b) Gray and Stanton (2010) report Rothbarth's equivalence scale estimates for Australian households to be 1.18, 1.39 and 1.63 for households consisting of a couple with one, two and three children respectively.

(c) Van der Ven (2003) reports Rothbarth equivalence scale estimates based on food outside the home and using a single adult as the reference as 1.26 for one child, 1.59 for two children, and 1.93 for three children for the UK. His corresponding estimates for Australia are 1.18, 1.46 and 1.76 respectively.

(d) Deaton and Muellbauer (1986) give their Rothbarth estimates for Sri Lanka as 1.12 for one child and 1.21 for two children, and for Indonesia as 1.10 for one child and 1.16 for two children 5 years old or younger and 1.12 for one child and 1.22 for two children older than 5 years old (reference household being a childless couple). Deaton (1997, p257) reported these same results in terms of percentages, arguing that children cost between 20% and 40% of an adult.

(e) Betson (2010) reported the cost of child estimates for the USA based on Rothbarth's approach where he found the average share devoted to one child to be 24%, to two children 37% and to three children 45% of total household expenditure.

5. Comparing Rothbarth-based estimates with those based on Engel's method

The Engel method, explained in detail in the previous chapter, uses estimates obtained from the following regression

$$w_{h,t} = \alpha_t + \beta_t \ln E_{h,t} + \gamma_t NCl8_{h,t} + \theta_t NC8\_18_{h,t} + \delta_t RU_{h,t} + v_{h,t} \qquad (6)$$

where w is the food expenditure share, E is total expenditure, v is a well-behaved disturbance term satisfying the required properties and the rest of the notation correspond to the Rothbarth's regression equation (2) above. Note that for convenience in reporting we have used identical coefficients in equations (2) and (6), and we report their corresponding estimates for the 3 1997, 2001 and 2005 in Table 5 below (estimates for the other years are available on request). All coefficient estimates are statistically significant and have the expected signs: (i) food expenditure share falls and adult good expenditure rise when total expenditure increases; (ii) an increase in the number of children raises the food expenditure share increases and reduces the adult good expenditure. In Engel's model, the coefficient estimate for *NCl8* has decreased from .023 in 1997 to .013 in 2005, signifying a fall in their contribution to food expenditure share and the reverse has happened with the coefficient for *NC8_18*, increasing from .014 (1997) to .021 (2005), indicating an increase in their contribution to food expenditure share. In Rothbarth's model, the coefficient for *NCl8* has decreased and that of *NC8_18* has increased from 1997 to 2005, signifying an increase in their contribution to adult good expenditure where children are below 8 years of age and a decrease in their contribution to adult good expenditure where they are aged between 8 and 18 years. Based on these estimates we can claim that the cost of children below 8 years of age has fallen and that of children aged between 8 and 18 years of age has risen. Another interesting point to note is that the Engel coefficient for children below 8 years of age was higher than that of children between 8 and 18 years of age in 1997, and that this was reversed in 2005. A similar change has also occurred in Rothbarth's coefficients. Compared to *NC8_18*, *NCl8* was associated with higher household food expenditure share levels in 1997 and with lower levels in 2007. Similarly they were associated with lower adult good expenditure levels in 1997 and higher levels in 2007. This possibly signifies a change in the pattern of spending on children in Iranian households. The pooled data shows us that the food expenditure share (adult good expenditure) associated with *NCl8* is slightly lower (higher) than that of *NC8_18*.

An interesting evidence emerging from these estimations concerns the role of location of residence in the two models: the coefficient of the rural/urban dummy, *RU*, has a negative sign in Engel's model but it switches to positive in Rothbarth's model. Thus, the impact of urban location is to reduce the food expenditure share and raise the adult good expenditure, which is suggestive of the urban/rural life-style discrepancy that is, to some extent, inevitable.

Finally, it is worth noting that although the R^2 for Rothbarth's model is significantly higher than that for the Engel's model, this is simply due to the fact that the dependent variables in the two models are in different scales: in Engle's model the dependent variable is the ratio of food expenditure to total expenditure whereas in Rothbarth's model it is the level of adult good expenditure.

Table 5. A comparison between coefficient estimates of equations (2) and (6)

	1997		2001		2005		Pooled(1997-2007)	
	Engel	Rothbarth	Engel	Rothbarth	Engel	Rothbarth	Engel	Rothbarth
$\hat{\beta}_t$	-.0684591 (-14.94)	1.02501 (47.65)	-.0825569 (-21.96)	1.106599 (98.36)	-.0892901 (-30.04)	1.146643 (122.69)	-.0803516 (-24.03)	1.104421 (131.14)
$\hat{\gamma}_t$	.0231014 (8.76)	-.0679906 (-7.81)	.0219251 (7.72)	-.0624111 (-9.17)	.0134344 (5.77)	-.0524242 (-8.19)	.0187996 (10.01)	-.0599291 (-12.35)
$\hat{\theta}_t$	.0143803 (6.92)	-.0393933 (-5.99)	.0214153 (14.41)	-.051494 (-14.43)	.0211593 (14.90)	-.0581509 (-20.44)	.0193342 (14.01)	-.0512503 (-18.76)
$\hat{\delta}_t$	-.1146785 (-12.82)	.4177333 (15.58)	-.0824929 (-17.62)	.243411 (16.70)	-.0793281 (-23.43)	.2376829 (20.41)	-.0879935 (-22.05)	.2748952 (19.70)
$\hat{\alpha}_t$	1.510634 (22.83)	-1.422709 (-4.67)	1.728535 (27.59)	-2.530049 (-14.39)	1.889215 (34.41)	-3.243944 (-18.39)	1.60406 (35.04).	-2.638957 (-28.36)
R^2	0.3371	0.8409	0.3992	0.9040	0.4162	0.9214	0.4013	0.9283
N_t	18446	18446	23119	23119	23348	23348	248560	248560

Estimation method is survey least squares using 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 to capture the impact of inflation across the years (the corresponding coefficient and t-ratio is not reported but is available on request).

As mentioned previously, there is a general consensus that Rothbarth's (Engel's) equivalence scale and cost of children estimates are relatively lower (higher) than the actual cost of child, the two estimates providing a range within which policy makers might wish to set the benchmark. In Table 6 below we provide the estimates which show this range for 2007, covering households of different composition, separately for urban and rural households. Engel-based estimates are consistently larger than their Rothbarth-based equivalents. Also, as discussed in detail in the previous chapter, there is a notable difference in Engel-based equivalence scales between urban and rural households, the former having higher values for all household compositions. Finally, it is worth noting that Engel-based scales are higher for *NC8_18* compared to those for *NCl8*, in both rural and urban areas. This age difference in scales is also seen, although not as profoundly, in Rothbarth's scales for rural households, but not for urban households (their equivalence scales being either equal or very close in value for children in the two age groups).

Table 6: Equivalence Scale Estimates of the Cost of Child in Iran for 2007

Household Composition			Equivalence Scale Values			
			Rural Households		Urban Households	
Parents +	***NCl8 +***	***NC8_18***	Engel	Rothbarth	Engel	Rothbarth
Parents +	0 +	0	1	1	1	1
Parents +	0 +	1	1.25	1.06	1.35	1.05
Parents +	0 +	2	1.56	1.13	1.83	1.10
Parents +	0 +	3	1.94	1.20	2.47	1.16
Parents +	1 +	0	1.11	1.04	1.24	1.05
Parents +	1 +	1	1.39	1.11	1.68	1.10
Parents +	1 +	2	1.74	1.18	2.27	1.16
Parents +	1 +	3	2.17	1.25	3.06	1.22
Parents +	2 +	0	1.24	1.09	1.54	1.10
Parents +	2 +	1	1.55	1.15	2.08	1.16
Parents +	2 +	2	1.94	1.23	2.82	1.22
Parents +	2 +	3	2.42	1.30	3.80	1.28
Parents +	3 +	0	1.38	1.13	1.92	1.16
Parents +	3 +	1	1.73	1.20	2.59	1.22
Parents +	3 +	2	2.16	1.28	3.50	1.28
Parents +	3 +	3	2.69	1.36	4.73	1.34

NCl8 and NC8_18 refer to number of children below age 8 years and between 8 and 18 years of age respectively; see explanations below equation (2). Estimates are available on request for other years (1997-2007) and other household compositions.

To provide a comparison with other results in the literature as an example, the following are worth noting:

(a) Based on Engel's approach the equivalence scale estimates for a couple with one child below 8 years old are 1.11 and 1.24 respectively for rural and urban households; the corresponding estimates for one child of age 8 to 18 years old are 1.25 and 1.35. The Engel estimates for a household with one child (based on two adult reference household) were found to be 1.21 by Lancaster and Ray (1998), 1.23 by Gray and Stanton (2010) and 1.39 and 1.50 for UK and Australia respectively (based on one adult as the reference household) by Van der Ven (2003). Deaton (1997, pg253) reports Engel-based estimates for a couple with one child in any of 4 different age groups to be between 1.24 and 1.34 for India and 1.28 and 1.42 for Pakistan.

(b) Our Engel-based equivalence scale estimates for a rural household with two children below 8 years of age is 1.24, for a rural household with two children of age between 8 and 18 years is 1.56, and for a rural household with two children of whom one is below 8 years of age and one is between 8 and 18 years old is 1.39. Our corresponding estimates for urban households are 1.54, 1.83 and 1.68, respectively. Engel-based estimates for a household with two children in Australia were found to be 1.45 by Lancaster and Ray (1998), 1.46 by Gray and Stanton (2010) and 1.83 and 2.05 for UK and Australia respectively by Van der Ven (2003).

(c) Based on our results, Engel-based estimates of equivalence scales for households with three children, in different age groups and localities, were between 1.38 and 2.47. The equivalent estimates reported in the literature were 1.75 by Lancaster and Ray (1998), 1.71 by Gray and Stanton (2010) and 2.27 and 2.63 for UK and Australia respectively by Van der Ven (2003).

In the light of the above discussion[1], it follows that our results are in line with those of other similar studies and on the whole demonstrate that the cost of children does not double or treble with the addition of a second or a third

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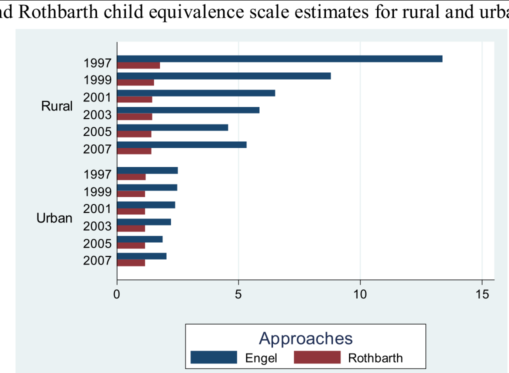
1 Estimates of the cost of children using the Engel approach can also be found in Esphenshade (1984) and Betson (2001). However, these report the cost of children as percentage of total household expenditure — Esphenshade's estimates are 24%, 41% and 51% and Betson's are 30%, 44% and 52% for the share of total household expenditure devoted to one, two and three children, respectively — and cannot be compared directly with the rest reported above.

child, establishing the existence of economy of scale in this respect which ought to be taken into account when formulating welfare policies in this context.

Finally, we provide in Table 7 a comparison of our estimates of equivalence scales based on Engel's and Rothbarth's methods. As the figures show, regardless of which reference household is used, Engle-based estimates are in all cases higher. When an urban couple household is used as the reference for both urban and rural estimates (F1), there is a notable difference in the Engle-based estimates between rural and urban households, the former being higher. This means that higher compensatory amounts are needed in order for a rural household to reach the welfare level of an urban household of the same characteristics. The difference in the Rothbarth-based scales between urban and rural households is not as marked. This shows that when food is taken as the proxy of welfare (Engel approach), the welfare level of rural households is shown to be much lower than their corresponding urban household but when adult good expenditure is used (Rothbarth approach) their welfare levels become closer. Another relevant finding concerns the fact that while Engel-based estimates have decreased through the years, Rothbarth-based ones have remained fairly constant. This observation has strong implications for which measure the policy maker chooses in setting the welfare system benchmarks

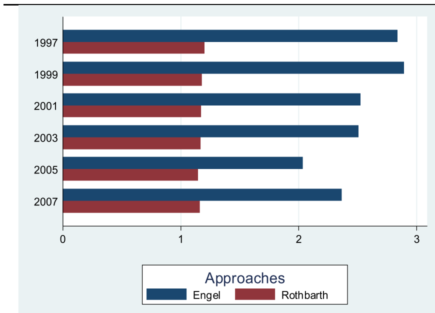
Table 7- Child equivalence scale estimates for Iranian households, 1984-2007 (Based on the Engle and Rothbarth methodologies)

F1: Engel and Rothbarth child equivalence scale estimates for rural and urban households



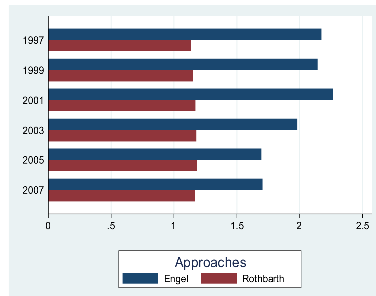
The reference household is an urban couple household for both urban and rural estimates

F2: Equivalence scales for urban households



The reference household is an urban couple household

F3: Equivalence scales for rural households



The reference household is a rural couple household

6. Summary and Conclusions

In this chapter we have used the Iranian household survey data to estimate the cost of children based on the theory of equivalence scales within the context of welfare analysis. We have argued that these estimates are essential if a policy makers wish to design a more appropriate welfare system of child benefit as opposed to that which currently practised in Iran.

We have used both Engel's and Rothbarth's methodology to derive the corresponding estimates of equivalence scales for different household types. We have argued that the use of both of these methods is essential since they result in a range of equivalence scales for each type of household with Engle-based and Rothbarth-based estimates constituting the upper and lower limits of the scales.

Our estimates, based on the underlying regression equations, have been consistent with the corresponding theoretical priors and the magnitudes of the equivalence scales calculated from these estimated have been in line with those reported in the literature. The evidence provided in this chapter supports our claim that the household survey data provides a valuable source of information for the design of an advanced welfare system compared to that currently practised by the authorities in Iran. In particular, we have shown that

(a) Rural/urban divide plays a considerable role when Engel's method is used but has a much smaller impact on Rothbarth-based estimates. This is consistent with the results of our previous chapter, where we saw a difference between rural and urban Engel estimated household equivalence scales, and signifies the importance of location or residence when food is taken as the proxy of welfare.

(b) Children's age group has an impact on their costs and this effect too is more enhanced shown in Engel-based estimates. This evidence indicates that treating all the children as identical and disregarding their age group is likely to bias the child benefit payment and that a fairer welfare system should be progressive in this respect by taking account of the age group effect.

(c) Our estimates imply the existence of a time pattern in households' behaviour underlying welfare analysis. In particular, both Engel-based and Rothbarth-based estimates demonstrate that (i) the cost of children below 8 years of age has fallen and that of children aged between 8 and 18 years has risen over the period of analysis, and (ii) the cost of children below 8 years of age was higher than those in the 8 to 18 years of age in 1997 and this was reversed in 2007. The existence of such time patterns indicates the need for a dynamic welfare system which takes account of such patterns. A more fundamental issue, of course, concerns the search for causes of such patterns since it is of utmost importance to determine whether they occur as a result of evolving habits or they are simply due to the volatile economic conditions.

(d) The total number of children in the household is another important variable that needs to be considered where children's costs are concerned. This follows from the finding that households' expenditure in general are subject to economies of scale in that doubling the number of children is likely to less than double the total cost allocated to them.

All in all, in this chapter we have established that socioeconomic and demographic factors play important roles in determining households' welfare and as such their impact ought to be explicitly built into the benefit system that concerns households' welfare. Due to limitations, we have experimented in this chapter only with a limited number of variables. However, we wish to stress in concluding this chapter that the household survey data is a rich source that contains information on different aspects of households' characteristics. Thus, in addition to those considered in this chapter, features such as parents' age, employment and marital status, children's education, households' composition regarding their non-immediate-family members (a factor that is common in Iranian households) and similar factors should be used in constructing a more advanced household welfare system. Clearly, this is a fertile area for future research and further work needs to be done by, for instance, estimating the cost of children using various methodologies to improve robustness and to identify the influencing factors.

Reference:

- Betson, D (2010), "Appendix A: Parental Expenditures on Children, in Judicial Council of California, Review of Statewide Uniform Child Support Guideline", San Francisco, California.
- Betson, D.M. (2010), "Parental Expenditures on Children: Rothbarth Estimates" A report prepared for the State of California.
- Central Bank of Iran. Economic Time Series Database, available at http://www.cbi.ir/page/4275.aspx.
- Centre for Policy Research (CPR) (2010), "Economic Basis of Updated Georgia Child Support Schedule" website.
- Deaton, A (1997), "The analysis of household surveys: a microeconometric approach to development policy", Published for the World Bank, The Johns Hopkins University Press, Baltimore and London.
- Deaton, A and Muellbauer, J. (1986), "On measuring child cost: with application to poor countries ", *Journal of Political Economy*, Vol. 94, No. 4, PP.720-744.
- Ghanoon-e Modiriyat-e Khadamat-e Keshvari.
- Gray, M and Stanton, D. (2010), "Costs of children and equivalence scale: A review of methodological issues and Australian estimates". *Australian Journal of Labour Economics*, volume13, number 1, pp 99-115.
- Lancaster, G. and Ray, R. (1998), "Comparison of Alternative Models of Household Equivalence Scales: The Australian Evidence on Unit Record Data", *Economic Record*, 74: 129-39.
- Rothbarth, E. (1943), "Note on a Method of Determining Equivalent Incomes for Families of Different Composition", Appendix 4 in Madge C. (ed.), War Time Pattern of Saving and Spending, Occasional Paper No. 4, National Income of Economic and Social Research, London, UK.
- Van der Ven, J. (2004), "Demand-based Equivalence Scale Estimates for Australia and the UK", National Institute of Economic and Social Research, Discussion Paper No.228.
- Watts, H. (1967), "The Isoprop Index: An Approach to the Determination of Differential Poverty Thresholds", *Journal of Human Resources,* 2, 3-18.
- White, H. and Masset, E. (2002), "Child poverty in Vietnam: using adult equivalence scales to estimate income-poverty for different age groups", MPRA Paper No. 777, posted 07. November 2007.