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**Empirical versus policy equivalence scales:
matching estimation**

Adam Szulc

**Working Papers
Institute of Statistics and Demography
Warsaw School of Economics**

Abstract

Properties of three types of equivalence scales obtained through the matching estimation are compared. The scales are derived by estimating the effect that demographic variables have on the household expenditures. The types estimated include: i/ matching on common values of well-being covariates (partly normative approach), ii/ matching on simulated equivalent expenditure minimising the deviation between the estimated and presumed value (solely empirical method), iii/ matching on covariates with imposed economy of scale on selected commodities (policy scales). Unlike many scales based on the estimates of demand systems, those obtained by the matching estimation confirm expectations based on the economic theory.

Keywords: equivalence scale, matching estimation

JEL classification: D12, C14

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1. Introduction

Equivalence scales are indicators intended to adjust the household nominal income or expenditure with respect to its demographic composition. Once they are properly estimated, the equivalent income/expenditure (i. e. income or expenditure divided by the equivalence scale) may be directly compared between households of different type. Therefore, the equivalence scales are inherent element of research on income distribution, poverty, inequality or social policy. Numerous studies in those fields confirmed considerable impact of the scales applied on the results (Buhmann et al, 1988, Duclos and Mercader-Pratts, 1999, Ayala et al, 2003). On the other hand, no commonly accepted method of estimation has been elaborated yet. This suggests that most of the studies on income distribution may be flawed with this respect.

The general question in equivalence scale construction is: how much more or less a household of given demographic type requires to attain the same well-being level that a household of other type. The resulting concern is: how to measure well-being to make it comparable between the households. This issue may be resolved for instance by applying an utility concept or by assuming that the food ratio is a such measure (Engel approach). The first concept cause identification problems (see Pollak and Wales, 1979, Blundell and Lewbel, 1991). The Engel concept is based on unrealistic assumption that households with the same food ratio reach the same well-being level. Moreover, utility based scales require estimation of the complete demand systems with demographic variables and, therefore, seek long time series to ensure sufficient price variation. The alternative solution that overcome most of the abovementioned problems is based on subjective income questions (Kapteyn and van Praag, 1976, Kot, 1997). However, its credibility is restricted by using verbal people's declarations rather than observing their behaviour.

In this paper the concept of equivalence scales utilising matching estimation (introduced by Szulc, 2009) is developed in order to address the following questions.

1. Identification problem; no assumption on household behaviour nor utility comparability is required.
2. Estimation using single period data without price information.
3. Incorporating multidimensional measures of household's well-being.

4. Distinction between purely empirical scales and those based on some normative assumptions.
5. Meeting two basic assumptions in matching estimation: conditional independence (unconfoundedness) and common support.

The remaining part of this paper is organised as follows. In Section 2 the principles of matching estimation in the equivalence scale context are presented. Section 3 discusses the conditional independence and common support assumptions and their relation with the selection of well-being covariates. In Section 4 the results of estimation by means of the three methods are reported together with comparison of the results. Section 5 concludes.

2. Matching estimation of equivalence scales

The matching technique yields the estimate of an average effect of a binary treatment on a continuous scalar outcome (say X). For each i th individual ($i = 1, \dots, N$) in the sample two potential outcomes may occur: $X_i(1)$ when the individual is exposed to the treatment and $X_i(0)$ otherwise. The population average treatment effect ($PATE$) is defined as follows

$$PATE = E[X_i(1) - X_i(0)] \quad (1)$$

In the empirical economic studies the “treatment” usually means participation in a social program. In the equivalence scales context the “treatment” denotes belonging of i th household to a particular demographic type. Therefore, the $PATE$ may be interpreted as a measure of the effect the demographic attributes have on the expenditure of one type of household (a “treated” household), as compared to the expenditure of a reference household (a “control” household).

The $PATE$ cannot be estimated directly as the individual cannot be at the state 0 and 1 simultaneously. This is also true when the demographic effect on expenditure is considered: when two types of household are compared (say A_1 and A_0) it may belong to one class only. The matching estimation resolves this problem by comparing two types of outcome for each household in the sample: (1) the actual expenditure, (2) the counterfactual expenditure that this household would have, if it was of a supplementary type. The latter is estimated by means of the

actual expenditure(s) of the supplementary type of household(s) matched on common or closest values of well-being covariates. This meets the idea of the equivalence scales presented in the Introduction: the matched households are assumed to reach the same or similar level of well-being. Therefore, for each element of the sample the (individual) equivalence scale may be calculated as the ratio of expenditure of a households with attributes A_j to expenditure(s) of a matched household(s) with attributes A_{1-j} .

As an equivalence scale is an expenditure ratio, and not a difference, the average effect of demographic attributes (A_0 and A_1) on logarithm of expenditure X is estimated. Moreover *PATE* defined above is an average treatment effect for the whole population while estimating equivalence scales the focus is on the subpopulation of the “treated”, i. e. households attributed by A_1 (hereafter: *PATT*). Hence, the logarithmic equivalence scale (say m) is estimated as follows:

$$\ln[m(A_1, A_0)] = E[\ln X_i(1) - (\ln X_i(0) | A_j = A_1)] \quad (2)$$

To estimate the equivalence scales defined above for each (*ith*) household the actual (X_i) and counterfactual (X_i^M) expenditures are calculated. The latter takes the form

$$X_i^M = \begin{cases} \frac{1}{M} \sum_{l \in \Gamma_i(1)} \frac{w_l x_l}{\sum w_j} & \text{if } A_i = A_0 \\ \frac{1}{M} \sum_{l \in \Gamma_i(0)} \frac{w_l x_l}{\sum w_j} & \text{if } A_i = A_1 \end{cases} \quad (3)$$

where $\Gamma_i(j)$ ($j=0,1$) denotes the set of M closest matches¹ for the *ith* household and w_l stands for the population weights. Each household may be used as a match more than once, which is equivalent to matching with replacement. Abadie and Imbens (2006) pointed out that this reduces the estimator bias, though increases its variance.

¹ Matches for which the norm $\|Z_j - Z_i\|_V$ takes the smallest values across the entire sub-sample, where Z stands for a vector of the household well-being covariates.

The formula for estimation of (2) uses the estimates of expenditures X proposed by Imbens (2004):

$$\tilde{X}_i(0) = \begin{cases} X_i & \text{if } A_i = A_0 \\ X_i^M + \mu_0 - \mu_1 & \text{if } A_i = A_1 \end{cases}$$

and (4)

$$\tilde{X}_i(1) = \begin{cases} X_i^M + \mu_1 - \mu_0 & \text{if } A_i = A_0 \\ X_i & \text{if } A_i = A_1 \end{cases}$$

that yield unbiased estimate of the population demographic effect (*PATE* or *PATT*); μ_j ($j=1,0$) is a regression estimate of actual expenditure X on covariates Z_j , weighted by the numbers of times the household is used as a match:

$$\mu_j = \alpha_j + \beta_j' Z_i \quad j=0, 1 \quad (5)$$

Finally, the corresponding estimator of the sample average treatment effect for the sub-sample of the “treated” takes the form

$$SATT = \frac{1}{N} \sum_{i=1}^N [X_i(1) \cdot w_i - \tilde{X}_i(0) \cdot w_i] \quad (6)$$

where $\tilde{X}_i(0)$ is defined by (4) and (5). Replacing expenditures by their logarithms allows estimation of the right-hand side of (2), i. e. the sample average equivalence scale comparing the households attributed by A_1 to those attributed by A_0 .

The variance of the sample average treatment effect defined by (6) is estimated as

$$\hat{V}^t = \frac{1}{N_1} \sum_{i=1}^N [W_i - (1 - W_i)K_i]^2 \hat{\sigma}_i^2(Z) \quad (8)$$

where $W_i = 1$ if $A_i = A_1$ and $W_i = 0$ otherwise and K_i stands for the number of times the i th household is used as a match. Under an assumption of constant treatment effect and constant variance of X^2 the conditional error variance $\hat{\sigma}^2(Z)$ may be calculated as:

$$\sigma_i^2(Z) = \sigma^2 = \frac{1}{2N_1} \sum_{i:W_i=1} \left[\frac{1}{M} \sum_{l \in \Gamma_i(j)} (Y_i - Y_l - SATT) \right] \quad (9)$$

$\Gamma_i(j)$ is described after eqn (3).

3. Selection of the covariates and two basic assumptions in matching estimation.

Matching estimation is based on two assumptions that are sufficient for identification of the treatment effect. The first one, usually termed as unconfoundedness or conditional independence, implies that systematic differences between two sub-samples under comparison are due to treatment. The second one, termed as common support or overlap, implies that individuals with the same covariates' Z values have positive probabilities of being both in treated and control group.

If the mean effect for the treated ($SATT$) is the only objective of the interest (the present case) both abovementioned assumptions may be weakened, as only the values for the controls are to be estimated. The unconfoundedness assumption is reduced to assumption that under given set of covariates (Z) potential outcome for the controls is independent of the treatment assignment

$$X(0) \perp W \mid Z \quad (10)$$

(\perp denotes independence). Weak overlap assumption may be formally written as:

$$P(W = 1 \mid Z) < 1 \quad (11)$$

Assumption (10) means that all variables that influence simultaneously potential outcome $X(0)$ and treatment assignment are observable and included into the set of covariates Z .

² For details of those assumption as well as variance estimation under heteroskedasticity see Abadie et al (2004).

Informally speaking, the better set of well-being covariates, the closer unconfoundedness assumption is satisfied. This issue is explored in section 4.2. The common support assumption may be interpreted that for both types of household the range of covariates Z is similar. This assumption hardly holds when completely different households, for example childless couple and couple with three children, are compared. To relax impact of violation of the common support assumption the scales were estimated also using a “chaining” method: a two person household was compared to a single person, three persons to two persons etc. The results were quite close to those obtained with a fixed reference household which suggests that the common support assumption may be ignorable in the present case.

Three types of the covariate sets are examined:

1. The set of variables correlated with household well-being that are comparable between various types. A food ratio (being used in the Engel method of estimation as a single well-being indicator) is an example of such a variable. This method allows expanding the set of well-being covariates by non-monetary indicators.
2. One variable being a potential measure of a household equivalent expenditure. The potential equivalence scales are scalars which values are simulated within the interval constructed around the estimates obtained by means of the previous method. It is assumed that the “true” equivalence scale minimises the absolute difference between the scale resulting from the presumed value and that resulting from the estimation. The scales obtained in this way may be considered purely empirical and focus on comparison of consumption levels only.
3. The set of covariates supplemented by a variable(s) for which economy of scale is assumed a priori. Such a scale may be useful in social policy analyses in which equivalence scales should incorporate some normative assumptions.

Depending on the covariates, the scales yield different type of information on relative cost of living. This issue is investigated in succeeding section.

4. Three types of equivalence scales

The scales in the present study are estimated using the data coming from the 2005 Household Budget Survey collected by the Central Statistical Office of Poland. All the estimations of the demographic effect are made with respect to the household size and with respect to the number of children below 16 years of age. As comparison between those two estimations are not the goal of this study, they are performed on different subsamples. The estimation intended to calculate the cost of children, is run on households with the head below 56 years of age to reduce the impact of age. Only urban households were used in both estimations. The algorithm applied has been developed by Abadie et al (2004) as STATA command *nnmatch*. It allows unbiased estimation using the formula introduced in eqn (4) for the correction of the counterfactual expenditures. The Mahalanobis metric is applied in all estimations³.

4.1. Generalised Engel scales

The equivalence scale utilising the set of well-being correlates may be considered a generalisation of the idea underlying the Engel scale⁴. Two households are assumed to achieve the same level of well-being provided that certain observable covariates are equal. Due to employing matching estimation instead of regression it is possible to use more than one variable⁵ (the list of covariates employed in the present study is reported in Appendix). This idea is in line with some recent attempts to include into comparisons also non-monetary variables. Lelli (2005) estimated equivalence scales expanding welfare covariates using “functioning variables” like housing or education. Ebert and Moyes (2003) investigating formal properties of equivalence scales generalised single measures by means of multidimensional welfare (or utility) proxies. Both approaches can be captured by employing an appropriate set of covariates Z .

The generalised Engel scales are estimated using one and four matches (M in eqn 3). The latter estimation should ensure lower standard errors than the previous, which is confirmed by the empirical results. In Table 1 the estimates of mean logarithmic demographic effects (eqn 2) with standard errors as well as equivalence scales are displayed. To facilitate the comparisons the estimates are supplemented by OECD 70/50 equivalence scales. It should be mentioned,

³ The results are quite robust to the choice of metric.

⁴ This approach to estimation of household equivalence scales was introduced by Szulc (2009).

however, that in original OECD formula children are defined as persons below 15 years of age (i. e. younger by one year than those in the present research), therefore the results are not perfectly comparable.

Tab 1. Mean logarithmic demographic effects (MLDE) and equivalence scales estimated by generalised Engel method

Type of household	OECD equivalence scale	1 match		4 matches	
		MLDE ¹	Equivalence scale	MLDE ¹	Equivalence scale
reference household = single adult					
2 persons	1.688	0.4755 (0.01140)	1.609	0.47205 (0.00991)	1.603
3 persons	2.303	0.66318 (0.01747)	1.941	0.65822 (0.01374)	1.931
4 persons	2.887	0.78786 (0.02272)	2.199	0.79350 (0.01710)	2.211
reference household = two adults, hh head age below 56					
2 adults, 1 child	1.294	0.17476 (0.01490)	1.191	0.16779 (0.01270)	1.183
2 adults, 2 children	1.588	0.28611 (0.02046)	1.331	0.29758 (0.01564)	1.347
2 adults, 3 children	1.882	0.43421 (0.03051)	1.544	0.38707 (0.02292)	1.473
reference household = single adult, hh head age below 56					
2 adults, 1 child	2.20	0.67481 (0.02474)	1.964	0.68104 (0.01932)	1.976
1 adult, 1 child	1.50	0.43358 (0.03004)	1.543	0.38177 (0.02533)	1.465

Standard errors in parentheses

⁵ Moreover, adding covariates reduces the matching estimator variance (Imbens, 2004).

The general conclusion is that OECD 70/50 scales underrate, with one exception, economy of scale, especially for the larger households (of three or more persons). Economy of scale varies with respect to the number of persons and number of children in the household. It is higher for households of three or more persons. For a single adult with one child the OECD and empirical scales are virtually same. The results of estimation are sensitive to the choice of some covariates. This is especially true for the dwelling size being a variable presuming some sort of commodity specific equivalence scale. If it is defined as number of squared meters per person rather than per square root of the number of persons, the equivalence scales increase by 4-6%.

The standard errors for the mean demographic effect are reasonably low yielding all t-statistics well above 10. This hardly can surprise, as it is only the proof of significant differences between total expenditures for households of different types. As suggested by the theory, the results obtained with the use of four matches yields lower standard errors than those obtained by means of one match. No regularities are observable when comparing the values of both estimates.

4.2. Recursive equivalence scales

This type of estimation provides the result that may be regarded “purely empirical” expenditure equivalence scales. The households are being matched on equivalent expenditure. The equivalence scale is assumed to be an exponential or linear function (depending on the type of comparisons⁶, to provide better exposition) defined uniquely by one unknown parameter a or b and by demographic attributes. Hence, the covariate Z appears in the form

$$Z = X / S^a \quad \text{or} \quad Z = X / (1 + b \cdot CH) \quad (12)$$

where S stands for a household size and CH stands for a number of children in the household.

The values of a or b are simulated to reach a minimum absolute difference between two values: the scale resulting from the assumed value of a or b and the scale being an effect of matching estimation on one of the covariates defined by (12). If the scales depending on the household size are calculated, the formula is $m = S^{a'}$ where a' is a solution to the minimisation problem

⁶ As comparisons are being made between two types of the household only, the specification of the function does not affect the final results.

$$\min_a |S^a - SATT| \quad (13)$$

The scales for estimation of the cost of children are calculated in an analogous way: $m = 1 + b \cdot CH$ where b is a solution to the minimisation problem

$$\min_b |(1 + b \cdot CH) - SATT| \quad (14)$$

In both cases $SATT$ is defined by eqn (6).

The estimates of the household demographic effect reveal in this case lower economy of scale than in the previous method when the household size is the variable of interest. However, the recursive method suggest that cost of children is much higher than that indicated by the previous method. The numerical results are quite close to those obtained by means of the OECD 70/50 equivalence scales and even higher for the households of three children. The differences between the method are discussed in more details in Section 4.4.

Tab 2. Equivalence scales estimated by recursive method

Type of household	OECD equivalence scale	Parameter minimising deviation	Equivalence scale
exponential scale: $m = S^a$			
2 persons	1.690	0.63	1.548
3 persons	2.310	0.65	2.042
4 persons	2.890	0.60	1.933
linear scale: $m = 1 + a \cdot CH$			
2 adults, 1 child	1.294	0.28	1.280
2 adults, 2 children	1.588	0.25	1.50
2 adults, 3 children	1.882	0.32	1.96

The simulated values of equivalent expenditure may be potentially used for measurement of impact of unconfoundedness assumption violation. The better the household outcome (here: equivalent expenditure) is explained by the set of covariates Z (here: single variable), the lower bias is. If particular Z value represents “true” equivalent expenditure, the bias should be the lowest. In other words, using approximations of equivalent expenditure other than that minimising the deviation would result in higher estimation bias.

The abovementioned method fails to produce conclusive results. The parameters minimising the estimation bias (see eqn 4 with further comments) differ considerably from the values minimising the deviation between estimated and presumed values, especially when the household size effect is estimated. This suggests that violation of the unconfoundedness assumption is not the only source of the bias.

4.3. Partly normative equivalence scales

In the previous method the actual household expenditure is the only information utilised. That method does not distinguish between “rational” and “non-rational” expenses. In policy applications some normative presumptions may be sometimes introduced, for example to ensure adequate diet (see Nelson, 1993, pp. 472-474). Technically, this is implemented by imposing some commodity specific equivalence scales. In the present method housing is such a commodity. The generalised Engel equivalence scales are estimated under assumption that adding one person to the household increases housing costs by certain proportion. In other words, housing equivalence scales are assumed rather than estimated. As this type of expenditure is characterised by very high economy of scale, the respective equivalence scales are set well below those estimated for the whole consumption. It is assumed that adding one person, child or adult, increases housing costs by 10%, as compared to a single adult household. The assumed values are displayed in Table 3 together with the estimates of the scales for the whole consumption.

In this estimation only a subset of covariates employed in the estimation reported in Section 4.1 is utilised. The whole set includes some non-monetary correlates of well-being, like education. In this estimation only the variables that may be used as proxy variables for housing equivalent expenditures are employed: dwelling size, food ratio, presence of car and satellite/cable TV. These covariates are supplemented by total housing expenditures divided by presumed

equivalence scale. For comparison purposes, the estimates obtained without the latter variable are also displayed in Table 3.

When the household size is the only household demographic attribute explored, the scales with presumed housing economy of scale are considerably below those obtained by the “free estimation”⁷. This is not true, however, when households with children are compared with a childless couple with same housing equivalence scales assumed. Both estimations yield very similar results. This means that assumed economy of scale for housing is close to that actual. In other words, children below 16 years of age cause much lower housing costs than older persons. This finding is not confirmed, however, by comparisons between households with one child (couple or single adult) and single person: presumed equivalence scales appeared to be well below the empirical ones. It should be noted, however that the results obtained with two different types of the reference household are not comparable since they utilise different household subsamples.

The present method allows also estimation of equivalence scale for any group of expenditures. It requires simulations of presumed values to reach rough equality between the scales estimated with and without presumptions. Such equity may be observed for a household of two adults with one child as well as for two adults with three children, both compared to a childless couple. For housing equivalence scales equal to 1.09 and 1.26, respectively, the scales resulting from the “free” and restricted estimations are similar, therefore 1.09 and 1.26 may be considered close approximations to the actual housing equivalence scales.

⁷ The numerical results are not very informative, as the assumption on housing equivalence scales are not based on any actual policy scales nor precise expert evaluations of housing costs. The scales are estimated only to illustrate the method.

Tab 3. Mean logarithmic demographic effects (MLDE) and equivalence scales estimated by generalised Engel method with and without presumed housing equivalence scale.

Type of household	Housing equivalence scale	1 match		4 matches	
		MLDE ¹	Equivalence scale	MLDE ¹	Equivalence scale
reference household = single adult					
2 persons	imposed 1.1	0.31240 (0.01272)	1.367	0.31079 (0.01085)	1.365
	no assumption	0.49319 (0.01272)	1.638	0.48569 (0.01237)	1.625
3 persons	imposed 1.2	0.48487 (0.01907)	1.624	0.49001 (0.01600)	1.632
	no assumption	0.64270 (0.02065)	1.902	0.64700 (0.01852)	1.910
4 persons	imposed 1.3	0.62547 (0.02330)	1.869	0.62782 (0.01933)	1.874
	no assumption	0.78482 (0.02675)	2.192	0.77104 (0.02287)	2.162
reference household = two adults, hh head age below 56					
2 adults, 1 child	imposed 1.09	0.15244 (0.01354)	1.165	0.14567 (0.01152)	1.157
	no assumption	0.15285 (0.01610)	1.165	0.13578 (0.01350)	1.145
2 adults, 2 children	imposed 1.18	0.24119 (0.01561)	1.273	0.26207 (0.01332)	1.300
	no assumption	0.27668 (0.01856)	1.319	0.26500 (0.01560)	1.303
2 adults, 3 children	imposed 1.26	0.31988 (0.02586)	1.377	0.32723 (0.02133)	1.387
	no assumption	0.33207 (0.03028)	1.394	0.32173 (0.02511)	1.380
reference household = single adult, hh head age below 56					
2 adults, 1 child	imposed 1.2	0.46408 (0.02774)	1.591	0.47160 (0.02285)	1.603
	no assumption	0.60687 (0.03057)	1.835	0.61951 (0.02829)	1.858
1 adult, 1 child	imposed 1.1	0.20355 (0.02721)	1.226	0.21661 (0.02249)	1.242
	no assumption	0.30176 (0.03482)	1.352	0.31826 (0.02872)	1.375

Standard errors in parentheses

4.4. Comparison of the estimates obtained by three methods

The results for all three methods are summarised in Diagrams 1 and 2. Each type of the estimation yields different information on cost of living comparisons. The generalised Engel scales uses non-monetary well-being covariates like dwelling size, proxy variables like education or main source of income as well as consumption patterns. Therefore, those comparisons introduce a type of normative judgements referring to the household needs. The recursive equivalence scales are based solely on observed household consumption which not necessary is equivalent to well-being measure. There are at least two reasons for such a distinction. First, some expenses, for instance on alcohol or tobacco, hardly improve the household well-being. Second, some households, especially those poor, may be unable to satisfy their increased needs resulting from changing their demographic composition. Therefore, applying directly low expenditures observed for a large group of households of particular type may result in underestimation of their needs. Comparison of the empirical results for both methods suggests

that this may be the case for the Polish households. “Purely empirical” (recursive) equivalence scales for four person households are much lower than those obtained with the use of some normative non-monetary covariates of well-being. On the other hand, the opposite phenomenon appears when the cost of children is observed. The parameter representing economy of scale reaches the highest value for a household with three children (this may be also observed, though to the lower degree, when generalised Engel method is employed). This seemingly counterintuitive result may be at least partly explained by the fact that the appearance of children in the household increases propensity to raise expenses to improve dwelling quality. Such expenses are likely to be credited. This observation is also valid for the poor (see Szulc, 2008).

The third method, employing a priori housing equivalence scales hardly can be compared with two previous ones. The numerical results strongly depend on assumed commodity specific equivalence scales and the restrictions imposed on the housing economy of scale lower the estimates of the households equivalence scales, as compared to those obtained without restrictions. This results directly from the definition of equivalence scale, which is a mean ratio of total expenditures provided equal well-being of two types of households under comparison. Imposing lower than actual housing equivalence scales results in comparing non-reference households with a reference type households whose housing expenditures overestimate real well-

being. Thus, the average ratio is underestimated which is a consequence of a priori policy suppositions on relative cost of living.

Diagram 1. Equivalence scales depending on the household size (1 match, single adult = 1)

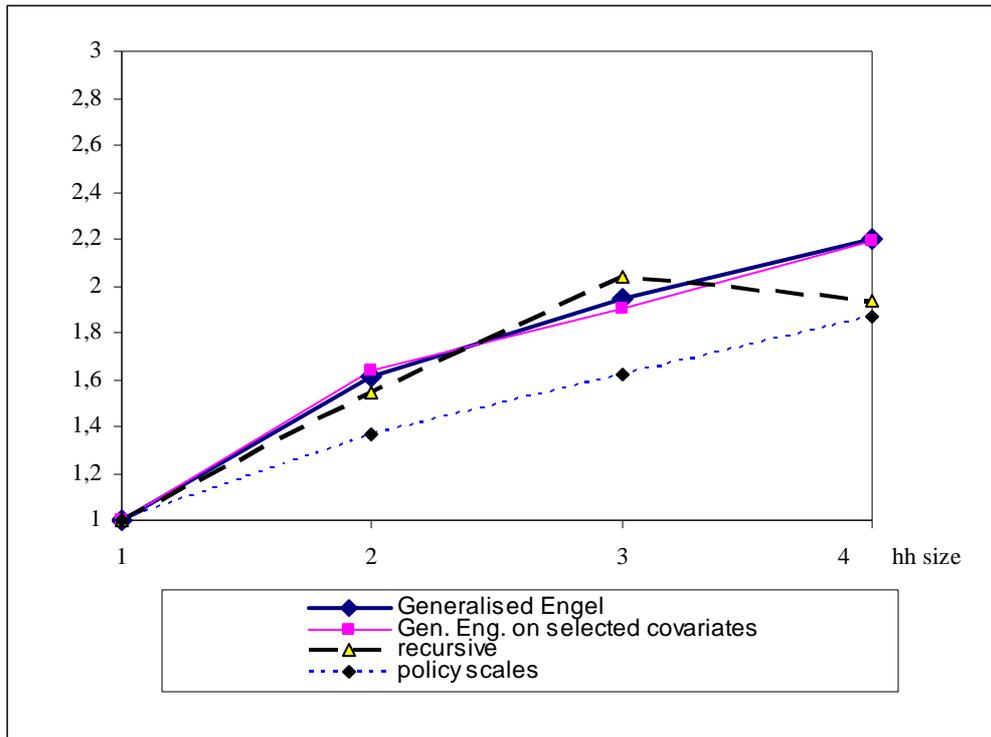
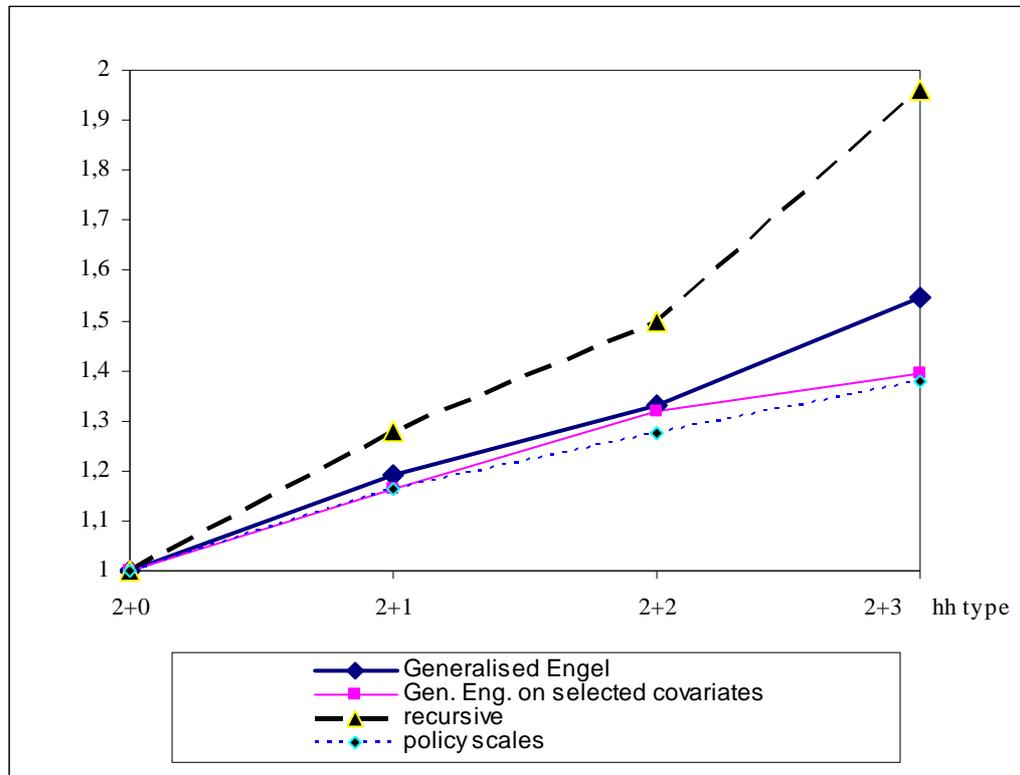


Diagram 2. Equivalence scales depending on the number of children
(1 match, single adult = 1)



5. Concluding remarks

The matching estimation is characterised by the following advantages:

1. The estimation and the identification do not require assumptions on the household behaviour.
2. It is possible to compare the household types of any composition without assuming particular functional form of interaction between expenditures and demographic variables. The assumptions on separability are also redundant.
3. It is possible to decide, due to elasticity in well-being covariates selection, what type of comparisons is performed. They may capture material needs only but also functionings.
4. With respect to social policy needs, it is possible to impose economy of scale for some types of expenditures and to estimate the scales for the remaining consumption empirically.

5. The matching estimation is not data consuming. It may be performed without price information, for a single period sample and only on households of interest.
6. The results obtained may be easily interpreted, as the equivalence scales are defined in the form of mean ratio of empirical expenditures.

The disadvantages of the proposed method of estimation include:

1. Necessity to compare each two types of the households separately. As a consequence, the scales for the types of households underrepresented in the sample may be difficult to estimate precisely.
2. Impossibility to test formally the unconfoundedness and common support assumptions. On the other hand, informal test suggest that the latter one is not violated by the empirical data.

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APPENDIX

Household welfare covariates employed in the estimation of generalised Engel scales.

- dwelling size (in squared meters) divided by square root of number of the persons in the household
- the head's age
- the head's age squared
- food ratio
- housing ratio
- percentage of cash expenditures in total consumption
- three dummies for the head's education
- three dummies for the type of residence
- dummy for employee's household
- dummy for owning a car
- dummy for owning a satellite or cable TV