



The Role of Household Arrangements in Income Comparisons: A Happiness Approach

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A happiness approach. Mexico

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Abstract:

The family is a central institution in most societies and its predominance in Latin American societies is widely accepted; although, its internal arrangements may show substantial differences along time and across cultures. The family is an ancient institution whose origin may be associated to some evolutionary needs. The institution of the family does play a direct role in promoting the survival of the specie and it may play many roles in fostering the well-being of its members. For example, the institution is associated to such important roles as child rearing and nurturing, correspondence of sentiments and affective support, care, satisfaction of psychological needs, and many others. The family also plays many important economic roles, such as: allowing for specialization and division of household chores, pooling up resources for the benefit of all members, informal insurance for members facing unexpected loses, and setting specific within-household resource-allocation norms (Rojas, 2006a).

People do live under different household arrangements. Households differ in size (number of income dependents) and in demographic composition (age and gender of members). In addition, households may implement different norms for the intra-household distribution of the benefits from household resources. It is usually recognized that household and intra-household arrangements matter for people's well-being. Cross-country and cross-household well-being comparisons which are based on household income face the challenge of appropriately incorporating the economic role of the family. Its appropriate incorporation is a crucial requirement –among many others- to make reliable well-being assessments of household members as well as to make well-being comparisons across households on the basis of household income. However, the common practice in the economic literature has been to disregard their role. As a matter of fact, cross-country comparisons based on GDP per capita and cross-household comparisons based on household per capita income completely neglect the economic role of the family. Furthermore, adult-equivalent scales are mostly based on strong and arbitrary assumptions. If the family plays a significant economic role in fostering well-being then these cross-country and cross-household comparisons based on per capita computations may be misleading, with important consequences for our correct assessment and interpretation of such relevant economic indicators as the rate of economic growth, the distribution of income, and the computation of poverty and economic-mobility figures.

This paper uses a happiness approach to address a crucial question in well-being assessments based on income comparisons: what is the appropriate way of making income-based well-being comparisons across households with different arrangements? The using of the happiness approach in addressing this relevant issues is relatively new but very promising (van Praag and Ferrer-i-Carbonell 2004; Rojas 2007, 2010) The happiness approach provides an equivalence scale founded on people's satisfaction measures which can be used to make well-being comparisons for persons living under different household arrangements.

The empirical research takes advantage of the first happiness survey implemented by a National Statistical Office in Latin America. INEGI (Mexico's national statistical office) implemented the BIARE (*Self-Reported Well-Being Survey*) in 2012; with more than 10650 observations it is a representative survey at the country level. This survey provides information about people's overall subjective well-being (happiness, life satisfaction) as well as about satisfaction in some domains of life –including the economic domain-. Further information from the BIARE and from the parallel ENGASTO survey allows studying the kind of household arrangement these people live in.

The main findings from this research show that there are moderate size economies within the family, and that household arrangements –as measured by age-structure of the family- are crucial in defining adult equivalence scales. Furthermore, it is shown that infants and adolescents imply a greater economic-satisfaction burden in comparison to adults, while elder people imply a lower burden. No substantial gender effects were found. In addition, it is observed that the Oxford and per capita equivalence scales tend to overestimate the economic burden of addition household members, in special in the case of larger families.

Keywords: Happiness, equivalence scales, subjective well-being, Mexico

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1. Introduction

The estimation of equivalence scales is fundamental for the well-being comparison of persons living under different household arrangements. How the economic burden in the household is affected by the household's number of members is a main concern in welfare economics. Equivalence scales are needed to make well-being comparisons across families that differ in size and members' age. Some crucial issues in economics are very sensitive to the equivalence scale being used to transform household income into a personal-level income-based well-being proxy. Issues such as the classification of people as poor, the study of income distribution in a population, and the design and implementation of tax schemes are very sensitive to the adult equivalence scale being used. Furthermore, if household arrangements do play a role then such relevant indicators as historic rates of economic growth in a country and GDP per capita comparisons across countries should take into account changes in household arrangements over time in a country as well as differences in household arrangements across countries. Being such a crucial issue in economics it is surprising to find out that the definition of adult equivalence scales is mostly based on strong technical assumptions and on value judgements. As a matter of fact, the Organization for Economic Cooperation and Development (OECD) opts for proposing different scales without making any recommendation on their using. A note by this organization states that "In general, there

is *no accepted method* for determining equivalence scales, and no equivalence scale is recommended by the OECD for general use”.

This paper follows a happiness approach -also known as subjective well-being approach (SWB)- to study what kind of adult equivalence scale allows for appropriate economic satisfaction comparisons across persons living under different household arrangements. The approach is based on the emerging literature on ‘happiness and economics’ (Easterlin, 1974, 1995, 2001; Clark and Oswald, 1994; Di Tella *et al*, 2001; Ferrer-i-Carbonell and Frijters, 2004; Frey and Stutzer, 2000, 2002; Layard, 2005; McBride, 2001; Ng, 1997; Oswald, 1997; van Praag *et al*, 2003; van Praag and Ferrer-i-Carbonell, 2004; Rojas, 2006b, 2006c; and Stutzer, 2004) The emerging happiness and economics paradigm is based on a simple but revolutionary idea: rather than presuming people’s well-being based on their assets and on their purchasing power it is better to directly ask people about their experience of being well. If well-being is a living experience people do have then they are in a privileged position to assess their situation and to let experts know about it.

The implementation of the approach in calculating equivalence scales assumes that the economic burden from an additional household member can be approximated by a marginal rate of substitution measuring the required change in a person’s income (the compensatory income) which is needed to keep a person’s economic satisfaction constant as the number of her household members increases (Rojas, 2007). The paper shows how the happiness approach can be used to estimate equivalence scales in order to make well-being comparisons between persons living under different household arrangements –

differences in the size of the household and in the age and gender composition of household members.

It is important to state that the main purpose of an equivalence scale is to make it possible to compare the well-being of persons living under different characteristics. The size and age and gender composition of their household is just one of the many characteristics in which persons can differ; for example, they could also differ in how healthy family members are. Thus, it is conceivable to calculate an adult equivalence scale contemplating for health differences in household members across families. However, this paper will concentrate in the computation of an adult equivalence scale which allows comparing the well-being of persons living under different household arrangements –household size and household age and gender composition-. The happiness approach leads to the computation of adult equivalence scales indicating the required change in a person’s household income in order to keep her economic satisfaction constant when her household size varies; the equivalence scale can also incorporate differences in the age and gender of household members.

The empirical analysis is based on a large survey run by Mexico’s national statistical office (INEGI) to inquire about the subjective well-being situation of Mexicans. The survey took place in 2012, and it constituted the first subjective well-being survey run by a national statistical office in Latin America. The survey is representative at the national level and the database incorporates sampling expansion factors. More than 10650 questionnaires were properly applied.

The main findings from this research show that there are moderate size economies within the family, and that household arrangements –as measured by age-structure of the

family- are crucial in defining adult equivalence scales. Furthermore, it is shown that infants and adolescents imply a greater economic-satisfaction burden in comparison to adults, while elder people imply a lower burden. No substantial gender effects were found. In addition, it is observed that the Oxford and per capita equivalence scales tend to overestimate the economic burden of addition household members, in special in the case of larger families.

This paper is structured as follows: Section 2 summarises the relevant literature on estimation of equivalence scales. Section 3 presents the happiness approach to the estimation of equivalence scales. Section 4 explains the construction of the Mexican database used to estimate an economic-satisfaction-based equivalence scale. Section 5 presents the estimated adult equivalence scale; it also studies how alternative equivalence scales, which are commonly used in the literature, tend to overestimate the economic-satisfaction burden of additional household members, which also implies and overestimation of the required income a person needs in order to keep her economic well-being constant as household size increases. Section 6 proposes an extension to the happiness methodology in order to contemplate different age compositions for household members; it calculates the household age-composition adjusted equivalence scale. Section 7 explores the role of household gender composition. Final considerations are presented in section 8.

2. Literature Review

The literature on the estimation and use of equivalence scales is vast. Commonly referred surveys include Blackorby and Donaldson (1994), Blundell (1988), Blundell,

Preston, and Walker (1994), Bourguignon and Chiappori (1994), Browning (1992), Cowell and Mercader-Pratts (1999), Deaton and Muellbauer (1980), Deaton (1999), Lewbel (1997), Pollak and Wales (1992), and Slesnick (1998). This literature also overlaps with the literature on household living arrangements (Benjamin, 1992; Brien and Sheran, 2003; Strauss and Thomas, 1995; Thomas, 1990; Vogel, 2003)

An equivalence scale attempts to answer the following question: “how much income would an individual living alone needs to attain the same indifference curve that the individual attains as a member of the household?” (Browning *et al*, 2004, p. 2) This is a modified version of an early question phrased as “how much money does a household need to earn to be as well off as a single person living alone?” However, problems on the conception and construction of a household’s utility function have lead to the current questions focusing on a household member’s utility rather than on the household’s utility. Hence, the question can be rephrased as “how much money must be earned in a specific n -members household in order for one of its members to be as well off as a person living alone”. The question can also be rephrased in terms of finding a compensatory income, this is: how much additional household income we must provide to the current members of a household in order to compensate for the burdens of incorporating an additional household member. The approach assumes an egalitarian distribution of benefits from household income among all household members; otherwise it would be necessary to identify the specific household member the equivalence scale is built for.

It is customary to assume for the existence of scale economies at the household level; as a matter of fact, equivalence scales are usually introduced as an adjustment to

the widely used household per capita income measures. It is stated that the existence of shared consumption and of public goods and services within the household makes it reasonable to introduce an adjustment to household per capita measures. In consequence, it is assumed that an additional person in the household does imply a lower economic burden with respects to the previous one. Thus, the required income to keep constant the well-being of a person increases as the number of his or her household members goes up; however, it increases at a decreasing rate because of scale economies (Vermeulen, 2000) It is also possible to consider adjustments on the basis of the age of the additional person in the household; the argument is that an additional child may not imply a similar burden than an additional adult. The argument could also apply to the gender of the additional person in the household.

Although there is general agreement among researchers on the existence of scale economies at the household level, there is substantial disagreement on the degree of these economies. As a matter of fact, it seems that we are flying blind when making proposals about the degree of scale economies. As it is stated by Székely *et al* (2004, p. 531) “*There is little theoretical guidance on what the values of α (the degree of scale economies) should be*”. It is noteworthy to put attention to the semantics used by Székely *et al.*; they are not referring to what the values of α *are*, but to the what the values of α *should be*.

Empirical research on the identification of equivalence scales has followed different approaches:

Political approach: van Praag and Ferrer-i-Carbonell (2004) affirm that sometimes the equivalence scale is defined by parliamentary or civil servants on the basis of its intuitive appeal and some nutritional considerations.

Micro-modelling approach: scales are constructed on the basis of spending patterns; and well-being levels are approximated by spending variables such as food share, and adult consumption (Charlier, 1997; Deaton and Muellbauer, 1986)

Demand-systems approach: the welfare level is approximated through the use of indirect measures of the expenditure function. The utility function in the model determines demand equations that can be estimated, and from which welfare conclusions can be obtained (Lewbel, 1989, 1997) However, these demand equations do not fully identify welfare functions, as it has been shown by Blundell and Lewbel (1991), Deaton and Muellbauer (1980), Muellbauer (1974), and Pollak and Wales (1979 a, b). Pollak and Wales (1979, p. 216) have notably criticised this methodology on the basis that “the equivalence scales required for welfare comparisons are logically distinct from those which arise in demand analysis.”

Referring to the methodological problems on equivalence scales estimation, Ebert and Moyes (2000, p. 2) remark that “*The arbitrariness would not be too much a problem if the choice of the adjustment procedure were shown to have little impact on the normative conclusions to be drawn. However, this is far from being the case and a number of examples in the literature have made clear that the way incomes are transformed and weighted affects dramatically the results.*”

Equivalence scales are of relevance for obtaining conclusions and making recommendations on such issues as poverty, inequality and redistribution programmes. For example, there is an extensive literature on the relationship between equivalence scales and poverty (Blackburn, 1998; de Vos and Zaidi, 1997; Foster and Shorrocks, 1988; Lanjouw and Ravallion, 1995; Ravallion, 1994 and 2012) In an empirical study

about the calculation of the number of poor people in Latin America, Székely *et al* (2004) estimate poverty on the basis of three options for the degree of scale economies: $\alpha=0.9$, $\alpha=0.8$, $\alpha=0.7$. They do justify these values on the basis that $\alpha=0.5$ is commonly assumed in developed countries; hence, they presume that Latin American countries, being middle-income rather than high-income countries, should have a lower degree of scale economies (higher α value). Székely *et al* (2004) find out that the number of poor families in Latin America is very sensitive to the degree of scale economies assumed. A similar procedure is followed by Creedy and Sleeman (2004), who simulate poverty and inequality figures under different degrees of scale economies. They show that the assumption about the degree of scale economies is of importance for the accountability of poor families and for the measurement of the distribution of income. The relevance of using a subjective well-being approach to address the issue of finding what the degree of scale economies is has recently being recognized by Ravallion (2012), who states that “until recently, most economists have resisted a seemingly obvious solution, namely to ask people themselves: “Do you feel poor?” ... Indeed, the idea of a “social subjective poverty line” (below which people tend to think they are poor, but above which they do not) is arguably the most conceptually appealing way of defining poverty.”

3. The Happiness Approach to Estimation of Equivalence Scales

The happiness approach (also known as the subjective well-being approach SWB) does not require an explicit micro-economic model. The welfare level for the construction of equivalence scales is approximated by a person’s self-declared satisfaction level. The Leyden School has pioneered this approach (van Praag and

Kapteyn, 1973; Kapteyn and Wansbeek, 1985; van Praag and Ferrer-i-Carbonell, 2004). Kapteyn and van Praag (1976), van Praag and van der Sar (1988), van Praag and Ferrer-i-Carbonell (2004) and Rojas (2007 and 2010) have used the happiness approach to estimate equivalence scales.

Suppose that a person's utility depends of her household income, on her household size and on other personal characteristics. Household income is a proxy for this person's capacity to satisfy material needs; while household size indicates the number of persons this purchasing capacity must be shared with. It is expected for utility to increase with household income and to decrease with household size. Let's define a concave utility function in household income and household size:¹

$$U = \alpha_0 + \alpha_y \ln Y + \alpha_s \ln S + \sum_{i=1}^n \gamma_i X_i \quad (1)$$

where:

U a satisfaction indicator (it could be happiness, life satisfaction, or economic satisfaction)

Y household-income in thousands of Mexican pesos

S number of household-income dependants

X_i control variable i . $i = 1, \dots, n$. Includes socio-demographic variables such as education, marital status, and others.

Solving for Y :

$$Y = e^{(U - \alpha_0 - \alpha_s \ln S - \sum_{i=1}^n \gamma_i X_i) / \alpha_y} \quad (2)$$

¹ A linear utility function in income and household size can also be empirically explored.

Setting U at a constant level U_k , it is possible to find combinations of all those household incomes and family sizes that render a constant utility level U_k ; given a person's socio-demographic condition, which is characterized by the vector X . Thus:

$$Y = e^{(U_k - \alpha_0 - \alpha_s \ln S - \sum_{i=1}^n \gamma_i X_i) / \alpha_y} \quad (3)$$

The required income level to attain satisfaction level U_k for a given family size S_0 and socio-demographic situation X_0 is given by:

$$Y(S_0, X_0 : U_k) = e^{(U_k - \alpha_0 - \alpha_s \ln S_0 - \sum_{i=1}^n \gamma_i X_{i0}) / \alpha_y} \quad (4)$$

In consequence, it is possible to calculate the percentage change in income that is required when family size changes from S_0 to S in order to keep a person's utility constant at level U_k as:

$$R(S_0 \rightarrow S, X_0 : U_k) = \frac{Y(S, X_0 : U_k)}{Y(S_0, X_0 : U_k)} = \frac{e^{(U_k - \alpha_0 - \alpha_s \ln S - \sum_{i=1}^n \gamma_i X_{i0}) / \alpha_y}}{e^{(U_k - \alpha_0 - \alpha_s \ln S_0 - \sum_{i=1}^n \gamma_i X_{i0}) / \alpha_y}} \quad (5)$$

$$R(S_0 \rightarrow S, X_0 : U_k) = e^{(\alpha_s (\ln S_0 - \ln S)) / \alpha_y} \quad (6)$$

Notice that the same reasoning can be used to estimate the required change in household income to keep satisfaction constant at U_k when a person's socio-economic situation changes from X_{i0} to X_i , given his or her family size. In general:

$$R(S_0 \rightarrow S, X_{i0} \rightarrow X_i : U_k) = \frac{Y(S, X : U_k)}{Y(S_0, X_0 : U_k)} = \frac{e^{(U_k - \alpha_0 - \alpha_s \ln S - \sum_{i=1}^n \gamma_i X_i) / \alpha_y}}{e^{(U_k - \alpha_0 - \alpha_s \ln S_0 - \sum_{i=1}^n \gamma_i X_{i0}) / \alpha_y}} \quad (7)$$

$$R(S_0 \rightarrow S, X_{i0} \rightarrow X_i : U_k) = e^{(\alpha_s (\ln S_0 - \ln S)) / \alpha_y} * e^{(\sum_{i=1}^n \gamma_i (X_{i0} - X_i)) / \alpha_y} \quad (8)$$

The specification used in this analysis (equation 1) implies that compensation ratios are independent of the defined satisfaction level U_k and of other characteristics.

Thus:

$$\begin{aligned} R(S_0 \rightarrow S, X_0 : U_k) &= R(S_0 \rightarrow S) \\ R(X_0 \rightarrow X, S_0 : U_k) &= R(X_0 \rightarrow X) \end{aligned} \quad (9)$$

4. The Database

4.1 The survey

Mexico's national statistical office (INEGI) run a survey during the first trimester of 2012 to inquire about the subjective well-being situation of Mexicans. Adult persons between 18 and 70 years old were randomly selected in households where another survey (ENGASTO) was also being applied. The survey is representative at the national level and it was run following the high standards of a national statistical office. The sample has a total of 10654 observations from all parts of the country. The database from the survey is called the BIARE (*Bienestar auto-reportado*: self-reported well-being) and it is available from INEGI's webpage.²

4.2 The information

The survey gathered information regarding the following variables:

Subjective Well-Being Variables: The survey gathered information about people's satisfaction with life and happiness as well as about people's satisfaction in specific domains of life. An important decision when using the happiness approach to estimate adult equivalence scales corresponds to the selection of the dependant variable which will proxy the concept of utility in economic theory. Several papers have shown that the

² <http://www.inegi.org.mx/inegi/contenidos/investigacion/experimentales/bienestar/default.aspx>

relationship between income and overall measures of subjective well-being –such as happiness and life satisfaction- is very weak; thus, rather than using overall measures of subjective well-being, in this paper we use economic satisfaction as the proxy variable for the concept of utility. Economic satisfaction has shown a closer relation to income measures. The specific question in the survey states: “Would you please tell me, in a 0 to 10 scale, how satisfied do you feel with each one of the following aspects in your life?” One of the options is “your economic situation”. The response scale allows for interpreting people’s assessments as a cardinal variable. The average economic satisfaction in the survey is 6.5, and the standard deviation is 2.3. About 30% of people in the survey report an economic satisfaction of 5 or less, while about 36% of people in the survey report an economic satisfaction of 8 or more.

Income variable: The survey does not provide information about people’s household or personal income. However, there is information about the household’s total expenditure. Current expenditure seems to be a better proxy than income for measuring people’s access to those goods and services that contribute to their well-being.

Family-structure variables: The BIARE provides information about the number of household members. It is also possible to get information about the age and gender of each household member on the basis of the ENGASTO survey, which was applied in parallel to the BIARE survey. Table 1 provides information about the age and gender structure on the average household. On average, households have 4.54 members, 2.33 are women and 2.22 are men. 3.3% of the households have just one member, 10.5% have two members, 23.5% of households have 4 members (this is the mode), and there are about 1.5% of households with more than 10 members.

Household members were classified in five groups according to their age: infants (0 to 4 years old), children (5 to 12 years old), adolescents (13 to 17 years old), adults (18 to 65 years old), and elder people (66 or more years old). Table 1 presents the averages for this age and gender structure. There are about 3.2% of households where women are not present and about 4.2% of households with no men. About 32 % of the households have at least one infant in the family, about 41.7% of the households have at least one child, about 31.5% of households have at least one adolescent, and about 14.6% of the households have at least one elder person.

Table 1
Household Structure
Average number of household members
by gender and age
Mexico, 2012

Age in years	Men	Women	Total
0 to 4	0.20	0.21	0.41
5 to 12	0.31	0.32	0.63
13 to 17	0.21	0.20	0.41
18 to 65	1.40	1.51	2.91
66 and more	0.09	0.09	0.18
Total	2.22	2.33	4.54

Source: computed by the author from BIARE/ENGASTO database

Demographic and Social Variables: The BIARE also provides information about the respondent's education, age, gender, civil status, and health condition. Table 2 provides descriptive statistics.

Table 2
Descriptive statistics for population in BIARE
Mexico 2012

Variable	Mean	Std. Dev.
Women	0.52	0.50
Age	38.3	14.0
Health problem	0.14	0.35
Schooling		
None	0.05	0.22
Primary incomplete	0.12	0.33
Primary complete	0.16	0.37
Secondary incomplete	0.03	0.18
Secondary complete	0.28	0.45
High school	0.18	0.38
Licenciatura	0.16	0.36
Graduate	0.01	0.10
Marital status		
Stable partner	0.18	0.38
Separated	0.05	0.21
Divorced	0.02	0.13
Widowed	0.03	0.18
Single	0.24	0.43
Married	0.49	0.50

5. Estimation of Equivalence Scales

5.1 The economic-satisfaction burden of incorporating one additional member

On the basis of equation (1), the following regression is estimated with *OLS* techniques:³

$$U = \alpha_0 + \alpha_y \ln Y + \alpha_s \ln S + \sum_{i=1}^n \gamma_i X_i + \mu \quad (10)$$

where:

U economic satisfaction, in a 0 to 10 scale.

Y household total expenditure in Mexican pesos.

S number of household members.

³ Alternative specifications used show that this concave specification in income and household size better fits the data. For example, the R-squared for a linear regression on total expenditure and household size is 0.073, while the non-linear specification shown in equation (10) has an R-squared of 0.095.

X_i control variable i . $i = 1, \dots, n$. Includes socio-demographic variables such as gender (women equals 1, men equals 0), age in years, age squared (divided by 100), health problems, schooling, and marital status.

Table 3 presents the results from the econometric analysis:

Table 3			
Economic Satisfaction			
OLS regression			
Variable	Coef.	Std. Err.	P>t
lnY	0.704	0.045	0.00
lnS	-0.546	0.064	0.00
Woman	0.096	0.054	0.08
Age	-0.042	0.013	0.00
Age_squared_/100	0.053	0.015	0.00
Health problem	-0.457	0.081	0.00
Stable partner	-0.167	0.077	0.03
Separated	-0.409	0.120	0.00
Divorced	-0.058	0.152	0.70
Widowed	-0.290	0.143	0.04
Single	-0.223	0.086	0.01
Married		Reference category	
None	-0.422	0.229	0.07
Primary incomplete	0.065	0.189	0.73
Primary complete	0.071	0.182	0.70
Secondary incomplete		Reference category	
Secondary complete	0.189	0.176	0.28
High school	0.326	0.182	0.07
<i>Licenciatura</i>	0.447	0.183	0.02
Graduate	0.375	0.260	0.15
Intercept	1.659	0.526	0.00
R-squared: 0.953			
Source: analysis with data from BIARE 2012			

Both household total expenditure and household size have the expected signs and are statistically significant. An increase of a hundred per cent in household expenditure rises *economic satisfaction* in almost 0.70 (in the 0 to 10 scale). If the number of household members doubles then *economic satisfaction* declines in 0.55.

The goodness of fit of the regression, as measured by the R-squared, is 0.095; which can be considered as normal for subjective well-being variables.

Other interesting results from the analysis indicate that economic satisfaction shows a U-shaped relationship with age.⁴ Married people tend to have greater economic satisfaction than people in other marital categories, with the exception of divorced ones. Economic satisfaction seems to rise with schooling, even after controlling by expenditure.

5.2 Computation of equivalence scale

On the basis of equation (6), the estimated coefficients for household expenditure and number of household members can be used to compute the percentage change in expenditure that is required when family size changes from S_0 to S in order to keep *economic satisfaction* constant at level U_k . Table 4 shows the estimated percentage change when S_0 is assumed to be 1. In other words, it shows the required percentage change in income for a household of size S with respects to a one-member household.

Number of Household Members	$R(S_0 \rightarrow S; X_0, U_k)$ $S_0=1$
S = 1	1.00
S = 2	1.71
S = 3	2.34
S = 4	2.93
S = 5	3.48
S = 6	4.01
S = 7	4.52
S = 8	5.02
S = 9	5.50
S = 10	5.96

⁴ Education has an important impact on *economic satisfaction*. However, it does not have a relevant impact on the estimation of equivalence scales. The estimated equivalence scale remains almost unchanged when the education variable is dropped from the regression.

Table 4 shows that there are economies of scale in the household; any additional person in the household implies a much smaller economic burden than the previous one. Thus, additional income is needed at a decreasing rate to keep a person's *economic satisfaction* constant as her household size increases. For example, an increase of 71 percent in household income is required to keep a person's economic satisfaction constant when a second member is added to his or her household; while a 19 percent increase is required to keep a person's economic satisfaction constant when a fifth person is added to a four-member household.

5.3 Overestimation of economic burden by alternative equivalence scales

The subjective well-being equivalence scale [$R(S_0=1 \rightarrow S; X_0, U_k)$] is directly based on economic-satisfaction levels. Thus, it is a more accurate equivalence scale for making well-being comparisons. It is possible to compare the overestimation implied by alternative scales commonly used in the literature. For example, Table 5 compares the subjective scale to the so-called Oxford scale –also known as old OECD scale–, and to the per capita scale –which is implicitly used when household per capita income is calculated to make cross-household comparisons–. It is observed that both scales tend to overestimate the economic burden of additional adult household members, and that the degree of overestimation increases with the number of household members; let's recall that the average household size in Mexico is 4.5. This finding has important implications for poverty measurement, as well as for public-policy decisions; for example, a family of four or five members may be considered very poor when using a household per capita income but not poor when using an equivalence scale estimated on the basis of a happiness approach.

Number of Household Members	Economic Satisfaction Scale	Oxford Scale (adults only)	Percentage of Overestimation	Per capita Scale	Percentage of Overestimation
S = 1	1.000	1.0	0.0	1	0.0
S = 2	1.712	1.7	-0.7	2	16.8
S = 3	2.344	2.4	2.4	3	28.0
S = 4	2.930	3.1	5.8	4	36.5
S = 5	3.484	3.8	9.1	5	43.5
S = 6	4.013	4.5	12.1	6	49.5
S = 7	4.523	5.2	15.0	7	54.8
S = 8	5.017	5.9	17.6	8	59.5
S = 9	5.496	6.6	20.1	9	63.7
S = 10	5.964	7.3	22.4	10	67.7

5.4 Calculation of the parameter α

The literature (Buhmann *et al*, 1988; Coulter *et al*, 1992) commonly defines the equivalent size of a household of size S as $S_{eq}=S^\alpha$. Where the parameter α is associated to the degree of economies of scale in the household. α declines as the magnitude of scale economies increases.

The equivalent income can be calculated as: $Y_{eq}(S)=Y/S^\alpha$. Therefore a one-person household with an income of Y has the same economic satisfaction as a person living in an S -person household with an income of $Y \cdot S^\alpha$. $\alpha=1$ implies no economies of scale; thus, household per capita income would be the relevant variable for well-being comparisons. $\alpha=0$ implies extreme scale economies; thus, household income would be the relevant variable for well-being comparisons.

The parameter α can be found from equation (6) by equating $R(S_0=1 \rightarrow S; X_0, U_k)$ to S^α .

$$\begin{aligned}
R(S_0 = 1 \rightarrow S, X_0 : U_k) &= e^{-(\alpha_s / \alpha_y) * (\ln S)} = S^\alpha \\
&= (\alpha_s / \alpha_y) \ln S = \alpha \ln S \\
\alpha &= -\frac{\alpha_s}{\alpha_y}
\end{aligned}
\tag{11}$$

Thus, on the basis of results from Table 3, the parameter α is 0.776 for the Mexican sample. This parameter indicates that the so-called new OECD scale, where an α of 0.5 is recommended, leads to underestimation of the economic burden from additional household members.

6. Household Age Composition and Adult-Equivalence Scales

6.1 Adult equivalence scales: Adjusting for household age composition

The literature also recognises that the age structure of household members play an important role in the definition of equivalence scales (Banks and Johnson, 1994; Creedy and Sleeman, 2004; Cutler and Katz, 1992; Jenkins and Cowell, 1994; van Praag and Warnaar, 1997) It is common to assume that children do imply a lower economic burden than adults. For example, the Oxford scale differentiates between adult and non-adult members. Additional adults are weighted by 0.7, while any additional non-adult member is weighted by 0.5. Gerdtham and Sundberg (1996) use the following scale for Sweden: Additional adults are weighted by 0.65; children younger or equal to 5 years old by 0.51, children 6 to 15 years old by 0.62, and children 16-18 years old by 0.65. Thus, in general, it is not only recognized that there is an economic burden from additional household members, but also that this economic burden varies with the age of the additional member. Hence, equivalence scales need to take into consideration the age composition of the household.

6.2 Information on household's age-structure

The ENGASTO survey was applied in parallel to the BIARE survey and it allows having information about the age and gender of each household member where the BIARE survey was applied. Based on this information it is possible to study what the economic burden from additional household members of different ages is.

6.3 Adult-equivalence scale estimation

As it was explained before, the utility specification takes into consideration a person's household income, her household size, and other personal characteristics. It is now recognized that all household members may not be of the same age. Hence, the objective is to study how the economic satisfaction of an adult person in the household is affected by changes in her household income, her household age composition, and other personal characteristics. The following non-linear utility specification is used to study the impact of household age-structure:

$$U = \alpha_0 + \alpha_y \ln Y + \alpha_s \ln(S_{adu} + \alpha_{tee} S_{tee} + \alpha_{ch} S_{ch} + \alpha_{inf} S_{inf} + \alpha_{eld} S_{eld}) + \sum_{i=1}^n \gamma_i X_i \quad (12)$$

where:

S_{adu} number of household members who are in between 18 and 65 years old (adults)

S_{tee} number of household members who are in between 13 and 17 years old (adolescents)

S_{ch} number of household members who are in between 5 and 12 years old (children)

S_{inf} number of household members who are in between 0 and 4 years old (infants)

S_{eld} number of household members who are 66 years old or more (elders)

The other variables in the regression have already been defined.

On the basis of the methodology introduced in section 3, simple manipulation of equation (12) yields:

$$R(S_{adu0} \rightarrow S_{adu}, S_{tee0} \rightarrow S_{tee}, S_{ch0} \rightarrow S_{ch}, S_{inf0} \rightarrow S_{inf}, S_{eld0} \rightarrow S_{eld}, X_{i0} \rightarrow X_i : U_k) = e^{\alpha_s (\ln(S_{adu0} + \alpha_{tee} S_{tee0} + \alpha_{ch} S_{ch0} + \alpha_{inf} S_{inf0} + \alpha_{eld} S_{eld0}) - \ln(S_{adu} + \alpha_{tee} S_{tee} + \alpha_{ch} S_{ch} + \alpha_{inf} S_{inf} + \alpha_{eld} S_{eld})) / \alpha_y} * e^{\sum_{i=1}^n \gamma_i (X_{i0} - X_i) / \alpha_y} \quad (13)$$

Let's consider as the reference case a household composed by one adult person, thus, $S_{adu0} = 1$, $S_{tee0} = 0$, $S_{ch0} = 0$, $S_{inf0} = 0$, and $S_{eld0} = 0$.

Under the assumption that the socio-demographic characteristics of the adult person remain constant ($X_i = X_{i0}$), then:

$$R(S_{adu0} = 1 \rightarrow S_{adu}, S_{tee0} = 0 \rightarrow S_{tee}, S_{ch0} = 0 \rightarrow S_{ch}, S_{inf0} \rightarrow S_{inf}, S_{eld0} \rightarrow S_{eld} : U_k) = e^{\alpha_s (-\ln(S_{adu} + \alpha_{tee} S_{tee} + \alpha_{ch} S_{ch} + \alpha_{inf} S_{inf} + \alpha_{eld} S_{eld})) / \alpha_y} \quad (14)$$

Equation (14) shows how to calculate the equivalence scale for different household sizes and age structures with respects to a one adult-person household.

6.4 Regression analysis

The following regression was estimated with non-linear least squares techniques:

$$U = \alpha_0 + \alpha_y \ln Y + \alpha_s \ln(S_{adu} + \alpha_{tee} S_{tee} + \alpha_{ch} S_{ch} + \alpha_{inf} S_{inf} + \alpha_{eld} S_{eld}) + \sum_{i=1}^n \gamma_i X_i + \mu \quad (15)$$

Table 6 shows the estimated coefficients:

Table 6
Economic Satisfaction and Socio-economic Explanatory
Variables
Considering Household's Age Composition
Non-linear least square estimation with specification (15)

	Coefficient	P>t
LnY	0.698	0.000
S _{adu}	-0.463	0.000
S _{inf}	2.860	0.018
S _{ch}	1.392	0.015
S _{tee}	1.961	0.017
S _{eld}	0.485	0.047

R-squared 0.096

Note: control variables include age, age squared, gender, marital status, health problems, and schooling.

Both the coefficients for household expenditure and for the number of household members (α_s) are statistically significant and have the expected signs: A person's economic satisfaction increases with her household expenditure and declines with her household size. The age composition in the household seems to make a difference in a person's economic satisfaction. In the margin, having an extra member of less than 5 years old (an infant) represent a much higher economic burden than having an adult extra member in the household. The marginal burden from adolescents and children is also larger than the burden from adults. Additional members being elder represent a lower burden than adults.

6.5 Adult-equivalence scale computation

Results from Table 6, together with equation (14), allow for the computation of an adult-equivalence scale for the Mexican data on the basis of the happiness methodology. Table 7 shows the computed adult-equivalence scale for different household sizes and age compositions.

Table 7
Adult Equivalence Scale
For different age-composition households
Happiness Approach

Total household size	Age structure of the household					Adult equivalence scale
	Adults	Infants	Children	Adolescents	Elders	
	S_{adu}	S_{inf}	S_{ch}	S_{tec}	S_{eld}	
1	1	0	0	0	0	1.000
2	2	0	0	0	0	1.584
2	1	1	0	0	0	2.450
2	1	0	0	1	0	2.055
2	1	0	0	0	1	1.300
2	0	0	1	0	2	1.784
3	3	0	0	0	0	2.072
3	2	0	1	0	0	2.249
3	2	1	0	0	0	2.854
3	1	0	2	0	0	2.418
3	1	0	1	0	1	2.016
3	1	0	1	1	0	2.653
4	4	0	0	0	0	2.508
4	2	0	2	0	0	2.825
4	2	2	0	0	0	3.880
4	1	1	1	1	0	3.709
4	2	0	0	0	2	2.059
5	2	0	2	1	0	3.547
5	2	2	1	0	0	4.331
5	1	0	2	2	0	3.875
5	2	1	0	0	2	3.220
6	2	1	2	1	0	4.485
6	2	1	2	0	1	4.015
6	4	0	0	0	2	2.897
6	2	2	2	0	0	4.759

It is observed that the age structure of the household matters when computing adult-equivalence scales. For example, an adult person living in a family of four members –two elder persons and two adults- may require twice the household expenditure of an adult living alone in order to have a similar economic satisfaction. However, if this person lives in a family of four members composed by two adults and two infants then

he/she would require a household expenditure of about 3.8 times that of an adult living alone in order to have the same economic satisfaction.

In another example, an adult person living alone may require from 30% to 140% of additional economic resources (expenditure) to keep his or her economic satisfaction constant when a new household member comes. He or she would require a 30% rise in expenditure if the new person is elder or a 140% rise in expenditure if the new person is an infant. If the new person is another adult then a 60% rise would be needed.

6.6 Estimating the parameters α and β with household age-composition considerations

The general expression for equivalent income $Y_{eq}=Y/S^\alpha$ can be expanded to allow for differences in household age composition. The adult-equivalent size of a household of size S with composition S_{adu} , S_{tee} , and S_{ch} can be defined as:

$$S_{eq}(S_{adu}, S_{inf}, S_{ch}, S_{tee}, S_{eld}) = \left(S_{adu}^{\beta_{adu}} + S_{inf}^{\beta_{inf}} + S_{ch}^{\beta_{ch}} + S_{tee}^{\beta_{tee}} + S_{eld}^{\beta_{eld}} \right)^\gamma \quad (16)$$

and the equivalent income would be:

$$Y_{eq}(S_{adu}, S_{inf}, S_{ch}, S_{tee}, S_{eld}) = \frac{Y}{S_{eq}(S_{adu}, S_{inf}, S_{ch}, S_{tee}, S_{eld})} \quad (17)$$

The parameter γ is associated to overall household-size economies of scale; the specific β parameters are associated to an adjustment to general economies of scale according to the age of the additional member. The β parameters would be equal to 1 if there were no differences in the economic burden of additional members across age groups.

Table 8 shows the estimated parameters γ and β :

Parameter	Value
β_{adu}	0.658
β_{inf}	0.851
β_{ch}	0.733
β_{tee}	0.789
β_{eld}	0.431
γ	0.886

It is observed that the economic burden of additional household members depends on their age. In a household constituted only by adult members the α parameter would be computed as the multiplication of $\gamma * \beta_{adu}$, providing a value of $\alpha=0.58$. The economic burden of an additional member would be much smaller if this additional member is elder (e.g.: grandparent) than if he or she is an infant (e.g.: a new baby in the house). Infants, children and teenagers do imply a larger economic burden with respect to adults.

7. Household Gender Composition and Adult-Equivalence Scales

The same methodology used in section 6 can be implemented to study the role of gender in computing adult-equivalence scales. Table 9 shows the result from the econometric exercise. It is observed that, in general, women represent a slightly lower economic burden than men.

	Coefficient	P>t
LnY	0.705	0.000
S _{men}	-0.548	0.000
S _{women}	0.852	0.000

R-squared 0.094

Note: control variables include age, age squared, gender, marital status, health problems, and schooling.

Table 10 presents the computed γ and β parameters. It is observed that gender considerations seem not to be as important as age consideration.

Table 10 Adult-Equivalence Scale γ and β parameters household gender-composition considerations	
Parameter	Value
B_{men}	1.178
β_{iwomen}	1.106
γ	0.680

8. Conclusions

This investigation uses a subjective well-being methodology to estimate adult-equivalence scales. The subjective well-being methodology allows estimating equivalence scales that are solidly founded, since they are based on a person's declared well-being. It is clear that each person is in a privileged position to judge their economic satisfaction. It is also clear that using information about people's possessions does not suffice to have a good idea about people's experience of being well.

It is shown that economic satisfaction increases with household income and declines with the number of household-income dependants. The investigation finds out that there are economies of scale within the Mexican households; thus, the loss of economic satisfaction from having additional household members decreases in the margin. The degree of scale economies in Mexico is greater than that assumed by the per capita and by the Oxford adult equivalence scales. These two adjustment schemes to household income would overestimate the economic-satisfaction burden faced by Mexicans as family size increases.

Household age composition has also proven to be relevant for the estimation of equivalence scales. It is shown that the economic burden –loss of economic satisfaction–

from an additional member being infant, child, or adolescent is larger than the economic burden from an additional adult person and much larger than that for elder persons. This is an unexpected result, because the literature usually assumes that children do imply a smaller economic burden than adults. Hence, it is convenient to take into consideration not only the size of the household but also its age composition when estimating equivalence scales.

Household gender composition seems not to be a fundamental consideration when estimation adult equivalence scales in Mexico.

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