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A Useful Preliminary Step for Evaluating Equivalence Scales

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Abstract

We suggest a simple survey method for evaluating certain features of equivalence scales that make their econometric estimation difficult. Our questionnaires focus on testing: (a) the dependence of equivalence scales on household income; and (b) the dependence of weights of children and adults on household income and demographic composition. We test our approach in two countries, Germany and Cyprus, finding similar results. We argue that our method is theoretically and statistically reliable and also appropriate for capturing the aforementioned dependencies. Data collected in this way can be a solid first step for building and testing applied consumer models used to estimate equivalence scales and household-production parameters.

Key Words: equivalence scales, survey method, independence of base

JEL Classification: C42, C90, D31, D63, I31, H23

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1. Introduction

The measurement of inequality and poverty in an economy requires an accurate comparison of well-being across households. This comparison becomes complicated as different families have different demographic composition. The concept of equivalence scales aims at erasing such complications by translating the well-being of different family types into a single income-based language. In particular, an equivalence scale is the income ratio of two households with different demographic composition guaranteeing that both of them have the same welfare level.

An issue of key importance in consumer expenditure-based (or econometric) methods of measuring equivalence scales is the potential dependence of scales on household income. Uncovering such a dependence using econometric modelling methodologies becomes a very difficult task, given that one should first uncover another hard aspect of household microeconomic analysis: this of within-household semi-public goods and economies of scale. The latter phenomena are usually unobserved in consumer statistical surveys. Since both preferences of households and household-production externalities are unobserved, there are too many degrees of freedom when one tries to estimate a parametric demand system from consumer-expenditure data. Recent econometric studies by Pendakur (1999) and Pendakur and Donaldson (2000) attempt to measure the dependence of equivalence scales on income and reflect such aforementioned difficulties.

In this study, we suggest a complementary survey method that aims at providing a reliable way of measuring the dependence of equivalence scales on income, without analyzing explicitly household economies of scale. To the extent that we succeed in doing so, we add a necessary piece to the puzzle of modelling living standards through consumer theories and econometric estimation. One can use patterns of dependence of scales on income derived by

our method as a guide for constructing an appropriate empirical consumer demand system that replicates these patterns from consumer expenditure data. Such a combination of the two approaches can be helpful for modelling unobserved household-production externalities.

We say that our method is one piece of the puzzle of equivalent incomes, because the true puzzle is not simply to measure equivalence scales, but to construct applied models that explain them. Only with the aid of applied models one is able able to draw conclusions on the responsiveness of inequality and poverty to policies. But we do not go as far as putting all the pieces of the puzzle together in this study: here we focus on presenting our survey method and providing cross-country evidence that it is reliable. Our method is a useful preliminary step for achieving a rigorous econometric evaluation of equivalence scales. But securing this preliminary step is a non-trivial task.

Our questionnaires are very simple and direct to the problem. We focus on a single-adult household (reference household) with a given reference-income level. We directly ask our subjects to state welfare-equivalent incomes for hypothetical households with different demographic composition. This task is repeated for different income levels.

We provide evidence from two countries with significantly different economic characteristics: a large industrial power of North Europe, Germany, and a small non-industrial country of South Europe, Cyprus.[1] In both we find similar results: (a) equivalence scales fall with decreasing income at a decreasing rate; (b) the weights of adults are higher than the weights of children; (c) the weights of children fall more rapidly with increasing reference income compared to these of adults; and (d) there are potentially higher costs for the first child in single-parent households compared to two-adult ones.[2]

[1] We contrast a northern with a southern country motivated by the finding of Hall and Jones (1999) that one of the strongest variables that explain differences in GDP levels across countries is their distance from the equator.

[2] As a reminder, the weight of an additional household member is the corresponding stated additional income divided by the reference income of the single-adult household.

For testing the validity of our results and the reliability of our method, we examine the following two particular issues:

(i) Whether subjective biases dominate or generate the findings. We mainly test the possibility of habit persistence in welfare evaluations related to respondent's income levels. Based on a simple theoretical model we motivate several sample classifications that allow isolating potential personal influences and more scrutinizing tests.

(ii) Whether using hypothetical households in our questionnaires is error-generating. We restrict our attention to subjects' stated scales that pertain income levels and demographic compositions similar to their own. We evaluate the patterns of dependence of stated scales on income and other demographic characteristics for this restricted sample. We compare these patterns to the ones from the overall sample and we find no significant differences.

The plan of the paper is as follows. In section 2 we present and explain the structure of the questionnaire and the data from the two countries. In section 3 we run regressions using the overall sample of responses, targeting on testing the aforementioned issues of focus. In section 4 we suggest a simple model of consumer behavior and we use it in order to explain how habit persistence may affect our results. We also test the validity of using hypothetical households in the questionnaire. In section 5 we focus on testing null hypotheses about the weights of adults and children. Section 6 compares our findings with these of previous studies and suggests new directions. Finally, 7 concludes.

2. Methodology and data

2.1 Structure of the questionnaire

Previous survey methods have stimuli and responses referring to different variables (income and welfare levels), so the use of a utility theory from the side of the researcher in elicit-

ing equivalence scales is unavoidable in their case.[3] On the contrary, our questionnaire requires from respondents to use tacitly "their own utility theory" and reach conclusions by themselves about welfare-equivalent incomes across families with different demographic composition.

Our questionnaire is divided into two parts. In the first part, the respondents are asked to evaluate five different situations. Each situation corresponds to a separate small table (one of these five is described by Table 1). Within each small table we provide eight hypothetical families of different size and composition. For only one of these family types, a single adult without children (our reference household), we provide a monetary value that gives this household's after-tax income (the reference income). We leave gaps next to the remaining seven family types. We ask our respondents to fill in the gaps putting the after-tax *family* income that they believe brings the modified household to the same living standard as the one of the single adult (with the given reference income). There are four more tables with identical structure to this of Table 1, but with a different reference income for the single-adult (reference) household.[4]

We should note that varying (gradually) the reference-income level is one of the crucial characteristics of our questionnaire. We want to see whether equivalence scales, as perceived by our subjects, depend on reference income in a systematic way.

In the second part of the questionnaire, our subjects are asked to state several of their personal characteristics: gender, whether they have a partner, the number of children in the household, their after-tax personal income, their educational level, whether they had siblings during their childhood and, finally, their occupation. In Cyprus we also ask our repondents

[3] See Bradbury (1989) for an outline of past survey methods and a comprehensive account of their stimuli-response structure.

[4] For details on the selection of the monetary values of the different reference incomes for each country, how we convert each country's monetary values in terms of the other, and the instructions given to the respondents, see Appendix 1.

to state whether they are living with their parents. We include this characteristic for Cyprus, since, according to our own cultural insights, it is very usual that: (a) single young Cypriot adults often stay in their parents' residence; and (b) old Cypriot adults often live in their married children's households. As it is explained below, the experiment was run first in Germany and, since, again according to our cultural insights, (a) and (b) above hold very rarely in Germany, the question whether respondents live with their parents was not included in the German questionnaire. We believe that this omission does not generate any significant error. A description of these personal characteristics of our respondents for both countries is given in Table 2.a. Some key features of Table 2.a are described in the following subsection below and more details can be found in Appendix 1.

2.2 Data

For Germany we have 167 respondents, whereas it is 130 for Cyprus. Our German sample is mainly from the area of Schleswig-Holstein and especially the city of Kiel. These data were collected in August 1999. Our Cypriot sample comes mainly from the Greek part of Nicosia and also the cities of Larnaca and Lemmesos, and the study was conducted in June 2000. In both countries we have a satisfactory gender distribution, about 43% females. Also, about 58% in both countries have a partner living in their household. Most of our respondents do not have children, and the average number of children in Cyprus is higher. Moreover, as we conjectured earlier, 28.5% of the respondents in Cyprus are living with their parents, even though all the respondents are adults.

The definition of our family-income classes is based on the definition of the German poverty line and facts about the German income distribution. In particular, while the poverty line of the single-childless-adult household is about DEM 1,000 per month (which is our starting value for our reference incomes in the questionnaire), the poverty line for a

two-adult household in Germany is about DEM 1,750.[5] We start from this threshold in order to define our lowest-income class and then we add increments such that the mean of the third income class is about the mean German household income. Each increment is 1.5 $\times$ ("Single–childless-adult Poverty Line" $\equiv$ P). For defining the Cypriot income classes, each German value is multiplied by 60%, after the exchange-rate conversion, in order to obtain the corresponding Cypriot value.[6]

Thus, we have defined 5 cross-country-equivalent after-tax family-income classes that are stated in Table 2.a. Underneath this distribution we also state an "adjusted" (or sometimes in the text "corrected") income distribution. In this second case we convert each respondent's stated family income to their equivalent childless-single-adult household income. This conversion relies on the assumption that each respondent recognizes his/her own income situation when confronted with family types that correspond to his/her own demographic status. We find the respondent's stated equivalent income for their own family type that is closest to their own family income.[7] Then we divide this income with the respondent's stated equivalence scale.

The distribution of occupational characteristics is similar in both countries, but there was an apparent difficulty in approaching welfare recipients, unemployed, pensioners and housewives (in Cyprus we had no welfare recipients and pensioners in our samples). Nevertheless, we examine in a later section the importance of these occupational characteristics for the stated equivalence-scale values.

With respect to educational categories, we take into account the differences in the two

[5] See "Übersicht über das Sozialrecht" (Overview of Social Law) 1998.
[6] The Cypriot per-capita GDP is about 60% of the German in 1999 and the projection for year 2000, see CIA world factbook. See also Flori-Lyssiotou (1997) for the Cypriot distribution and definition of the Cypriot poverty line.
[7] We do not ask our subjects to make any explicit statement about their own family when asked about equivalence scales. We find out about it after looking at their personal characteristics.

educational systems. These differences and how we define the educational groups and the cross-country equivalent educational dummy variables are given in Appendix 1.

Finally, we ask our subjects how many siblings they had during their childhood. We conjecture that this may be an important factor in forming people's perceptions around possible household-production economies of scale. The corresponding distributions are shown at the bottom of Table 2.a. A past tendency of Cyprus to have larger families compared to Germany is reflected in our samples. This may be explained from the fact that Cyprus was at a lower development stage 20-30 years ago, which is often correlated with higher fertility.

Table 2.b gives an overview of our respondents' joint distribution of demographic characteristics and adjusted income. The symbol "A" stands for one adult and "C" for one child in the household. We have very few single parents for both countries, and especially for Cyprus (only one single parent with two children). For Cyprus, however, it is most likely that single parents live with their own parents (the children's grandparents), so some are contained in the two-adult household groups (we state in parentheses how many of the two-adult households have adults living with their parents). More people live by themselves in Germany and in both countries there is a high fraction of households without children. However, our respondents in two-adult households with children are well distributed across the variables "number of children" and "income." Since we are interested in the respondent's views on hypothetical households, we believe that these samples are satisfactory.

3. Testing the IOB hypothesis, and the influence of personal characteristics

As it was mentioned in the introduction, our goals are multiple. First, we want to test the Independence-of-base (IOB) assumption that is the cornerstone of the most commonly used expenditure-based methodologies for calculating equivalence scales. This means that if the

reference income that is provided as a stimulus in our questionnaire is uncorrelated with the equivalence scales stated by our subjects, then IOB holds. Otherwise, our regressions enable us to see the sign of dependency of equivalence scales on reference income.

Second, we want to get an answer to the question whether our subjects value children's needs differently from these of adults. This is easy to identify in regressions explaining the stated equivalence scales, by comparing the regression coefficients corresponding to an additional adult or a child in a household. Our questionnaire enables us to go a bit further by examining whether the needs of children are valued differently depending on whether they live in a one- or a two-adult household. Moreover, we can test how the weights of additional children or additional adults are affected by the reference-income level.

Third, we analyze how personal characteristics affect respondents' answers. Since our study is subjective, we are interested in knowing the extent to which adding personal variables adds to explaining the stated values. This may uncover biases that stem from personal characteristics. For example, women might have different perceptions of family needs and living standards compared to men. Or, more educated respondents may invest more in their children's education, implying higher stated equivalence scales. We also want to see whether people with different occupations state different scale values. It is possible that occupational choice and attitude towards living standards have a correlation. Since we have gathered a few associated personal characteristics of our subjects, we can include them in our regressions.

We specify our econometric models starting from the simplest set of conditioning variables and we proceed by adding more. This strategy allows us to judge the robustness of the results for the most important issues (testing IOB and personal-characteristics biases). Moreover, we can see features that enable us to judge whether our specifications are correct.

We start by estimating a basic linear equation:

$$
\begin{aligned}
E_{i,j} &= a_0 + a_1 STIMULI_j + a_2 STIMULI\_INTERACTIONS_j + \\
&+ a_3 PERSONAL\_Y_i + a_4 OTHER\_PERSONAL(I)_i + \\
&+ a_5 OTHER\_PERSONAL(II)_i + e_{i,j} \ .
\end{aligned}
$$

By $E_{i,j}$ we denote the stated equivalence scales by subject "i" corresponding to stimuli "j". STIMULI$_j$ stands for:

(a) The given reference-income levels. These are the pre-specified single-adult-household incomes, taking the values {1, 2.5, 4, 5.5, 7} (we normalize the lowest reference-income level to 1).

(b) The number of adults, taking the values {1, 2}.

(c) The number of children, {0, 1, 2, 3}.

So, there are 35 values of $E_{i,j}$ for each respondent i (observe that for single-adult households our subjects do not provide data since they are the reference households). The STIMULI_INTERACTIONS$_j$ are the following products between stimuli variables:

(a) Reference income $\times$ number of adults. This product captures the reference-income dependence of the weights of adults as implied by the stated equivalence scales.

(b) Reference income $\times$ number of children. This product captures the reference-income dependence of the stated weights of children.

(c) Number of children $\times$ number of adults. This product captures whether the needs of children are valued differently depending on whether they live in a one- or a two-adult household.

The variable PERSONAL_Y$_i$ is the respondent i's net household income. This is *not* the adjusted after-tax income, but the stated family income. Since the adjusted income is derived by dividing the family income by the stated equivalence scale of the respondent's

demographic situation and income class, there would be a built-in endogeneity between the endogenous variable (equivalence scales) and the explanatory variable (adjusted income). We therefore use only the family income even though it does not capture perfectly the variation in living standards across households.

OTHER_PERSONAL$_i$ is a set of conditioning variables that capture other personal characteristics of each respondent i. We split personal characteristics into two groups, (I) and (II). For distinguishing group (I), we proceed as follows: (i) we exclude variables revealing the occupation of the respondent; and (ii) we exclude two more variables that are highly correlated with personal family income, i.e. living with a partner, "partner," and having children in the household, "children" (for Cyprus we also exclude whether the respondent lives with his/her parents, "living with parents").[8] This specification minimizes the possibility of multicollinearity problems. Therefore, group (I) consists of three variables that are weakly correlated with personal family income, namely: (a) gender (correlation coefficient for Germany 0.048 [-0.009 for Cyprus]); (b) the number of siblings that the respondent had during his/her childhood, "siblings," with correlation coefficient 0.217 [0.181 for Cyprus]; and (c) the education level of the respondent with correlation coefficient 0.06 [0.240 for Cyprus].[9] Finally, $e_{i,j}$ is the error term.

We run two versions of our regressions for each country: (a) one version including an unrestricted constant, reported in Tables 3.a and 3.b; and (b) one version with a constant

[8] For example, the correlation coefficient between personal family income and partner for Germany is 0.54 [0.31 for Cyprus], the one between personal family income and children is 0.44 [0.10].

[9] The low correlation coefficient between personal family income and education of the respondents in Germany may be justified in various ways. First, it may be that there is high variation in the educational levels and incomes between the two working partners and what is taken into account in this correlation is their combined income. Second, the fraction of students in our sample was about 20% [about 23% for Cyprus], and this is a group of highly educated low-income respondents. Going with the first explanation, it is possible that the higher coefficient for Cyprus reflects that the Cypriot marriage market is more efficient in terms of matching couples monotonically according to their education and income (see, for example, Aiyagari, Greenwood and Guner, 2000).

restricted to be equal to one, reported in Tables 4.a and 4.b (an equivalent way of restricting the intercept to the value of one is to subtract the number one from the equivalence scales and also from the number of adults, and simply restrict the constant to be zero). We use version (b) as well, because in our questionnaire the reference household (childless single-adult) has, by definition, equivalence scales equal to one. Therefore, there is a strong theoretical reason to restrict our regression lines to "pass" through this intercept value. The economic interpretation of this restricted specification is that it better captures the weights for the second adult and children.

The specification of Tables 3.a and 3.b (unrestricted constant) allows for an extra degree of freedom that facilitates the multiple linear regression to better capture the relative importance of the explanatory variables. In achieving this, it may do poorly in reflecting reasonable weights for additional adults and children. So, presenting Tables 3 and 4 is useful both for comparing the two countries and for checking the robustness of our conclusions.

In both Tables 3 and 4, columns (1)-(5) have the same linear specification for the stimuli. In column (1) we only include the stimuli and until column (4) we add successively the aforementioned personal-characteristics conditioning groups. In order to avoid potential problems of collinearity between personal family income and the second group of personal characteristics, in column (5) we exclude personal income.

First of all, reference income has a strong negative coefficient for both countries and all specifications of columns (1)-(5). This result strongly contrasts the IOB hypothesis. Also, the stated scale values increase more for an additional adult compared to an additional child. In the unrestricted-constant specification (Tables 3.a and 3.b), all the stimuli coefficients and their errors remain almost unchanged as the conditioning set changes. In the restricted-constant case (Tables 4.a and 4.b), the coefficients change slightly as the condi-

tioning set changes. As we mentioned above, the adult and children coefficients represent more accurately the corresponding weights in Table 4.

Examining the influence of personal characteristics, we observe that in both Tables 3 and 4 "Gender" and "Education" preserve both their significance and their sign of influence. Therefore, these are two personal characteristics that we consider as generating a robust upwards bias in people's perceptions of equivalence scales. The positive influence of education might reflect a desire of more educated respondents to invest more in their children's education. Having children in the household ("Children") generates a robust downward bias in Cyprus.

Apart from most personal characteristics having insignificant influence, the inclusion of all the personal conditioning sets does not add much to the explanation of the variation in responses. In particular, while the adjusted coefficient of determination in column (1) of Tables 3 and 4 is fairly high, it increases by about only 2% for the unrestricted-constant case and by less than 10% for the restricted-constant case in column (4). In general, the quantitative effect of personal characteristics is small.

In column (6) we use a non-linear expression for reference income in order to capture possible non-linearities in the dependency of equivalence scales on this variable of particular interest. It should be noted that (6) is the same as (3) but with squared reference income added. Interestingly, we find that in both countries increasing reference income comes with a decrease in equivalence scales *at a decreasing rate*. This is robust for both countries in both Tables 3 and 4.

So far, our regressions have revealed the estimated weights of adults and children, i.e. how much equivalence scales change for an additional adult or a child, after conditioning for the effect of changing reference incomes. In column (7) we check how these weights of

adults and children change *as a result of* increasing reference income. Therefore, we exclude reference income, we condition for the average weights of adults and children and we use the product of the number of adults (stimulus) times reference income and also the product of the number of children (stimulus) times reference income. We find that in both countries weights for both adults and children decrease as reference income increases. While this result holds for both Tables 3 and 4, we have ambiguous conclusions on the strength of influence of reference income on the weights of adults versus these of children. In Table 3, the weights for children decrease more sharply with reference income for both countries, but this difference is not statistically significant in Table 4.[10] We therefore leave an open questionmark for further investigation of this matter in a later section.

In column (8) we test whether children are valued differently depending on whether they live in a single-adult or a two-adult household. This is revealed by the sign and significance of the coefficient on the product "Number of adults" $\times$ "Number of children." In Table 4, for both countries, column (8) indicates that the perceived needs of children are higher when they live in a single-adult household, compared to living with two parents. However, this is not true for Table 3. We return to this question in a later section using descriptive statistics and more detailed tests.

Our main conclusions from Tables 3 - 4 are as follows:

(a) We find strong evidence against the IOB hypothesis. In fact, equivalence scales decrease with increasing reference income. Moreover, they decrease at a decreasing rate.

(b) The weights of adults are higher compared to these of children. Moreover, it is likely that they decrease faster with increasing reference income for children compared to

[10]For Table 3, a Wald test under the null hypothesis that the coefficients of the two products are the same, was rejected at the 1% level for both countries. On the contrary, for Table 4, a Wald test on whether these effects on weights are the same for adults and children is not rejected with a 25% significance of the test for Germany (50% for Cyprus).

the weights for adults. It is also likely that children's needs are higher when children live in a single-adult household. The latter two observations will be examined more closely in a later section.

(c) From all personal characteristics of the respondents, we observe that only gender and education have a robust upwards influence on the perception of equivalence scales. But these effects are minor. For all other personal characteristics, the influence is not robust and, in any case, minor. In general, personal characteristics do not add much in explaining the variation of stated equivalence-scale values within our method.

3.1 Tests of equality of coefficients across the two countries

Our comparisons in Tables 3.a-b and 4.a-b indicated that the main influence of stimuli and the robust personal characteristics on stated equivalence scales is *qualitatively* similar in both countries. In this section we would like to see whether there are also statistically significant *quantitative* similarities.

For making such comparisons, our strategy is to test whether the coefficients reported in Tables 3.a-b and 4.a-b are statistically different from each other. Our null hypothesis is that the coefficient of a particular variable for Germany is equal to the coefficient of the same variable for Cyprus and we run a Wald test under this constraint. We test this hypothesis as follows: we pool the data for both Germany and Cyprus and we run regressions with each and every variable as being country-specific.[11] Then we test the restriction that the coefficients corresponding to a particular variable are the same for the two countries.

In Tables 3.c and 4.c we state the probability of not rejecting the null hypothesis using a Wald test. In each column we have run a cross-country pooled regression, incorporating

[11]We do not include the variable "Pensioner" in the comparisons since there are no observations on it for Cyprus. We also exclude the variable "Living with parents," since there are no available data on this for Germany.

each and every variable as country-specific (i.e. we use two separate coefficients for the same variable: one with German and one with Cypriot data). Then next to each variable of Tables 3.a-b and 4.a-b we report the significance of the Wald test that the coefficients for Germany and Cyprus pertaining the same variable are equal. We denote with three stars " *** " (" ** " , " * ") that both the F-statistic and the χ^2 have high values that support rejecting the null hypothesis of equality of the coefficients at the 99% (95%, 90%) significance level. The symbol "X" denotes significance below 90%.

The Wald tests reveal that the downwards influence of increasing reference income on equivalence scales is significantly stronger in Cyprus compared to Germany. Moreover, Cypriots stated significantly higher costs for children. It is striking that the costs of adults are also quantitatively similar across the two countries.

With respect to personal characteristics (focusing on variables that were found to be robust in the previous subsection), females in Cyprus stated significantly higher equivalence scales compared to German females. The upwards influence of educational level seems to be quantitatively similar in both countries.

4. Testing the validity of our method

A usual question about subjective methods is to what extent biases stemming from personal characteristics of the respondents may be reflected in the data they provide. In particular, it is difficult to secure that a single way of analysis of subjective data is capable of orthogonalizing an average behavioral or rational rule from subjective biases and/or errors.

We use a simple consumer model as a vehicle of our intuition on what may rationalize our subjects' responses and also drive our observations from Tables 3 and 4. Moreover, we use this model in order to communicate what may go wrong in terms of securing that our

conclusions of the previous subsection are orthogonal to subjective biases. From our model's analysis, we motivate and perform tests that we present below.

For reasons of theoretical and empirical tractability only, we employ a simple version of the Brown and Heien (1972) consumer model. We believe and argue that despite the fact that our model is dominated by more recent consumer paradigms in equivalence scales applications, it is nevertheless adequate for our purposes and that its omitted descriptive features do not affect its qualitative analysis.

4.1 A simple consumer model

Consider a household that consumes a variety of goods $\mathbf{x} = (x_i)_{i\in[0,q]}$ from a continuum [0,q], and let i be an index.[12] We denote the number of adults as n_A and the number of children as n_C. Therefore, a family with (n_A, n_C) members solves the following problem:

$$\max_{(x_i)_{i\in[0,q]}} \int_0^q g^i(n_A, n_C) \frac{(x_i + \kappa_i)^{1-\frac{1}{\eta}} - 1}{1 - \frac{1}{\eta}} di$$

subject to:

$$\mathbf{p}'\mathbf{x} = \int_0^q p_i x_i di \leq y \quad \text{and} \quad x_i \geq \max\{0, -\kappa_i\}. \tag{P1}$$

The vector $\mathbf{p} \equiv (p_i)_{i\in[0,q]}$ is the price vector, y is the household-income level, and $\mathbf{G} \equiv (g^i)_{i\in[0,q]}$ is a vector of functions that map the size and composition of the family into a weighting parameter for consumption good i. These functions capture the extent to which a good is private or public within the household. We assume that $g^i \geq 0$ and that also the derivative $g^i_{n_s} \leq 0$ for all n_s, $s \in \{A, C\}$, and all $i \in [0, q]$. The non-increasing derivative of g^i captures

[12] It need not be a continuum of goods. All the analysis holds for a countable set of goods and q can also be infinity. Moreover, we can include explicit household production in our analysis, taking also into account hours worked in the household. But the present version of the model facilitates best our current purposes.

the congestion sensitivity of a semi-public good within the household. We place no other restriction on the functional forms of $\mathbf{G}(n_A, n_C) \equiv (g^i(n_A, n_C))_{i\in[0,q]}$. In the extreme case of a perfectly private good j within the family (say, clothing for adults and children), the function g^j might imply no sharing possibilities through a functional form as: $g^j(n_A, n_C) = \frac{\beta_j}{n_A+n_C}$ with $\beta_j > 0$. On the opposite extreme of a perfectly public good within the household (say, "security provided by a locked bolt on the door" - see Lazear and Michael 1980), the function might be $g^j(n_A, n_C) = \beta_j$ with $\beta_j > 0$. All other cases of semi-public goods lie "in between." It is obvious that we are using a Stone-Geary demand system that can easily replicate Engel curves for the different goods, where the vector $\boldsymbol{\kappa} \equiv (\kappa_i)_{i\in[0,q]}$ denotes constants (subsistence levels) that can take either a negative or a positive value. We should note that, at the moment, we have not assumed any influence of personal income on the utility function capturing income-related consumption habits.

Proposition 1 *Under the assumption that y, $\boldsymbol{\kappa}$, $\mathbf{p}$ and $\mathbf{G}$, are such that:*

$$y > \kappa_i \frac{\int_0^q g^i(n_A, n_C)^\eta p_i^{1-\eta} di}{\frac{1}{p_i} g^i(n_A, n_C)^\eta p_i^{1-\eta}} - \mathbf{p}'\boldsymbol{\kappa} \quad \textit{for all } i \in [0, q],$$

the demands corresponding to (P1) are given by:

$$\begin{aligned} x_i &= X^i(\mathbf{p}, y, n_A, n_C) = \\ &= -\kappa_i + \frac{1}{p_i} \frac{g^i(n_A, n_C)^\eta p_i^{1-\eta}}{\int_0^q g^i(n_A, n_C)^\eta p_i^{1-\eta} di} (y + \mathbf{p}'\boldsymbol{\kappa}), \end{aligned} \tag{1}$$

and the indirect utility function corresponding to (P1) is given by:

$$V(\mathbf{p}, y, n_A, n_C) = \frac{(y + \mathbf{p}'\boldsymbol{\kappa})^{1-\frac{1}{\eta}}}{1-\frac{1}{\eta}} \left[\int_0^q g^i(n_A, n_C)^\eta p_i^{1-\eta} di\right]^{\frac{1}{\eta}} - \frac{1}{1-\frac{1}{\eta}}. \tag{2}$$

Proof. This is an elementary consumer demand exercise, focusing on interior solutions. Possibly the simplest outline of the argument is given in Jovanovic (1995). Q.E.D.

Now we let a family of size $(\overline{n}_A, \overline{n}_C)$ be the reference household. The (a,c)-th equivalence scale, $m_{a,c}$, for a household with a more adults and c more children should satisfy:

$$V(\mathbf{p}\ ,\ m_{a,c}\cdot y\ ,\ \overline{n}_A + a,\ \overline{n}_C + c) = V(\mathbf{p}\ ,\ y\ ,\ \overline{n}_A,\ \overline{n}_C)\ .$$

Combining this last equation with (2), and setting $\varphi(\mathbf{G}(n_A, n_C), \mathbf{p}) \equiv \int_0^q g^i(n_A, n_C)^{\eta} p_i^{1-\eta} di$, we get:

$$m_{a,c} = \left(\frac{\varphi(\mathbf{G}(\overline{n}_A, \overline{n}_C), \mathbf{p})}{\varphi(\mathbf{G}(\overline{n}_A + a,\ \overline{n}_C + c), \mathbf{p})}\right)^{\frac{1}{\eta-1}} + \left[\left(\frac{\varphi(\mathbf{G}(\overline{n}_A, \overline{n}_C), \mathbf{p})}{\varphi(\mathbf{G}(\overline{n}_A + a,\ \overline{n}_C + c), \mathbf{p})}\right)^{\frac{1}{\eta-1}} - 1\right] \frac{\mathbf{p}'\boldsymbol{\kappa}}{y}\ . \tag{3}$$

Equation (3) gives a clear analysis of the determinants of equivalence scales for this demand system.

First of all, it is easy to see that the function $\varphi(\mathbf{G}(n_A, n_C), \mathbf{p})$ should be weakly decreasing with respect to n_s, $s \in \{A, C\}$. It captures how much the optimal consumption budget is semi-public within the household. In the extreme case that all goods are perfectly public, then $\varphi_{n_s} = 0$, $s \in \{A, C\}$, so (2) implies that all equivalence scales should be equal to one. In the plausible case where $\varphi_{n_s} > 0$, $s \in \{A, C\}$, it is easy to verify that if $\eta > 1$, and $\mathbf{p}'\boldsymbol{\kappa} > 0$, then scales increase as more family members are added. Moreover, if $\varphi_{n_s n_s} \leq 0$, $\eta > 1$, and $\mathbf{p}'\boldsymbol{\kappa} > 0$, then equivalence scales increase *at a decreasing rate* when more family members are added. The latter means that the weights of additional family members are decreasing, a plausible implication.

Second, the consumption "subsistence levels" in conjunction with prices, given by the term $\mathbf{p}'\boldsymbol{\kappa} = \int_0^q p_i \kappa_i di$, play a key role in determining whether scales are independent of base or not. If most goods in the budget are "luxuries" so that $\mathbf{p}'\boldsymbol{\kappa} > 0$, then equivalence scales depend negatively on reference income. The opposite holds if more goods are necessities and prices are such that $\mathbf{p}'\boldsymbol{\kappa} < 0$. We should note that in this demand system it is not necessary

that preferences over all goods are homothetic, i.e. $\kappa_i = 0$ for all $i \in [0, q]$, in order to have $\mathbf{p}'\boldsymbol{\kappa} = 0$, which implies IOB. Our regressions in the previous section indicate that if our assumed demand system is correctly specified, it should be that $\mathbf{p}'\boldsymbol{\kappa} > 0$.

The demand system is of the Stone-Geary form and it has been estimated for the first time in Brown and Heien (1972). If the subsistence level κ_i for good i is negative (i is a necessity), the demand system given by (1) has the interpretation that the consumer takes away from his/her budget the amount $p_i\kappa_i$ before starting responding to prices. Moreover, the consumer responds to prices considering not his overall income y, but the remaining income $y + \mathbf{p}'\boldsymbol{\kappa}$, after he/she has subtracted the net value of all subsistence levels. On the contrary, when good i is a luxury, having $\kappa_i > 0$, the consumer refrains from consumption of i up to the level $p_i\kappa_i$, i.e. he/she first makes sure that there is "disposable" income beyond $y + \mathbf{p}'\boldsymbol{\kappa}$ (income after subtracting subsistence levels). Again, he/she responds to prices by weighting this "disposable" income with the preference and price weight given in (1). So, if the net value of subsistence levels in the budget, $\mathbf{p}' \cdot \boldsymbol{\kappa}$, is positive, with a plausible $\eta > 1$, the equivalence scales are decreasing in income y.

4.2 Adding habit persistence

A feature that has become popular in microeconomic analysis and the finance literature is this of habit persistence in consumption. General assumptions that also define the concept can be found in Ryder and Heal (1973). For reasons of tractability, we employ a similar form to the one used by Constandinides (1990).

We let a vector of functions $\mathbf{H} \equiv (h^i)_{i \in [\mathbf{0}, q]}$ that map a respondent's income level to a non-negative real number, i.e. $h^i(y_p) \geq 0$ for all $y_p \geq 0$ and all $i \in [0, q]$. We assume that

the utility function of a person who exhibits habit persistence is given by:

$$\int_0^q g^i\left(n_A, n_C\right) \frac{\left[x_i + \kappa_i - h^i\left(y_p\right)\right]^{1-\frac{1}{\eta}} - 1}{1-\frac{1}{\eta}} di \ .$$

Now we fix an arbitrary respondent with income y_p. His/her responses on equivalence scales with reference income y, would be given by:

$$\begin{aligned} m_{a,c} \ = \ & \left(\frac{\varphi\left(\mathbf{G}\left(\overline{n}_A, \overline{n}_C\right), \mathbf{p}\right)}{\varphi\left(\mathbf{G}\left(\overline{n}_A + a, \ \overline{n}_C + c\right), \mathbf{p}\right)} \right)^{\frac{1}{\eta-1}} + \\ & + \left[\left(\frac{\varphi\left(\mathbf{G}\left(\overline{n}_A, \overline{n}_C\right), \mathbf{p}\right)}{\varphi\left(\mathbf{G}\left(\overline{n}_A + a, \ \overline{n}_C + c\right), \mathbf{p}\right)} \right)^{\frac{1}{\eta-1}} - 1 \right] \frac{\mathbf{p}'\left[\boldsymbol{\kappa} - \mathbf{H}\left(y_p\right)\right]}{y_r} \ . \quad (4) \end{aligned}$$

It is obvious from equation (4) that if $\eta > 1$ ($\eta < 1$), then respondents with higher y_p tend to state lower (higher) equivalence scale values. This is because when $\eta > 1$ a marginal change in the subsistence level is dominated by a higher marginal decrease in (indirect) utility. Therefore, the richest respondents tend to perceive a lower utility level (living standard) for a given reference income (y_r). As a result, they suggest lower compensating costs for additional family members in order to retain the same utility, or in other words, lower scales. The same reasoning holds for $\eta < 1$ towards the opposite direction. We will test whether the stated values are consistent with $\eta > 1$ and $\mathbf{p}'\left[\boldsymbol{\kappa} - \mathbf{H}\left(y_p\right)\right] > 0$ versus $\eta < 1$ and $\mathbf{p}'\left[\boldsymbol{\kappa} - \mathbf{H}\left(y_p\right)\right] < 0$ in a later section. In what follows, we will focus on describing in detail the responses of our subjects and on testing in a strict way whether IOB holds or not and whether habit persistence is strong.

In Figures 1.a and 1.b we present the average stated equivalence scales in seven different graphs. Each graph corresponds to each of the seven demographic compositions that we used as stimuli in our questionnaire. On the horizontal axis we state the five different adjusted (corrected) personal income classes in increasing order. Only the adjusted personal income captures living standards well, since it equivalizes each respondent's family income with the

income of a single adult without children.[13] Therefore, classifying according to this variable is appropriate for testing for habit persistence. In each graph there are five distinct lines. Each line corresponds to a different *reference*-income level, and it plots average scales stated by the different *personal*-income groups of the x-axis.

There are two visible patterns in Figures 1.a and 1.b for both countries. First, in each of the seven graphs, lines corresponding to a certain reference income lie, almost in each case, strictly above the line of the next higher reference income. This is indicative of a violation of IOB in the direction pointed out by our previous section's regressions. Second, there is a slight tendency for richer people to state lower values, especially for high reference incomes. This tendency might be due to a habit effect.

Tables 5.a and 5.b state all the average values presented in Figures 1.a and 1.b respectively, together with their standard deviations. In these tables we test both the IOB hypothesis and the potential habit influence.

Each of the seven columns of Tables 5.a and 5.b corresponds to one of the seven graphs in Figures 1.a and 1.b respectively. The significance of the tests for IOB are presented in colums "IOB-test." These are t-tests of differences of pairs selected as follows. For a *fixed* demographic composition $\overline{d}$, and a *fixed* personal-income group $\overline{y}_p$, in every reference-income entry y_r we report the t-test for the paired differences $Scales\left(\overline{d}, y_r, \overline{y}_p\right) - Scales\left(\overline{d}, y_r - 1, \overline{y}_p\right)$ of the stated scale values by the income group $\overline{y}_p$. For example, in Table 5.a, if $\overline{d} = AA$ and $\overline{y}_p = 4$, the significance of the paired differences for the stated values for reference income 3 versus reference income 2, is given by one star (*), denoting rejection of the hypothesis that the scales are equal at the 90% level of confidence. This star is reported at the entry

[13] As we explained above, we were unable to use corrected personal income in our regressions so far, since it is derived from the stated equivalence scales. Therefore, we did not perfectly capture the influence of living standards of the respondents in our regressions above. Of course, if there are significant habit influences on stated equivalence scales, our adjusted personal-income groups may not be defined well. However, as it will be clearer below, our tests for habit persistence are cross-checked for the original income definition as well.

of reference-income 3 for the given $\overline{d}$ and $\overline{y}_p$. Similarly, for the same table, if $\overline{d} = AACC$ and $\overline{y}_p = 2$, and the comparison is between the reference income 5 versus 4, the significance of rejection is 95% (**), and it is reported at the reference-income entry 5. It is thus self-explanatory that we do not report any significance levels in entries of the reference-income class 1. In the language of Figures 1.a and 1.b, we focus on a particular personal-income group (a perpendicular line) and we examine each consecutive pair of stated values for consecutive reference incomes, moving from the top to the bottom. Since all these values are stated by the same group of respondents, they are not independent. This is why we use a test of pairs of observations as opposed to a typical t-test for the difference of means for independent samples.

Apparently, this is a "tough" test of our previous finding that IOB doesn't hold. First of all, the increments of reference incomes for each test are not so big (only 150% of the poverty line). A weaker test would be to compare the scales of each reference income with these of the lowest reference income. Also, in many cases the number of respondents in each subgroup is small, implying a high penalty for the confidence interval. Nevertheless, for both countries, the confidence of rejecting IOB is 99% in most cases. There is a tendency for less confident rejections or no rejections as the reference income increases and for demographic stimuli with less children. This is in accordance with the tested non-linear dependence of scales on reference income in column (6) of Tables 3 and 4 (decreasing and convex function of ref. income) and also equations (3) and (4).

Our tests for habit persistence are reported in columns "habit test." Again we use a "tough" test for not accepting habit formation. For a *fixed* demographic composition $\overline{d}$, and a *fixed* reference-income group $\overline{y}_r$, in every personal-income entry $y_p > 1$, we report the t-test for the differences of means $Scales\left(\overline{d}, \overline{y}_r, y_p\right) - Scales\left(\overline{d}, \overline{y}_r, y_p = 1\right)$. For example,

in Table 5.b, if $\overline{d} = AACCC$ and $\overline{y}_r = 2$, the significance of the t-test for the difference of means between the stated values by the personal-income group 4 versus personal group 1, is given by one star (*), denoting rejection of the hypothesis that the scales are equal at the 90% level of confidence. This star is reported at the entry of personal-income 4 for the given $\overline{d}$ and $\overline{y}_r$. Similarly, for the same table, if $\overline{d} = ACCC$ and $\overline{y}_r = 3$, and the comparison is between personal income 4 versus 1, the significance of rejection is 95% (**), and it is reported at the personal-income entry 4. It is thus self-explanatory that we do not report any significance levels in entries of the personal-income class 1. We should also note that since these are comparisons of scale values stated by different income groups, our subsamples are independent and therefore the typical t-tests of mean differences between independent samples are the appropriate ones.

As one can see in Tables 5.a and 5.b, we do not find striking evidence for strong habit influences on the perceptions of repondents. We do, however, find some robust differences for higher reference incomes in Cyprus: richer respondents state lower scale values relative to poorer ones. For Germany, Table 5.a, one cannot report confidently a systematic pattern of difference in perceptions.[14] In all cases, independently of whether a habit-persistence pattern arises or not, the quantitative differences of the stated scale values and the standard deviations of the pertinent means are generally small.

[14]In order to check whether the pattern in Cyprus was due to our methodology of deriving the adjusted personal income from the reported scales (it could have placed respondents from larger families who stated low values into higher corrected personal-income groups), we redid Table 5.b using personal family income. A similar pattern was observed, but with less occurrence of high-confidence rejections of equality of means. For Germany, using personal family income did not reveal almost any rejections. All these tests are available from the authors upon request.

4.3 How reliable is the use of hypothetical households in the questionnaire?

So far, we have analyzed stated subjective equivalence scales on hypothetical households: the respondents provide 35 different scales, so at least 34 responses do not coincide with their own current family situation. The thought experiment that our respondents perform is similar to this of experts in "expert approaches" of calculating scales. Experts use insights from data on needs for households of different income levels, they form insights about these households' needs and they suggest equivalence scales.[15] We believe that our hypothetical approach is much stronger. First of all, a large number of respondents adds more living-standards experiences and more preference profiles over income. We have argued above that our subjective methodology is immune from subjective biases, so increasing the number of respondents is an improvement over expert approaches. Moreover, respondents have non-trivial insights about living standards of households of different demographic composition or even different income. This is exactly the assumption of rationality that pervades most of the recent economic literature. In this section, however, we will examine possibilities of *bounded* rationality: we will consider the plausible possibility that respondents have a better knowledge of living standards of families "close" to their own income and demographic situation.

We restrict our sample in two different ways:

(a) For the first restricted subsample, we take into account stated equivalence scales for all the demographic stimuli compositions but only the ones where the reference income is closest to the respondent's adjusted personal income. We therefore consider only 7 stated scales for each respondent. We call this sample "Weakly Restricted" (WR).

[15] See, for example Bradbury (1989) for a review of the "expert" or "budget approach."

(b) In addition to focusing on the respondents' adjusted personal income, we take into account only the *single* stated value where the demographic stimuli coincide with the demographic situation of the respondent. We call this sample "Strictly Restricted" (SR). As it is obvious from Table 2.b, only 103 observations (167 respondents – 64 single childless adults) are considered for Germany and also only 112 observations for Cyprus.

We refer to the original sample that we used in the previous subsection as "Unrestricted" (UR).

In Tables 6.a and 6.b we report regressions using model specifications that are consistent with equation (3). We use the term $\frac{1}{\text{Reference Income}}$ in order to capture the non-linear dependence of scales on reference incomes. Moreover, the terms $\frac{\text{Number of Adults}}{\text{Reference Income}}$ and $\frac{\text{Number of Children}}{\text{Reference Income}}$ that are used in column (3) capture the fact that, according to equation (3), the coefficient of $\frac{1}{\text{Reference Income}}$ also depends on the demographic stimuli.

In each column of Tables 6.a and 6.b we use a particular econometric specification. Within the same column, we run the same regression twice: once for the UR sample and once for the WR sample. We report in each independent-variable row a pair of the coefficients that correspond to each of these samples. Underneath each pair and in the middle, we report the Wald-test significance levels of rejection of the null hypothesis that the two coefficients of the pair are equal. In Tables 7.a and 7.b we follow the same procedure but comparing the WR with the SR sample. Finally in Tables 8.a and 8.b we compare the UR with the SR sample.

By evaluating the extent to which the regression coefficients statistically differ across the above subsamples, we form a picture on whether the approach of using hypothetical households is error-generating or not.

The results are striking. For both countries and across all the different subsamples the

coefficients of $\frac{1}{\text{Reference Income}}$ are always the same. For Cyprus, all coefficients tend to be statistically the same, except from the coefficients on the children stimuli that are sometimes different. For Germany, the coefficients on adults tend to differ as we move from one subsample to another and also the specification in column (3) tends to give slightly different coefficients. In all cases, however, the quantitative differences of the coefficients are not large.

Since there is some ambiguity about the robustness of the influence of the demographic stimuli in the regressions of Tables 6-8 (and also since we are not sure that the demographic stimuli should enter the regression linearly), we proceed to a taugher test for the influence of reference income. We split samples UR and WR into 7 subsamples according to each of the 7 demographic stimuli categories of our questionnaire.[16] In Tables 9.a and 9.b we provide 7 regressions for each country. We report only the coefficient of the constant and the term $\frac{1}{\text{Reference Income}}$, even though we also conditioned for personal income and personal characteristics.[17] We find that in almost all cases the coefficients are the same across the subsamples UR and WR. Moreover, we can see that in accordance with equation (3) for the case of $\eta > 1$, both coefficients increase as family members are added. Also the fact that in almost all cases the constants are greater than one, advocates that $\eta > 1$ and $\mathbf{p}'\boldsymbol{\kappa} > 0$ (or, if there are income habits, $\mathbf{p}'\left[\boldsymbol{\kappa} - \mathbf{H}\left(y_p\right)\right] > 0$).

We conclude that Tables 6-9 provide affirmative evidence that the use of the hypothetical household in our method does not generate significant errors.

[16] We cannot follow the same procedure using the SR sample, due to the lack of adequate data.
[17] Here we state only the regressions conditioning for the first group (I) of personal characteristics. The results are the same when we also use group (II) and they are available from the authors upon request.

5. The weights for adults and children

In Figure 2 we depict the average weights for the first, second, and third child in a one and two adult houshold against the corresponding reference income, for both countries. We also plot the average weights of the second adult. As it is expected by our previous analysis of equivalence scales, they all fall with increasing reference income.

We can see that, as reference income increases, in both countries the range spanned by children weights is larger (about 70% drop) than the corresponding range for the second adult (about 50% drop). In column 7 of Tables 3-4 we tested whether the interaction between reference income and weights is different for adults versus children. Our conclusions from Tables 3 and 4 were ambiguous. Therefore, we repeat the Wald tests of equality of coefficients of the terms $\frac{\text{Number of Adults}}{\text{Reference Income}}$ and $\frac{\text{Number of Children}}{\text{Reference Income}}$ that are used in column (3) of Tables 6-9. So, there are three cases for each country (for samples: UR, WR and SR). In four out of the six cases the coefficients are different with 99% confidence. For the WR German sample equality is not rejected, whereas for the SR Cypriot sample equality is rejected at the 10% level.

In Table 10.a we test whether the weight of the first child is higher than that of the second, and whether the weights for the second child are different from these of the third. We distinguish the tests for single and two-adult households and we report the pertinent t-tests of pairwise differences. We find that the first child is more expensive than the second in single-adult households for both countries. For the two-adult household the latter result holds only for Germany.

In column (8) of Tables 3 and 4 we also tested whether children costs are higher in a one- versus a two-adult householeld. The results were ambiguous. We therefore report t-tests of difference of paired observations for two related null hypotheses. We compare the weights of

the first child in a single-parent household versus the weights of the first child in a two-adult household. We do the same for the second and the third child and the results are reported in Table 10.b (the tests for Cyprus are in parentheses). As it is obvious, in both countries the costs of children are higher in single-adult households but only for the first child. This result holds for all income levels.

To the best of our knowledge, there are no studies reporting similar results to these of Table 10. We therefore believe that, at least, we have raised new interesting null hypotheses.

6. Comparison with previous studies and suggested extensions

There are two basic sources reporting equivalence scales for Germany and Cyprus. The German extensive reference is the book by Faik (1995) and the relevant Cypriot study is this of Flori-Lyssiotou (1997). If we consider the average scales across all reference incomes stated by our subjects, both the means and the errors would be pretty close to the equivalence scales stated in these studies. However, we add in a non-trivial way the important dimension of reference-income dependence. This dimension is crucial for evaluating horizontal equity: since taxes and transfers change the net income of a household, the horizontal-equity comparison through scales that are independent of base will be erroneous.

Nevertheless, we do not want by any means to suggest that our methodology could be the final step before policy evaluation (taxation or redistribution). On the contrary, we believe that our subjective method can be a very important preliminary step within a more general methodology that uses applied dynamic models. Dynamic models that take explicitly into account households' expectations are appropriate for studying the responsiveness of income distributions to taxation schemes and redistributive policies. Models like these of Aiyagari et. al. (2000), Greenwood et. al. (1999) and (2000) are early examples of this

orientation. In these models, however, household production parameters are calibrated to match income-distribution data in the presence of more "free" taste parameters that are to be jointly calibrated. This feature may cast doubt on the predictive accuracy of these models. Therefore, estimating household-production externalities can be of key interest, since a calibrating degree of freedom could be eliminated.

Estimating household-production-externality parameters, is a task of well-known difficulty (see, for example Bradburry 1995 and Pendakur 1999). One can use a database of subjective scales which is derived through our method and assume that these are the "true" scales. In a first step, using theoretically plausible household-production parametric forms, one may estimate the related parameters, by fitting the subjective scales. Then, in a second step, using consumer-expenditure data and through data-mining approaches one could derive objective equivalence scales that best fit the averages of the subjective ones. If a particular functional-parametric form for household production performs poorly, alternative ones can be tried and tested. These two steps can be a useful iterative procedure that may reasonably uncover structural unobserved features of household production that are still treated as "black box". Moreover, fitting objective scales to subjective ones, allows to cross-check the validity of the two approaches. Even though we are actively interested in this extension, in this study we confined ourselves to providing compelling cross-country evidence that our new subjective method improves upon existing ones.

7. Conclusion

We have designed a subjective method for evaluating equivalence scales. Our target was to test and measure the dependence of equivalence scales on income. Moreover, we wanted to study the the dependence of weights of adults versus these of children on household income

and demographic composition.

Our questionnaires focus on a single-adult household (reference household) with a given reference-income level. We directly ask our subjects to state welfare-equivalent incomes for hypothetical households with different demographic composition. This task is repeated for different income levels.

We implemented our method in two countries with significantly different economic characteristics: Germany and Cyprus. We provide cross-country evidence that our method's subjective scales are influenced very little quantitatively by our respondents' personal characteristics and potential subjective biases. We also provide evidence that our respondents are not too rationally bounded with respect to perceiving the needs of households with different income and demographic composition from their own. Therefore, the use of hypothetical households in the questionnaire is reliable.

Our method adds an important dimension to the measurement of equivalence scales: their dependence on income. We have also found evidence that the weights for adults are higher than these for children, that weights for children fall more rapidly with increasing household income and that the weight for the first child is higher for single- versus two-adult households. We suggested ways of blending our method with existing objective methodologies in future work. Such a synthesis can be useful for a robust evaluation of household-production externalities, equivalence scales and horizontal equity.

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Appendix 1

Adults are assumed to be at an age between 30 and 55, children are between 7 and 14. For both countries we picked the poverty line as the lowest reference income (the first of the five tables). For each subsequent table, we added increments equal to 150% $\times$ the poverty line (so if the poverty line is \$1, the five reference incomes were \$1.0, \$2.5, \$4.0, \$5.5 and \$7.0).

The important educational levels in Cyprus are the basic compulsory 9 years of schooling (6 years of elementary school and 3 years of "Gymnasion") and the next 3 years of high school, "Lyceion" (total of 12 years before university). In Germany, primary school lasts for 4 years and after that there are three options: (i) the "Hauptschule" (5 additional years); (ii) the "Realschule" (6 additional years); and (iii) the "Gymnasium" (9 additional years). Since the Hauptschule represents the 9 basic and compulsory years of schooling, we put it at the same level with the Cypriot "Gymnasion", so we label this category as "Completed Extended Elementary School". Since there is no analogue to the "Realschule" in Cyprus, we call it "completed special secondary school" and we leave it blank for Cyprus. We put the German "Gymnasium" (total 13 years of schooling) together with the Cypriot "Lyceion" (total 12 years of schooling) under the category "Completed Secondary School".

We do not believe that there is a perfect way to convert the Cypriot educational system into German terms and vice versa. In our regressions below we construct dummies that we believe capture the link between the scaling of educational levels and their importance in the labor market within each country. We give the value 0 for "Below 9 Years of Education," the value 1 for "Completed Extended Elementary School," the value 1.5 for "Completed Special Secondary School," (the German "Realschule"), the value 2 for "Completed Secondary School," and, finally, the value 3 for higher education. We are confident that our

regressions capture well the correlation between the educational level of the respondents with their stated equivalence scales. Moreover, we believe that our categorization allows for the inter-country comparison. The educational distributions of our samples are shown in Table 2.a. It is obvious that our samples have a lot of technical-school and university graduates. We are not sure how much of this fact is due to a sampling bias for each country. It is true, however, that there is a sample bias with respect to the number of university students. The latter is unavoidable, given that we could approach more easily subjects related to universities, due to our profession. Yet, we have put a serious effort into extending the samples to as many other educational and occupational categories as possible.

Table 1

Single adult household without children	Reference income	Two-adult household without children	?
Single-adult household with one child	?	Two-adult household with one child	?
Single-adult household with two children	?	Two-adult household with two children	?
Single-adult household with three children	?	Two-adult household with three children	?

	Germany: 167 obs.		**Cyprus**: 130 obs.	
	N	%	N	%
Gender				
Female	71	42.5	57	43.8
Male	96	57.5	73	56.2
Partner in the Household				
Yes	97	58.1	75	57.7
No	70	41.9	55	42.3
Number of Children in the Household				
None	123	73.7	82	63.1
One	18	10.8	18	13.8
Two	15	8.9	23	17.7
More than two	11	6.6	7	5.4
Living with Parents				
Yes	-	-	37*	28.5
No	-	-	93	71.5
Family After-tax Income Class				
1 (Y<1.75P)	32	19.2	9	6.9
2 (1.75P <Y<1.75P+1.5P)	44	26.3	25	19.2
3 (1.75P+1.5P < Y<1.75P+3P)	37	22.2	24	18.5
4 (1.75P+3P < Y<1.75P+4.5P)	37	22.2	31	23.8
5 (1.75P+4.5P < Y)	17	10.2	41	31.6
Adjusted After-tax Income Class				
1 (Y<1.75P)	50	29.9	29	22.3
2 (1.75P < Y<1.75P+1.5P)	64	38.3	40	30.8
3 (1.75P+1.5P<Y<1.75P+3P)	33	19.8	31	23.8
4 (1.75P+3P < Y<1.75P+4.5P)	16	9.6	24	18.5
5 (1.75P+4.5P < Y)	4	2.4	6	4.6
Occupational Group				
Welfare Recipient	2	1.1	0	0.0
Unemployed	5	3.0	2	1.5
Blue-collar Worker	10	6.0	2	1.5
White-collar Worker	83	49.7	40	30.8
Pupil, Student, Trainee	34	20.4	30	23.1
Civil Servant	13	7.8	40	30.8
Self-employed	7	4.2	13	10
Pensioner	10	6.0	0	0.0
Housewife , Houseman	3	1.8	3	2.3
Education				
Below 9 years of Education	1	0.6	4	3.1
Completed Extended Elementary School	21	12.6	8	6.2
Completed Special Secondary School	39	23.4	-	-
Completed Secondary School	65	38.9	65	50.0
Technical School and University Degree	41	24.6	53**	40.7
Number of Siblings during Childhood				
None	31	18.6	9	7.0
One	55	32.9	34	26.2
Two	47	28.1	40	30.8
More than two	34	20.4	47	36.2

* One of the respondents who were living with their parents also had a partner and two children.

** In Cyprus, 14 out of the 53 highly educated respondents in our sample had finished a technical school (3 years of higher education).

Table 2.a Breakdown of the Sample

Germany

Household Type	Single-childless-adult Equivalent Income Class											
	1		2		3		4		5		Sum	
	N	%	N	%	N	%	N	%	N	%	N	%
A	30	17.9	21	12.6	10	6.0	2	1.2	1	0.6	64	38.3
AC	0	0.0	1	0.6	1	0.6	3	1.8	0	0.0	5	3.0
ACC	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ACCC	0	0.0	1	0.6	0	0.0	0	0.0	0	0.0	1	0.6
AA	13	7.8	25	14.9	11	6.6	10	6.0	0	0.0	59	35.3
AAC	2	1.2	6	3.6	2	1.2	1	0.6	2	1.2	13	7.8
AACC	4	2.4	4	2.4	6	3.6	0	0.0	1	0.6	15	9.0
AACCC	1	0.6	6	3.6	3	1.8	0	0.0	0	0.0	10	6.0
Sum	50	29.9	64	38.3	33	19.8	16	9.6	4	2.4	167	100.0

Cyprus

Household Type	Single-childless-adult Equivalent Income Class											
	1		2		3		4		5		Sum	
	N	%	N	%	N	%	N	%	N	%	N	%
A	5	3.8	6	4.6	3	2.3	0	0.0	4	3.1	18	13.8
AC	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
ACC	0	0.0	0	0.0	1	0.8	0	0.0	0	0.0	1	0.8
ACCC	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0	0	0.0
AA	10 (7)	7.7 (5.4)	17 (9)	13.1 (6.9)	19 (4)	14.6 (3.1)	16 (5)	12.3 (3.8)	2 (0)	1.5 (0.0)	64 (25)	49.2
AAC	4 (2)	3.1 (1.5)	8 (6)	6.2 (4.6)	4 (0)	3.1 (0.0)	2 (0)	1.5 (0.0)	0 (0)	0.0 (0.0)	18 (8)	13.8
AACC	8 (1)	6.2 (0.01)	8 (2+1)*	6.2	2 (0)	1.5 (0.0)	4 (0)	3.1 (0.0)	0 (0)	0.0 (0.0)	22 (3+1)*	16.9
AACCC	2 (0)	1.5 (0.0)	1 (0)	0.8 (0.0)	2 (0)	1.5 (0.0)	2 (0)	1.5 (0.0)	0 (0)	0.0 (0.0)	7 (0)	5.4
Sum	29	22.3	40	30.8	31	23.8	24	18.4	6	4.6	130	100.0

* The family that has both two adults and also lives with their parents has two children
In parentheses: number of respondents out of the particular group who were living with their parents .

Table 2.b Joint distribution of demographic composition and adjusted income class of the respondents

Table 3.a – Data for Germany

Dependent variable : equivalence scales
Pooled estimations White's Heteroskedasticity correction for covariance matrix
Number of observations : 5845 t- statistics in parentheses

Equation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	1.10 (50.26)	1.13 (47.86)	1.01 (38.38)	1.04 (36.00)	1.02 (35.56)	1.46 (48.03)	0.47 (19.20)	1.04 (29.89)
Stimuli								
Reference Income	-0.13 (-48.16)	-0.13 (-48.18)	-0.13 (-48.26)	-0.13 (-48.38)	-0.13 (-48.37)	-0.45 (-37.25)		-0.13 (-48.27)
(Reference Income) ^{2}						0.04 (29.33)		
Number of adults	0.47 (43.12)	0.47 (43.14)	0.47 (43.35)	0.47 (43.44)	0.47 (43.43)	0.47 (47.00)	0.60 (41.96)	0.46 (26.24)
Number of children	0.20 (35.12)	0.20 (35.16)	0.20 (35.34)	0.20 (35.41)	0.20 (35.40)	0.20 (37.58)	0.40 (35.57)	0.19 (10.45)
Reference Income x Number of adults							-0.03 (-15.88)	
Reference Income x Number of children							-0.05 (-24.19)	
Number of adults x Number of children								0.01 (0.87)
Personal family income		-0.01 (-3.49)	-0.01 (-3.89)	-0.01 (-1.87)		-0.01 (-4.22)	-0.01 (-4.06)	-0.01 (-3.89)
Personal Characteristics (I)								
Gender			0.03 (2.60)	0.03 (2.57)	0.03 (2.70)	0.03 (2.81)	0.03 (2.73)	0.03 (2.60)
Siblings			-0.001 (-0.24)	0.005 (0.89)	0.003 (0.61)	-0.001 (-0.25)	-0.001 (-0.25)	-0.001 (-0.24)
Education			0.06 (8.71)	0.05 (6.35)	0.05 (6.26)	0.06 (9.39)	0.06 (9.12)	0.06 (8.71)
Personal Characteristics (II)								
Partner				-0.04 (-2.83)	-0.05 (-4.07)			
Children				-0.004 (-0.62)	-0.01 (-1.08)			
Housewife				0.01 (0.37)	0.002 (0.06)			
Pensioner				-0.08 (-3.31)	-0.08 (-3.43)			
Student				-0.02 (-1.10)	-0.01 (-0.38)			
Welfare/Unemployed				-0.01 (-0.34)	0.003 (0.10)			
Blue Collar				-0.03 (-1.44)	-0.02 (-1.00)			
Self-employed				-0.01 (-0.25)	-0.01 (-0.25)			
Civil Servant				0.05 (2.47)	0.04 (2.23)			
$\overline{\mathbf{R}}^2$	0.497	0.498	0.503	0.506	0.505	0.574	0.548	0.503

Table 3.b – Data for Cyprus

Dependent variable : equivalence scales
Pooled estimations — White's Heteroskedasticity correction for covariance matrix
Number of observations : 4550 — t- statistics in parentheses

Equation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	1.25 (37.43)	1.25 (32.25)	1.20 (27.12)	1.23 (21.92)	1.23 (22.52)	1.76 (34.42)	0.57 (13.51)	1.21 (21.44)
Stimuli								
Reference Income	-0.16 (-36.84)	-0.16 (-36.84)	-0.16 (-37.16)	-0.16 (-37.44)	-0.16 (-37.43)	-0.54 (-28.86)		-0.16 (-37.16)
(Reference Income)^2						0.05 (23.26)		
Number of adults	0.44 (26.17)	0.44 (26.17)	0.44 (26.43)	0.44 (26.70)	0.44 (26.70)	0.44 (28.23)	0.59 (26.41)	0.43 (16.25)
Number of children	0.29 (34.35)	0.29 (34.34)	0.29 (34.67)	0.29 (34.94)	0.29 (34.94)	0.29 (36.62)	0.53 (29.55)	0.29 (9.96)
Reference Income x Number of adults							-0.04 (-12.50)	
Reference Income x Number of children							-0.06 (-17.91)	
Number of adults x Number of children								0.003 (0.16)
Personal family income		0.001 (0.19)	0.001 (0.34)	0.004 (0.87)		0.001 (0.36)	0.001 (0.35)	0.001 (0.34)
Personal Characteristics (I)								
Gender			0.07 (4.66)	0.07 (3.89)	0.07 (3.97)	0.07 (4.99)	0.07 (4.85)	0.07 (4.66)
Siblings			-0.06 (-7.58)	-0.05 (-5.41)	-0.05 (-5.33)	-0.06 (-8.08)	-0.06 (-7.84)	-0.06 (-7.57)
Education			0.06 (5.12)	0.08 (6.85)	0.08 (7.23)	0.06 (5.44)	0.06 (5.29)	0.06 (5.11)
Personal Characteristics (II)								
Partner				-0.02 (-0.68)	-0.02 (-0.53)			
Children				-0.06 (-6.60)	-0.06 (-6.66)			
Living with parents				-0.07 (-2.50)	-0.06 (-2.36)			
Housewife				0.16 (2.93)	0.16 (2.92)			
Student				-0.04 (-1.55)	-0.04 (-1.58)			
Welfare/Unemployed				-0.22 (-4.53)	-0.22 (-4.73)			
Blue Collar				-0.01 (-0.07)	-0.01 (-0.12)			
Self-employed				0.03 (1.02)	0.04 (1.39)			
Civil servant				-0.09 (-3.80)	-0.09 (-3.65)			
$\overline{\mathbf{R}}^2$	0.439	0.439	0.450	0.460	0.460	0.515	0.490	0.450

Table 3.c – Data for Germany and Cyprus

Dependent variable: equivalence scales
Pooled estimations
Number of observations: 10395

Wald tests for structural break with a null hypothesis of equal coefficients for Germany and Cyprus. All variables are country-specific.
White's Heteroskedasticity correction for covariance matrix

Equation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	***	**	***	**	***	***	**	***
Stimuli								
Reference Income	***	***	***	***	***	***		***
(Reference Income)^2						***		
Number of adults	*	*	*	*	*	*	X	X
Number of children	***	***	***	***	***	***	***	***
Reference Income x Number of adults							*	
Reference Income x Number of children							**	
Number of adults x Number of children								X
Personal family income		**	**	X		**	**	**
Personal Characteristics (I)								
Gender			**	X	X	***	**	**
Siblings			***	***	***	***	***	***
Education			X	***	***	X	X	X
Personal Characteristics (II)								
Partner				***	***			
Children				***	***			
Housewife				**	**			
Pensioner				-	-			
Student				X	X			
Welfare/Unemployed				***	***			
Blue Collar				X	X			
Self-employed				X	X			
Civil Servant				***	***			

Notes: *** rejection of equality of coefficients for Germany and Cyprus at the 1% level
** rejection of equality of coefficients for Germany and Cyprus at the 5% level
* rejection of equality of coefficients for Germany and Cyprus at the 10% level
X cannot reject the equality-of-coefficients hypothesis

Table 4.a – Data for Germany

Dependent variable : equivalence scales-1 Constant is omitted from regression
Pooled estimations White's Heteroskedasticity correction for covariance matrix
Number of observations: 5845 t-statistics in parentheses

Equation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant								
Stimuli								
Reference Income	-0.08 (-33.67)	-0.09 (-36.10)	-0.12 (-43.05)	-0.12 (-44.26)	-0.12 (-43.67)	-0.25 (-25.41)		-0.12 (-44.56)
(Reference Income)^2						0.02 (15.32)		
Number of adults - 1	0.67 (65.49)	0.62 (58.28)	0.54 (49.91)	0.53 (48.49)	0.54 (49.40)	0.56 (51.97)	0.68 (33.26)	0.68 (41.85)
Number of children	0.32 (55.47)	0.29 (50.06)	0.24 (42.49)	0.24 (40.67)	0.24 (41.48)	0.26 (43.55)	0.43 (45.60)	0.38 (23.50)
Reference Income x (Number of adults –1)							-0.05 (-14.41)	
Reference Income x Number of children							-0.06 (-35.70)	
Number of adults x Number of children								-0.09 (-8.70)
Personal family income		0.03 (14.94)	0.005 (1.86)	0.02 (5.12)		0.01 (4.25)	-0.01 (-5.14)	0.0009 (0.33)
Personal Characteristics (I)								
Gender			0.06 (5.87)	0.07 (6.15)	0.07 (6.10)	0.07 (6.51)	0.02 (1.97)	0.05 (4.45)
Siblings			0.02 (3.48)	0.02 (2.61)	0.02 (3.82)	0.11 (7.98)	-0.02 (-1.80)	0.05 (3.89)
Education			0.15 (25.11)	0.13 (21.08)	0.15 (23.40)	0.13 (28.94)	0.04 (10.93)	0.09 (21.45)
Personal Characteristics (II)								
Partner				-0.03 (-1.70)	0.01 (0.61)			
Children				-0.02 (-2.05)	-0.01 (-0.86)			
Housewife				0.01 (0.14)	0.04 (1.08)			
Pensioner				-0.03 (-1.25)	-0.02 (-0.69)			
Student				0.07 (5.65)	0.05 (3.95)			
Welfare/Unemployed				0.14 (4.38)	0.11 (3.45)			
Blue Collar				0.09 (4.18)	0.07 (3.30)			
Self-employed				0.06 (2.36)	0.07 (2.69)			
Civil Servant				0.04 (2.13)	0.06 (3.02)			
$\overline{R}^2$	0.392	0.411	0.472	0.477	0.475	0.498	0.551	0.486

Table 4.b – Data for Cyprus

Dependent variable : equivalence scales-1 Constant is omitted from regression
Pooled estimations White's Heteroskedasticity correction for covariance matrix
Number of observations: 4550 t- statistics in parentheses

Equation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant								
Stimuli								
Reference Income	-0.10 (-26.24)	-0.12 (-29.17)	-0.14 (-32.91)	-0.15 (-35.11)	-0.15 (-35.13)	-0.31 (-19.76)		-0.14 (-33.95)
(Reference Income) ^{2}						0.02 (12.43)		
Number of adults - 1	0.67 (43.43)	0.58 (36.61)	0.52 (32.11)	0.49 (29.60)	0.49 (29.67)	0.55 (33.50)	0.70 (21.95)	0.71 (29.35)
Number of children	0.43 (49.82)	0.38 (44.19)	0.34 (40.81)	0.32 (37.67)	0.32 (37.68)	0.36 (41.26)	0.57 (37.85)	0.53 (20.15)
Reference Income x (Number of adults –1)							-0.06 (-11.20)	
Reference Income x Number of children							-0.07 (-25.83)	
Number of adults x Number of children								-0.12 (-7.40)
Personal family income		0.05 (17.22)	0.02 (4.43)	0.01 (3.10)		0.02 (6.04)	0.002 (0.44)	0.01 (3.36)
Personal Characteristics (I)								
Gender			0.13 (8.52)	0.10 (6.06)	0.11 (6.45)	0.16 (10.02)	0.07 (5.15)	0.12 (7.52)
Siblings			-0.02 (-2.18)	-0.002 (-0.19)	0.003 (0.29)	0.0003 (0.04)	-0.06 (-8.25)	-0.03 (-3.64)
Education			0.15 (14.91)	0.17 (15.69)	0.18 (18.43)	0.19 (17.50)	0.06 (6.23)	0.13 (12.38)
Personal Characteristics (II)								
Partner				0.15 (6.04)	0.18 (7.19)			
Children				-0.09 (-9.30)	-0.09 (-9.63)			
Living with parents				0.08 (3.27)	0.10 (4.30)			
Housewife				0.23 (4.32)	0.23 (4.39)			
Student				0.09 (3.70)	0.09 (3.82)			
Welfare/Unemployed				-0.03 (-0.62)	-0.04 (-0.86)			
Blue Collar				0.21 (3.03)	0.21 (2.96)			
Self-employed				0.07 (2.44)	0.10 (3.79)			
Civil servant				-0.13 (-5.17)	-0.11 (-4.50)			
$\overline{\mathbf{R}}^2$	0.343	0.380	0.421	0.442	0.441	0.439	0.491	0.428

Table 4.c – Data for Germany and Cyprus

Dependent variable : equivalence scales-1
Pooled estimations
Number of observations: 10395

Wald tests for structural break with a null hypothesis of equal coefficients for Germany and Cyprus. All variables are country-specific.
White's Heteroskedasticity correction for covariance matrix

Equation	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-	-	-	-	-	-	-	-
Stimuli								
Reference Income	***	***	***	***	***	***		***
(Reference Income)^2						***		
Number of adults-1	X	**	X	**	**	X	X	X
Number of children	***	***	***	***	***	***	***	***
Reference Income x (Number of adults-1)							X	
Reference Income x Number of children							***	
Number of adults x Number of children								X
Personal family income		***	***	X		***	***	***
Personal Characteristics (I)								
Gender			***	*	**	***	***	***
Siblings			***	*	*	***	***	***
Education			X	***	***	X	X	X
Personal Characteristics (II)								
Partner				***	***			
Children				***	***			
Housewife				***	***			
Pensioner				-	-			
Student				X	**			
Welfare/Unemployed				***	**			
Blue Collar				X	*			
Self-employed				X	X			
Civil Servant				***	***			

Notes:
*** rejection of equality of coefficients for Germany and Cyprus at the 1% level
** rejection of equality of coefficients for Germany and Cyprus at the 5% level
* rejection of equality of coefficients for Germany and Cyprus at the 10% level
X cannot reject the equality-of-coefficients hypothesis

y_r	c_y_p	N	AC				ACC				ACCC				AA				AAC				AACC				AACCC			
			Ave-rage Scale	SD	IOB-Test	habit test	Ave-rage Scale	SD	IOB-Test	habit test	Ave-rage Scale	SD	IOB-Test	habit test	Ave-rage Scale	SD	IOB-Test	habit test	Ave-rage Scale	SD	IOB-Test	habit test	Ave-rage Scale	SD	IOB-Test	habit test	Ave-rage Scale	SD	IOB-Test	habit test
1	1	50	1.56	0.22			2.03	0.41			2.46	0.62			1.80	0.20			2.30	0.33			2.80	0.51			3.26	0.78		
	2	64	1.57	0.20		X	2.06	0.38		X	2.57	0.59		X	1.73	0.20		*	2.29	0.34		X	2.76	0.50		X	3.24	0.73		X
	3	33	1.57	0.26		X	1.98	0.42		X	2.44	0.72		X	1.73	0.21		X	2.23	0.33		X	2.64	0.52		X	3.10	0.84		X
	4	16	1.58	0.27		X	1.97	0.37		X	2.29	0.39		X	1.72	0.21		X	2.21	0.24		X	2.58	0.32		X	2.88	0.41		*
	5	4	1.58	0.26		X	1.88	0.29		X	2.23	0.25		X	1.80	0.14		X	2.18	0.13		X	2.53	0.29		X	2.88	0.31		X
2	1	50	1.25	0.11	***		1.44	0.20	***		1.64	0.31	***		1.55	0.28	***		1.76	0.33	***		1.98	0.44	***		2.18	0.54	***	
	2	64	1.27	0.12	***	X	1.49	0.20	***	X	1.69	0.27	***	X	1.52	0.26	***	X	1.77	0.30	***	X	1.99	0.35	***	X	2.20	0.41	***	X
	3	33	1.22	0.10	***	X	1.40	0.17	***	X	1.59	0.27	***	X	1.45	0.22	***	X	1.66	0.28	***	X	1.84	0.34	***	X	2.03	0.42	***	X
	4	16	1.19	0.07	***	*	1.35	0.12	***	*	1.49	0.18	***	*	1.38	0.26	***	**	1.55	0.32	***	**	1.69	0.36	***	**	1.84	0.40	***	**
	5	4	1.12	0.05	***	**	1.23	0.08	***	**	1.32	0.13	***	**	1.33	0.31	**	X	1.46	0.35	***	*	1.57	0.37	***	*	1.69	0.39	***	*
3	1	50	1.17	0.09	***		1.30	0.17	***		1.44	0.25	***		1.51	0.27	X		1.66	0.30	***		1.80	0.35	***		1.92	0.40	***	
	2	64	1.19	0.13	***	X	1.35	0.19	***	X	1.50	0.26	***	X	1.51	0.28	X	X	1.67	0.34	***	X	1.83	0.38	***	X	1.98	0.45	***	X
	3	33	1.18	0.11	***	X	1.33	0.18	***	X	1.46	0.25	***	X	1.38	0.25	***	**	1.54	0.29	***	X	1.69	0.33	***	X	1.81	0.37	***	X
	4	16	1.13	0.07	***	X	1.24	0.12	***	X	1.34	0.17	***	X	1.34	0.25	*	**	1.45	0.30	***	**	1.55	0.33	***	**	1.66	0.38	***	**
	5	4	1.06	0.06	***	**	1.13	0.08	***	*	1.18	0.14	**	**	1.25	0.31	**	*	1.31	0.37	***	**	1.40	0.38	***	**	1.44	0.43	***	**
4	1	50	1.12	0.08	***		1.23	0.14	***		1.33	0.19	***		1.41	0.27	***		1.52	0.30	***		1.63	0.34	***		1.74	0.39	***	
	2	64	1.14	0.10	***	X	1.26	0.17	***	X	1.38	0.24	***	X	1.43	0.27	***	X	1.57	0.32	***	X	1.68	0.37	***	X	1.80	0.43	***	X
	3	33	1.13	0.08	***	X	1.23	0.13	***	X	1.34	0.19	***	X	1.33	0.22	***	X	1.45	0.26	***	X	1.57	0.32	***	X	1.68	0.37	***	X
	4	16	1.10	0.05	***	X	1.19	0.11	***	X	1.27	0.15	***	X	1.30	0.25	X	X	1.40	0.29	*	X	1.49	0.32	**	X	1.60	0.38	X	X
	5	4	1.04	0.06	X	**	1.06	0.11	**	**	1.10	0.15	***	**	1.19	0.31	X	X	1.23	0.37	X	*	1.26	0.42	**	**	1.31	0.46	**	**
5	1	50	1.10	0.06	***		1.19	0.11	***		1.27	0.15	***		1.44	0.28	*		1.53	0.31	X		1.62	0.34	X		1.70	0.37	X	
	2	64	1.13	0.11	***	*	1.23	0.17	***	X	1.34	0.24	***	X	1.43	0.27	X	X	1.54	0.33	X	X	1.64	0.38	**	X	1.74	0.44	***	X
	3	33	1.12	0.08	X	X	1.21	0.14	***	X	1.30	0.19	***	X	1.31	0.23	X	**	1.43	0.28	X	X	1.53	0.33	*	X	1.62	0.39	*	X
	4	16	1.09	0.05	X	X	1.16	0.10	**	X	1.24	0.13	**	X	1.32	0.25	X	X	1.41	0.28	X	X	1.48	0.32	X	X	1.57	0.34	X	X
	5	4	1.03	0.05	X	**	1.06	0.10	X	**	1.09	0.16	X	**	1.14	0.25	X	*	1.17	0.30	X	**	1.20	0.35	X	**	1.23	0.40	*	*

y_r: Reference-income Class ;c_y_p: Adjusted Personal-income Class ; N: Number of Observations ; SD: Standard Deviation; IOB: Independence of Base.
Levels of Significance : ***: 1%; **: 5%; *: 10%; X: insignificant

Table 5.a Test of IOB and habit persistence for Germany with Corrected Personal Income

y_r	c_y_p	N	AC				ACC				ACCC				AA				AAC				AACC				AACCC			
			Ave-rage Scale	SD	IOB-test	habit test	Ave-rage Scale	SD	IOB-test	habit test	Ave-rage Scale	SD	IOB-test	habit test	Ave-rage Scale	SD	IOB-test	habit test	Ave-rage Scale	SD	IOB-test	habit test	Ave-rage Scale	SD	IOB-test	habit test	Ave-rage Scale	SD	IOB-test	habit test
1	1	29	1.67	0.32			2.24	0.53			2.85	0.82			1.77	0.22			2.39	0.47			2.98	0.80			3.53	1.04		
	2	40	1.75	0.40		X	2.35	0.69		X	2.99	1.12		X	1.85	0.33		X	2.43	0.50		X	3.02	0.77		X	3.61	1.03		X
	3	31	1.76	0.30		X	2.42	0.56		X	3.10	0.91		X	1.78	0.26		X	2.50	0.49		X	3.24	0.76		X	3.91	1.05		X
	4	24	1.75	0.33		X	2.36	0.54		X	2.89	0.74		X	1.74	0.43		X	2.39	0.60		X	2.98	0.91		X	3.58	1.10		X
	5	6	1.67	0.12		X	2.23	0.27		X	2.92	0.40		X	2.08	0.42		**	2.64	0.34		X	3.23	0.40		X	3.88	0.55		X
2	1	29	1.34	0.17	***		1.62	0.26	***		1.89	0.38	***		1.47	0.18	***		1.77	0.27	***		2.07	0.37	***		2.35	0.49	***	
	2	40	1.36	0.22	***	X	1.67	0.39	***	X	1.96	0.54	***	X	1.60	0.41	***	X	1.86	0.40	***	X	2.16	0.54	***	X	2.45	0.66	***	X
	3	31	1.32	0.14	***	X	1.61	0.30	***	X	1.89	0.42	***	X	1.51	0.28	***	X	1.82	0.36	***	X	2.10	0.47	***	X	2.35	0.57	***	X
	4	24	1.28	0.15	***	X	1.52	0.26	***	X	1.75	0.39	***	X	1.31	0.18	***	***	1.56	0.24	***	***	1.84	0.41	***	**	2.08	0.51	***	*
	5	6	1.30	0.08	***	X	1.57	0.15	***	X	1.82	0.20	***	X	1.58	0.27	***	X	1.87	0.32	***	X	2.13	0.42	***	X	2.30	0.47	***	X
3	1	29	1.27	0.14	**		1.52	0.26	**		1.74	0.37	***		1.42	0.23	X		1.70	0.32	X		1.94	0.42	**		2.16	0.50	***	
	2	40	1.32	0.20	*	X	1.58	0.34	**	X	1.85	0.50	**	X	1.51	0.28	*	X	1.77	0.37	**	X	2.02	0.49	***	X	2.26	0.64	***	X
	3	31	1.25	0.10	***	X	1.46	0.19	***	X	1.67	0.28	***	X	1.44	0.29	**	X	1.66	0.36	***	X	1.87	0.43	***	X	2.05	0.49	***	X
	4	24	1.20	0.13	***	*	1.36	0.19	***	**	1.52	0.29	***	**	1.23	0.13	***	***	1.39	0.18	***	***	1.56	0.28	***	***	1.74	0.37	***	***
	5	6	1.21	0.14	***	X	1.34	0.20	***	X	1.48	0.23	***	X	1.46	0.37	X	X	1.60	0.41	**	X	1.74	0.45	***	X	1.86	0.50	***	X
4	1	29	1.27	0.17	X		1.54	0.34	X		1.76	0.46	X		1.40	0.20	X		1.66	0.34	X		1.88	0.46	X		2.08	0.56	X	
	2	40	1.30	0.22	X	X	1.53	0.36	**	X	1.76	0.50	***	X	1.44	0.27	***	X	1.68	0.37	***	X	1.92	0.48	***	X	2.13	0.62	***	X
	3	31	1.19	0.10	***	**	1.36	0.17	***	**	1.51	0.24	***	**	1.44	0.28	X	X	1.62	0.32	X	X	1.79	0.38	**	X	1.96	0.44	**	X
	4	24	1.14	0.09	***	***	1.26	0.14	***	***	1.38	0.20	***	***	1.20	0.12	*	**	1.31	0.17	***	***	1.44	0.24	***	***	1.56	0.30	***	***
	5	6	1.12	0.07	**	**	1.22	0.13	**	**	1.35	0.16	***	**	1.30	0.34	X	X	1.42	0.42	X	X	1.52	0.46	*	*	1.67	0.46	X	X
5	1	29	1.25	0.17	*		1.45	0.29	***		1.65	0.41	***		1.38	0.24	X		1.61	0.36	X		1.81	0.46	**		1.99	0.53	**	
	2	40	1.26	0.20	**	X	1.46	0.33	***	X	1.65	0.45	***	X	1.40	0.28	***	X	1.62	0.38	***	X	1.81	0.47	***	X	1.99	0.58	***	X
	3	31	1.16	0.09	***	**	1.31	0.17	***	**	1.45	0.23	***	**	1.38	0.28	***	X	1.54	0.33	***	X	1.68	0.38	***	X	1.81	0.44	***	X
	4	24	1.11	0.07	***	***	1.22	0.13	***	***	1.32	0.18	***	***	1.17	0.11	*	***	1.27	0.16	**	***	1.39	0.23	***	***	1.52	0.29	X	***
	5	6	1.08	0.05	***	**	1.17	0.09	**	**	1.27	0.12	**	**	1.29	0.32	X	X	1.36	0.35	X	X	1.43	0.38	**	*	1.58	0.44	**	X

y_r: Reference-income Class ;c_y_r: Adjusted Personal-income Class ; N: Number of Observations ; SD: Standard Deviation; IOB: Independence of Base.
Levels of Significance : ***: 1%; **: 5%; *: 10%; X: insignificant

Table 5.b Tests of IOB and habit persistence for Cyprus with Corrected Personal Income

Table 6.a – Data for Germany

Dependent variable : equivalence scales — Wald tests for equality of coefficients between the UR and the WR sample
Pooled estimations — White's Heteroskedasticity correction for covariance matrix
Number of observations: 5845 (UR) + 1169 (WR) — t-statistics in parentheses

Equation	(1) Wald test		(2) Wald test		(3) Wald test		(4) Wald test	
	UR	WR	UR	WR	UR	WR	UR	WR
Constant	0.06	-0.15	0.09	-0.11	0.47	0.37	0.09	-0.34
	(2.32)	(-2.11)	(3.42)	(-1.52)	(21.76)	(6.54)	(2.75)	(-3.92)
	***		***		*		***	
Stimuli								
1	1.04	1.07	1.04	1.07			1.04	1.07
Reference Income	(51.22)	(25.16)	(51.41)	(25.49)			(51.21)	(24.93)
	X		X				X	
Number of adults	0.47	0.51	0.47	0.54	0.38	0.36	0.46	0.65
	(47.81)	(20.81)	(47.91)	(21.07)	(39.51)	(14.49)	(27.79)	(16.19)
	**		**		X		***	
Number of children	0.20	0.23	0.20	0.23	0.05	0.08	0.19	0.34
	(38.06)	(19.60)	(38.14)	(19.68)	(7.73)	(5.06)	(11.63)	(8.54)
	**		**		*		***	
Number of adults					0.24	0.37		
Reference Income					(18.46)	(10.05)		
					***			
Number of children					0.39	0.32		
Reference Income					(26.48)	(10.46)		
					**			
Number of adults x Number of children							0.01	-0.06
							(0.96)	(-2.49)
							***	
Personal family income	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	(-4.29)	(-1.99)	(-2.05)	(-1.76)	(-4.64)	(-1.78)	(-4.29)	(-2.00)
	X		X		X		X	
Personal Characteristics(I)								
Gender	0.03	0.05	0.03	0.06	0.03	0.05	0.03	0.05
	(2.85)	(2.02)	(2.80)	(2.33)	(3.08)	(2.35)	(2.85)	(2.03)
	X		X		X		X	
Siblings	-0.001	0.008	0.005	0.01	-0.001	0.01	-0.001	0.01
	(-0.26)	(0.69)	(0.96)	(1.04)	(-0.28)	(0.81)	(-0.26)	(0.69)
	X		X		X		X	
Education	0.06	0.07	0.05	0.05	0.06	0.07	0.06	0.07
	(9.54)	(4.86)	(6.96)	(3.42)	(10.29)	(4.74)	(9.54)	(4.87)
	X		X		X		X	
Personal Characteristics(II)								
Partner			-0.04	-0.04				
			(-3.08)	(-1.43)				
			X					
Children			-0.004	0.03				
			(-0.68)	(1.91)				
			**					
Housewife			0.01	-0.05				
			(0.40)	(-0.51)				
			X					
Pensioner			-0.08	-0.05				
			(-3.54)	(-0.98)				
			X					
Student			-0.02	-0.00				
			(-1.20)	(-0.01)				
			X					
Welfare/Unemployed			-0.01	-0.05				
			(-0.37)	(-0.72)				
			X					
Blue Collar			-0.03	-0.003				
			(-1.60)	(-0.06)				
			X					
Self-employed			-0.01	-0.04				
			(-0.27)	(-0.72)				
			X					
Civil Servant			0.05	0.09				
			(2.77)	(1.83)				
			X					
$\overline{R}^2$	0.584		0.586		0.641		0.584	

Notes: *** rejection of equality of coefficients for UR and WR at the 1% level
** rejection of equality of coefficients for UR and WR at the 5% level
* rejection of equality of coefficients for UR and WR at the 10% level
X cannot reject the equality-of-coefficients hypothesis

Table 6.b – Data for Cyprus

Dependent variable : equivalence scales — Wald tests for equality of coefficients between the UR and the WR sample
Pooled estimations — White's Heteroskedasticity correction for covariance matrix
Number of observations 4550 (UR) + 910 (WR) — t statistics in parentheses

Equation	(1) Wald test		(2) Wald test		(3) Wald test		(4) Wald test	
	UR	WR	UR	WR	UR	WR	UR	WR
Constant	0.08	-0.04	0.10	0.02	0.57	0.59	0.09	0.34
	(1.74)	(-0.37)	(3.42)	(0.16)	(15.06)	(6.70)	(1.54)	(3.18)
	X		X		X		**	
Stimuli								
1	1.25	1.36	1.25	1.38			1.25	1.34
Reference Income	(38.71)	(17.65)	(39.05)	(17.92)			(38.70)	(17.60)
	X		X				X	
Number of adults	0.44	0.48	0.44	0.48	0.33	0.33	0.43	0.27
	(28.76)	(13.48)	(29.09)	(13.63)	(22.38)	(9.40)	(17.03)	(5.03)
	X		X		X		***	
Number of children	0.29	0.34	0.29	0.34	0.11	0.08	0.29	0.14
	(37.16)	(17.33)	(37.47)	(17.52)	(11.22)	(3.31)	(10.80)	(2.67)
	**		**		X		***	
Number of adults					0.29	0.25		
Reference Income					(13.36)	(5.36)		
					X			
Number of children					0.48	0.55		
Reference Income					(19.36)	(8.77)		
					X			
Number of adults x Number of children							0.002	0.11
							(0.17)	(3.38)
							***	
Personal family income	0.001	0.01	0.004	0.02	0.001	0.02	0.001	0.01
	(0.37)	(1.54)	(0.95)	(1.64)	(0.39)	(2.43)	(0.37)	(1.55)
	X		X		**		X	
Personal Characteristics(I)								
Gender	0.07	0.06	0.07	0.06	0.07	0.05	0.07	0.06
	(5.08)	(1.67)	(4.23)	(1.58)	(5.43)	(1.71)	(5.08)	(1.67)
	X		X		X		X	
Siblings	-0.06	-0.09	-0.05	-0.08	-0.06	-0.09	-0.06	-0.09
	(-8.23)	(-4.96)	(-5.98)	(-3.63)	(-8.74)	(-5.51)	(-8.23)	(-4.98)
	X		X		X		X	
Education	0.06	0.03	0.08	0.05	0.06	0.04	0.06	0.03
	(5.52)	(1.11)	(7.52)	(1.73)	(5.84)	(1.72)	(5.52)	(1.10)
	X		X		X		X	
Personal Characteristics(II)								
Partner			-0.02	-0.04				
			(-0.72)	(-0.64)				
			X					
Children			-0.06	-0.07				
			(-7.34)	(-3.54)				
			X					
Living with Parents			-0.07	-0.08				
			(-2.66)	(-1.35)				
			X					
Housewife			0.16	-0.02				
			(3.05)	(-0.21)				
			X					
Student			-0.04	-0.05				
			(-1.67)	(-0.90)				
			X					
Welfare/Unemployed			-0.22	-0.35				
			(-4.99)	(-3.65)				
			X					
Blue Collar			-0.01	-0.07				
			(-0.07)	(-0.40)				
			X					
Self-employed			0.03	0.02				
			(1.13)	(0.40)				
			X					
Civil Servant			-0.09	-0.11				
			(-4.09)	(-2.18)				
			X					
$\overline{R}^2$	0.545		0.554		0.602		0.545	

Notes: *** rejection of equality of coefficients for UR and WR at the 1% level
** rejection of equality of coefficients for UR and WR at the 5% level
* rejection of equality of coefficients for UR and WR at the 10% level
X cannot reject the equality-of-coefficients hypothesis

Table 7.a – Data for Germany

Dependent variable : equivalence scales — Wald tests for equality of coefficients between the WR and the SR sample
Pooled estimations — White's Heteroskedasticity correction for covariance matrix
Number of observations: 1169 (WR) + 103 (SR) — t-statistics in parentheses

Equation	(1) Wald test		(2) Wald test		(3) Wald test		(4) Wald test	
	WR	SR	WR	SR	WR	SR	WR	SR
Constant	-0.18	0.02	-0.17	0.20	0.34	0.57	-0.37	-0.11
	(-2.56)	(0.10)	(-2.44)	(1.30)	(6.21)	(4.11)	(-4.22)	(-0.47)
	X		*		X		X	
Stimuli								
1	1.07	1.17	1.07	1.35			1.07	1.17
Reference Income	(24.98)	(6.46)	(24.96)	(6.60)			(24.74)	(6.39)
	X		X				X	
Number of adults	0.54	0.37	0.54	0.25	0.36	0.22	0.65	0.43
	(20.68)	(5.47)	(20.68)	(3.15)	(14.45)	(3.57)	(16.00)	(4.11)
	**		***		**		**	
Number of children	0.23	0.25	0.23	0.23	0.08	-0.17	0.34	0.34
	(19.48)	(4.45)	(19.42)	(4.70)	(5.00)	(-2.36)	(8.45)	(3.87)
	X		X		***		X	
Number of adults					0.37	0.29		
Reference Income					(9.90)	(6.46)		
					X			
Number of children					0.32	0.93		
Reference Income					(10.47)	(4.78)		
					***			
Number of adults x Number of children							-0.06	-0.05
							(-2.47)	(-0.79)
							X	
Personal family income								
Personal Characteristics(I)								
Gender	0.04	0.05	0.05	0.05	0.05	-0.01	0.04	0.05
	(1.91)	(0.71)	(2.03)	(0.65)	(2.25)	(-0.12)	(1.91)	(0.74)
	X		X		X		X	
Siblings	0.003	-0.01	0.01	0.02	0.005	-0.02	0.003	-0.01
	(0.30)	(-0.38)	(0.66)	(0.53)	(0.46)	(-0.58)	(0.30)	(-0.41)
	X		X		X		X	
Education	0.07	0.11	0.06	0.08	0.07	0.13	0.07	0.11
	(4.71)	(2.54)	(3.60)	(1.71)	(4.60)	(3.83)	(4.72)	(2.56)
	X		X		*		X	
Personal Characteristics(II)								
Partner								
Children								
Housewife			-0.06	0.19				
			(-0.62)	(1.06)				
			X					
Pensioner			-0.08	0.02				
			(-1.53)	(0.17)				
			X					
Student			0.03	-0.17				
			(0.95)	(-1.91)				
			**					
Welfare/Unemployed			-0.01	-0.44				
			(-0.24)	(-2.38)				
			**					
Blue Collar			0.02	-0.07				
			(0.41)	(-0.50)				
			X					
Self-employed			-0.01	-0.19				
			(-0.21)	(-1.51)				
			X					
Civil Servant			0.07	0.35				
			(1.51)	(1.33)				
			X					
$\overline{R}^2$	0.545		0.548		0.604		0.547	

Notes: *** rejection of equality of coefficients for WR and SR at the 1% level
** rejection of equality of coefficients for WR and SR at the 5% level
* rejection of equality of coefficients for WR and SR at the 10% level
X cannot reject the equality-of-coefficients hypothesis

Table 7.b – Data for Cyprus

Dependent variable : equivalence scales — Waldtests for equality of coefficients between the WR and the SR sample
Pooled estimations — White's Heteroskedasticity correction for covariance matrix
Number of observations: 910 (WR) + 112 (SR) — t-statistics in parentheses

Equation	(1) Wald test		(2) Wald test		(3) Wald test		
	WR	SR	WR	SR	WR	SR	
Constant	-0.003	-0.07	0.02	0.06	0.64	0.69	
	(-0.03)	(-0.25)	(0.23)	(0.18)	(7.54)	(2.91)	
	X		X		X		
Stimuli							
1	1.37	1.27	1.38	1.30			
Reference Income	(17.55)	(6.33)	(17.53)	(6.42)			
	X		X				
Number of adults	0.48	0.53	0.48	0.56	0.33	0.26	
	(13.39)	(5.41)	(13.33)	(3.88)	(9.25)	(3.51)	
	X		X		X		
Number of children	0.34	0.23	0.34	0.20	0.09	-0.08	
	(17.21)	(4.06)	(17.25)	(4.01)	(3.40)	(-1.42)	
	*		**		***		
Number of adults					0.26	0.33	
Reference Income					(5.45)	(4.50)	
					X		
Number of children					0.54	0.65	
Reference Income					(8.62)	(4.27)	
					X		
Number of adults x Number of children							
Personal family income							
Personal Characteristics(I)							
Gender	0.06	-0.01	0.05	-0.05	0.05	0.01	
	(1.69)	(-0.10)	(1.30)	(-0.51)	(1.75)	(0.07)	
	X		X		X		
Siblings	-0.08	-0.14	-0.09	-0.16	-0.08	-0.12	
	(-4.63)	(-2.24)	(-4.44)	(-2.52)	(-5.01)	(-1.99)	
	X		X		X		
Education	0.04	0.14	0.04	0.12	0.05	0.12	
	(1.54)	(2.33)	(1.63)	(1.92)	(2.42)	(2.38)	
	X		X		X		
Personal Characteristics(II)							
Partner							
Children							
Living with Parents							
Housewife			-0.03	-0.22			
			(-0.29)	(-1.88)			
			X				
Student			-0.04	-0.25			
			(0.79)	(-1.93)			
			X				
Welfare/Unemployed			-0.36	-0.53			
			(-4.00)	(-3.26)			
			X				
Blue Collar			-0.03	-0.65			
			(-0.14)	(-5.67)			
			***				
Self-employed			0.04	0.24			
			(0.75)	(0.11)			
			X				
Civil Servant			-0.06	-0.09			
			(1.34)	(-0.79)			
			X				
$\overline{R}^2$	0.586		0.589		0.651		

Notes: *** rejection of equality of coefficients for WR and SR at the 1% level
** rejection of equality of coefficients for WR and SR at the 5% level
* rejection of equality of coefficients for WR and SR at the 10% level
X cannot reject the equality-of-coefficients hypothesis

Table 8.a – Data for Germany

Dependent variable : equivalence scales — Wald tests for equality of coefficients between the UR and the SR sample

Pooled estimations — White's Heteroskedasticity correction for covariance matrix

Number of observations: 5845 (UR) + 103 (SR) — t-statistics in parentheses

Equation	(1) Wald test		(2) Wald test		(3) Wald test		(4) Wald test	
	UR	SR	UR	SR	UR	SR	UR	SR
Constant	0.03	0.02	0.04	0.20	0.44	0.57	0.06	-0.11
	(1.24)	(0.10)	(3.42)	(1.04)	(20.89)	(4.13)	(1.92)	(-0.47)
	X		X		X		X	
Stimuli								
1	1.04	1.17	1.04	1.35			1.04	1.17
Reference Income	(51.16)	(6.48)	(51.28)	(6.66)			(51.15)	(6.42)
	X		X				X	
Number of adults	0.47	0.36	0.47	0.24	0.38	0.22	0.46	0.43
	(47.75)	(5.50)	(47.79)	(3.18)	(39.46)	(3.58)	(27.81)	(4.13)
	X		***		**		X	
Number of children	0.20	0.25	0.20	0.23	0.05	-0.17	0.19	0.34
	(38.00)	(4.46)	(38.03)	(4.74)	(7.71)	(-2.37)	(11.63)	(3.89)
	X		X		***		*	
Number of adults					0.24	0.29		
Reference Income					(18.45)	(6.49)		
					X			
Number of children					0.39	0.93		
Reference Income					(26.44)	(4.81)		
					***			
Number of adults x Number of children							0.01	-0.05
							(0.96)	(-0.80)
							X	
Personal family income								
Personal Characteristics(I)								
Gender	0.03	0.05	0.03	0.05	0.03	-0.01	0.03	0.05
	(2.63)	(0.71)	(2.41)	(0.66)	(2.84)	(-0.12)	(2.63)	(0.74)
	X		X		X		X	
Siblings	-0.01	-0.01	-0.002	0.02	-0.01	-0.02	-0.01	-0.01
	(-1.18)	(-0.38)	(-0.59)	(0.53)	(-1.27)	(-0.58)	(-1.18)	(-0.41)
	X		X		X		X	
Education	0.06	0.11	0.05	0.08	0.06	0.13	0.06	0.11
	(9.27)	(2.55)	(7.60)	(1.73)	(9.99)	(3.84)	(9.27)	(2.57)
	X		X		**		X	
Personal Characteristics(II)								
Partner			-					
Children			-					
Housewife			-0.02	0.19				
			(-0.63)	(1.07)				
			X					
Pensioner			-0.08	0.02				
			(-3.81)	(0.17)				
			X					
Student			0.01	-0.17				
			(0.83)	(-1.93)				
			**					
Welfare/Unemployed			0.02	-0.44				
			(0.53)	(-2.40)				
			**					
Blue Collar			-0.01	-0.07				
			(-0.63)	(-0.50)				
			X					
Self-employed			0.01	-0.19				
			(0.38)	(-1.52)				
			X					
Civil Servant			0.04	0.34				
			(2.23)	(1.34)				
			X					
$\overline{R}^2$	0.586		0.588		0.648		0.586	

Notes: *** rejection of equality of coefficients for UR and SR at the 1% level

** rejection of equality of coefficients for UR and SR at the 5% level

* rejection of equality of coefficients for UR and SR at the 10% level

X cannot reject the equality-of-coefficients hypothesis

Table 8.b – Data for Cyprus

Dependent variable : equivalence scales — Wald tests for equality of coefficients between the UR and the SR sample
Pooled estimations — White's Heteroskedasticity correction for covariance matrix
Number of observations: 4550 (UR) + 112 (SR) — t-statistics in parentheses

Equation	(1) Wald test UR	(1) Wald test SR	(2) Wald test UR	(2) Wald test SR	(3) Wald test UR	(3) Wald test SR	
Constant	0.08	-0.07	0.08	0.06	0.57	0.69	
	(1.90)	(-0.25)	(1.80)	(0.18)	(15.79)	(2.93)	
	X		X		X		
Stimuli							
1	1.25	1.27	1.25	1.30			
Reference Income	(38.70)	(6.36)	(38.70)	(6.48)			
	X		X				
Number of adults	0.44	0.53	0.44	0.56	0.33	0.26	
	(28.76)	(5.44)	(28.86)	(3.92)	(22.38)	(3.54)	
	X		X		X		
Number of children	0.29	0.23	0.29	0.20	0.11	-0.08	
	(37.16)	(4.08)	(37.24)	(4.05)	(11.22)	(-1.43)	
	X		*		***		
Number of adults					0.29	0.33	
Reference Income					(13.36)	(4.53)	
					X		
Number of children					0.48	0.65	
Reference Income					(19.36)	(4.29)	
					X		
Number of adults x Number of children							
Personal family income							
Personal Characteristics (I)							
Gender	0.07	-0.01	0.05	-0.01	0.07	0.05	
	(5.08)	(-0.10)	(3.51)	(-0.51)	(5.43)	(0.07)	
	X		X		X		
Siblings	-0.06	-0.14	-0.06	-0.16	-0.06	-8.61	
	(-8.11)	(-2.26)	(-7.38)	(-2.55)	(-8.61)	(-2.00)	
	X		X		X		
Education	0.06	0.14	0.07	0.12	0.06	0.12	
	(5.94)	(2.35)	(6.97)	(1.94)	(6.28)	(2.40)	
	X		X		X		
Personal Characteristics (II)							
Partner			-				
Children			-				
Living with Parents			-				
Housewife			0.16	-0.22			
			(3.17)	(-1.89)			
			***				
Student			-0.04	-0.25			
			(-1.63)	(-1.95)			
			*				
Welfare/Unemployed			-0.22	-0.53			
			(-5.39)	(-3.29)			
			*				
Blue Collar			0.05	-0.65			
			(0.66)	(-5.82)			
			***				
Self-employed			0.02	0.24			
			(1.00)	(1.13)			
			X				
Civil Servant			-0.06	-0.09			
			(-3.02)	(-0.79)			
			X				
$\overline{R}^2$	0.533		0.537		0.589		

Notes: *** rejection of equality of coefficients for UR and SR at the 1% level
** rejection of equality of coefficients for UR and SR at the 5% level
* rejection of equality of coefficients for UR and SR at the 10% level
X cannot reject the equality-of-coefficients hypothesis

Table 9.a - Data for Germany

Wald tests for equality of coefficients between the UR and the WR sample
Regressions for subgroups defined by demographic stimuli
Number of observations : 1169 (UR) + 167 (WR)
Other conditioning variables: Personal family income and Personal Characteristics (I) (they do not appear in the table)
White's Heteroskedasticity correction for covariance matrix
t-statistics in parentheses

Number of adults		Number of Children							
		0		1		2		3	
		A		AC		ACC		ACCC	
		UR	WR	UR	WR	UR	WR	UR	WR
1	Constant			0.98 (56.50)	0.96 (20.56)	0.99 (32.91)	1.00 (10.14)	1.02 (24.27)	1.04 (8.89)
				X		X		X	
	1 / Reference Inc.			0.53 (23.98)	0.57 (13.23)	0.95 (24.77)	0.97 (14.54)	1.38 (23.31)	1.14 (12.38)
				X		X		**	
	$\bar{R}^2$			0.608		0.639		0.613	
2		AA		AAC		AACC		AACCC	
	Constant	1.26 (33.99)	1.28 (13.98)	1.24 (27.87)	1.14 (10.87)	1.27 (23.37)	1.20 (9.38)	1.30 (20.19)	1.09 (6.27)
		X		X		X		X	
	1 / Reference Inc.	0.43 (16.84)	0.44 (5.67)	0.91 (25.27)	0.99 (12.91)	1.33 (25.76)	1.69 (11.98)	1.75 (23.37)	2.04 (8.26)
		X		X		**		X	
	$\bar{R}^2$	0.213		0.461		0.541		0.529	

*** rejection of equality of coefficients for UR and WR at the 1% level
** rejection of equality of coefficients for UR and WR at the 5% level
* rejection of equality of coefficients for UR and WR at the 10% level
X cannot reject the equality -of-coefficients hypothesis

Table 9.b – Data for Cyprus

Wald tests for equality of coefficients between the UR and the WR sample
Regressions for subgroups defined by demographic stimuli
Number of observations : 910 (UR) + 130 (WR)
Other conditioning variables: Personal family income and Personal Characteristics (I) (they do not appear in the table)
White's Heteroskedasticity correction for covariance matrix
t-statistics in parentheses

Number of adults		Number of Children							
		0		1		2		3	
		A		AC		ACC		ACCC	
		UR	WR	UR	WR	UR	WR	UR	WR
1	Constant			1.07 (31.67)	1.16 (16.30)	1.16 (19.94)	1.14 (7.60)	1.23 (14.88)	1.54 (8.24)
				X		X		X	
	1 / Reference Inc.			0.62 (16.47)	0.53 (5.39)	1.13 (17.29)	1.37 (4.78)	1.67 (16.45)	0.93 (2.36)
				X		X		*	
	$\bar{R}^2$			0.454		0.472		0.465	
2		AA		AAC		AACC		AACCC	
	Constant	1.26 (23.29)	1.44 (9.28)	1.32 (18.80)	1.24 (8.65)	1.41 (15.16)	1.32 (5.88)	1.46 (12.78)	1.22 (5.19)
		X		X		X		X	
	1 / Reference Inc.	0.53 (13.64)	0.57 (6.39)	1.06 (18.28)	0.94 (11.28)	1.60 (18.05)	1.49 (9.25)	2.12 (18.48)	2.46 (13.82)
		X		X		X		X	
	$\bar{R}^2$	0.27		0.448		0.482		0.545	

*** rejection of equality of coefficients for UR and WR at the 1% level
** rejection of equality of coefficients for UR and WR at the 5% level
* rejection of equality of coefficients for UR and WR at the 10% level
X cannot reject the equality -of-coefficients hypothesis

	Single-adult Household		Two-adult Household	
Reference - income Level	Weight Child1 vs. Weight Child2	Weight Child2 vs. Weight Child3	Weight Child1 vs. Weight Child2	Weight Child2 vs. Weight Child3
1	***(***)	X(X)	***(X)	X(X)
2	***(***)	X(X)	***(X)	X(X)
3	***(***)	*(X)	*(X)	***(X)
4	***(***)	X(**)	***(*)	X(**)
5	***(***)	**(X)	***(***)	X(X)

Notes: *** rejection of equality of coefficients for UR and SR at the 1% level
** rejection of equality of coefficients for UR and SR at the 5% level
* rejection of equality of coefficients for UR and SR at the 10% level
X cannot reject the equality -of-coefficients hypothesis

Table 10.a Significance of pairwise T-Tests for differences (changes) in the weights of children as the number of children in the household increases . Germany and Cyprus (Cyprus appears in parentheses)

Reference - income Level	1 Child	2 Children	3 Children
1	***(***)	X(X)	X(X)
2	***(***)	X(X)	X(X)
3	***(***)	X(X)	X(X)
4	**(***)	X(X)	X(X)
5	**(***)	X(X)	X(X)

Notes: *** rejection of equality of coefficients for UR and SR at the 1% level
** rejection of equality of coefficients for UR and SR at the 5% level
* rejection of equality of coefficients for UR and SR at the 10% level
X cannot reject the equality -of-coefficients hypothesis

Table 10.b Significance of pairwise T-Tests for differences in the weights of children having a single parent versus children living with two parents . Germany and Cyprus (Cyprus appears in parentheses)

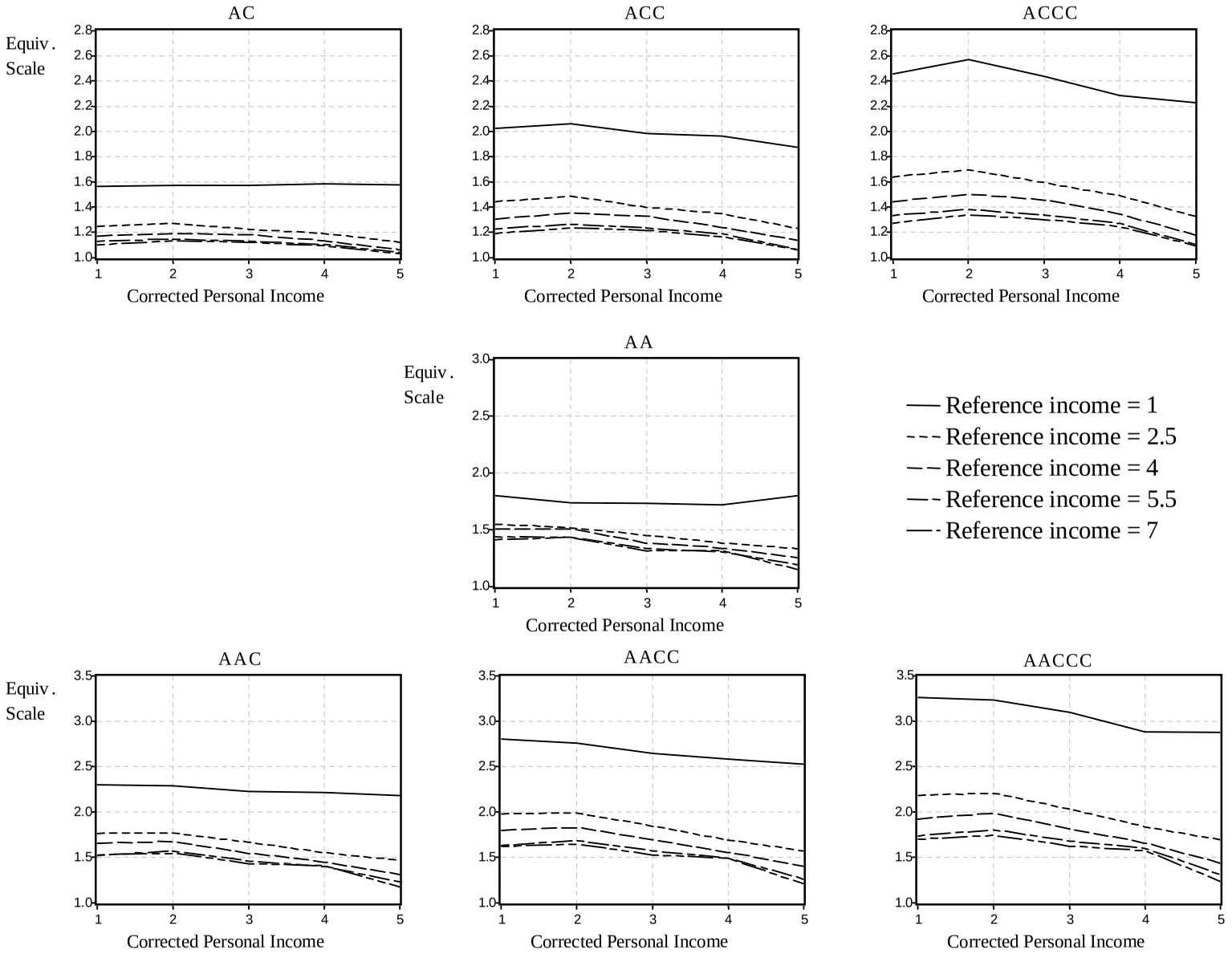

Figure 1.a Average Equivalence Scales for Germany

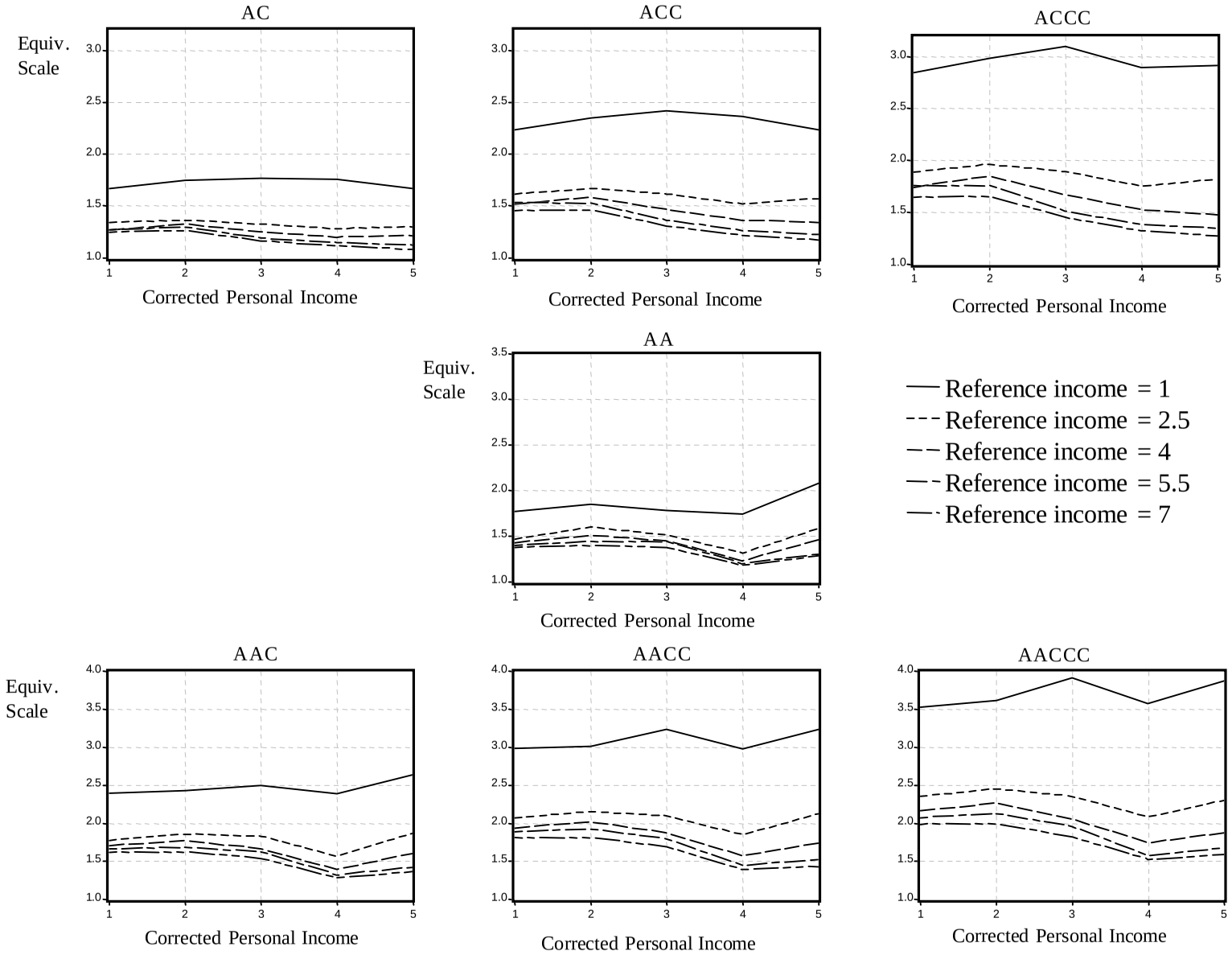

Figure 1.b Average Equivalence Scales for Cyprus

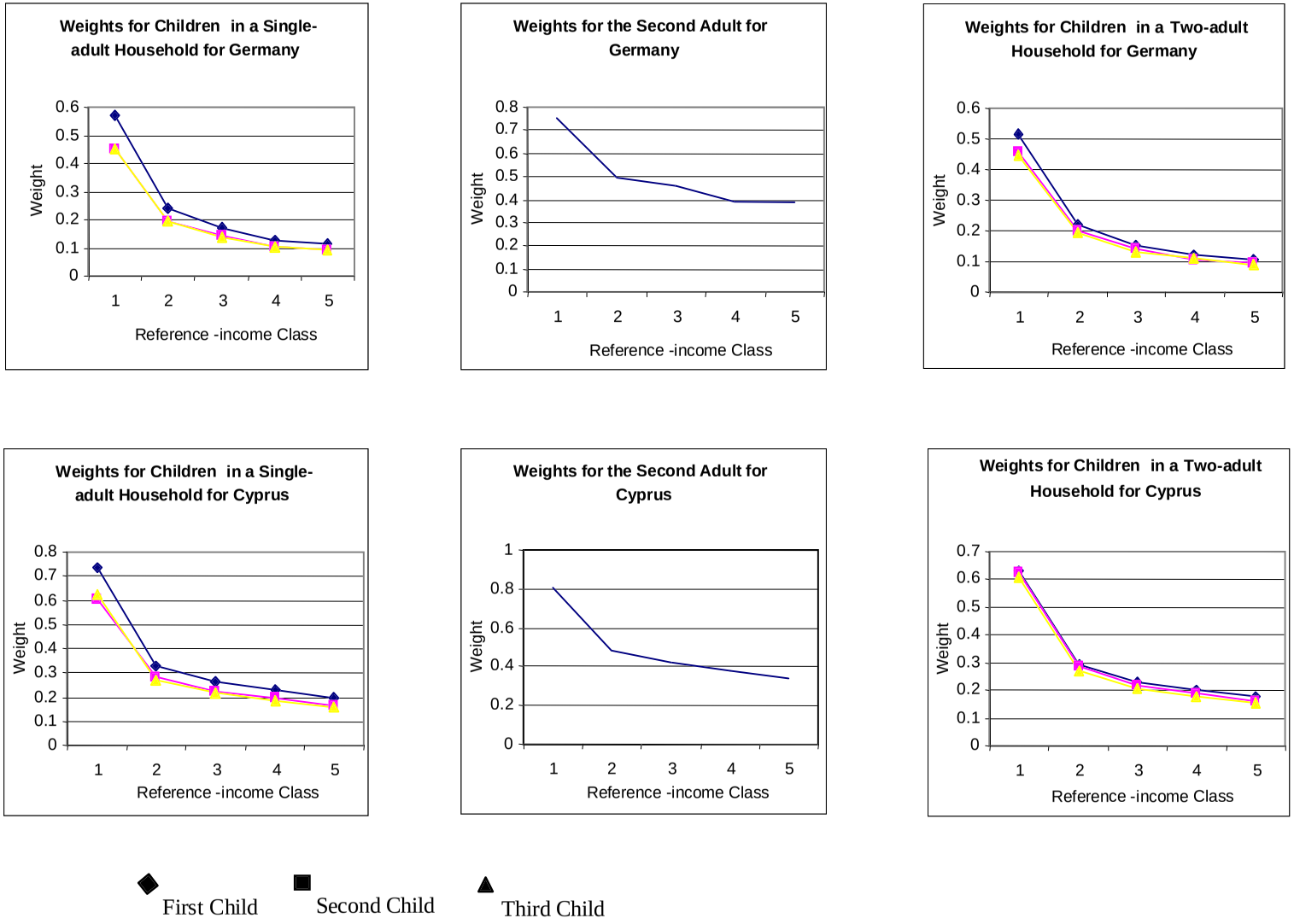

Figure 2 Weights for Germany and Cyprus

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