Equivalence scales: rationales, uses and assumptions

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In poverty and income inequality research, equivalence scales are used to adjust for the relative cost of living, or assumed standard of living, of households of different sizes and composition. This makes income (or expenditure) information comparable to a given reference unit by taking into account the economies of scale of larger households as well as differing needs by stated characteristics, generally the number of children in the household. The reference unit is often a single adult household, or, more commonly in the UK, a childless adult couple household. Both the methods for deriving equivalence scales and the normative assumptions made by them are subject to considerable debate, and there is no "correct" scale for general use. The choice of scale depends on assumptions about economies of scale, judgements about different individuals' needs, data constraints and general conventions to ensure comparability of results. Different scales lead to different results in terms of the level of poverty, the groups affected by poverty and the ranking of different countries (Coulter, Cowell & Jenkins, 1992; OECD, n.d.; Rio Group, 2006). Eurostat comment that switching between equivalence scales (from the original to the modified OECD) has a larger effect on poverty rates among certain subgroups than for the overall population. Thus, while important to account for the economies of scale for larger households, the crude scales are unable to take the full complexity of household composition into account (CPS, 1998).

This note is organised around the four groups of questions below:

1. How was the OECD modified equivalisation scale arrived at? What factors were considered in its creation? What factors were considered in its acceptance by Eurostat?
2. What other equivalisation scales are available? What are their main characteristics and differences compared to the modified scale, and who uses them?
3. Does use of the OECD modified equivalisation scale overestimate the standard of living achieved by disabled people and the families of disabled people?
4. Is the assumption that income is shared equally amongst all members of the household a fair one?

1. How was the OECD modified equivalisation scale arrived at? What factors were considered in its creation?

The modified OECD equivalisation scale was developed by Hagenaars, De Vos and Zaidi (1994). They argued that comparative research showed that the original OECD equivalence scale (also called the old OECD scale and the Oxford scale) overestimated the weight of additional people in the household, beyond the first adult. They therefore developed the modified OECD scale for their Eurostat research project. The modified scale assigns a weight of 0.5 for each additional adult in the household (aged 15+) and a weight of 0.3 for each child (aged 0-14 years), compared

with weights of 0.7 and 0.5 respectively in the original OECD scale. The authors note, however:

> Admittedly, this is a pragmatic choice and should be considered as arbitrary as the choice of the original OECD scale. One of the main arguments to use the modified OECD scale is that this scale is close to the average of the scales derived in the literature. In our view, more research efforts should be devoted to the choice of equivalence scales which can be used for cross-country comparisons. One principal issue to be resolved is whether in the cross-country comparisons we should use a single equivalence scale for all the Member States, or whether a single methodology should be applied to estimate equivalence scales which can be different across different countries (Hagenaars et al., 1994, p. 194).

According to Dennis and Guio (2004), the decision to adopt and recommend the modified OECD scale for more general use at EU level was arrived at "in collaboration with member states, formalised at political level in 1998 and reconfirmed in Laeken in 2001" (p. 6). The reason for the change of scale was the fall in the proportion of food expenditure in household budgets over time resulting in more economies of scale. By giving the first additional adult a weight of 0.5, the modified OECD scale assumes higher economies of scale in household consumption that the original (Oxford) scale which gives the first additional adult a weight of 0.7 (OECD, n.d.).

The 1998 Eurostat Task Force recommended the use of the relative poverty line at 60% of median income and the use of the modified OECD equivalence scale for continuity and comparability reasons. However, the recommendation was also for different scales to be included alongside the modified OECD, firstly in recognition of the lack of consensus on the determination of equivalence scales and secondly to assess the robustness of results (CPS, 1998).

The Joint Inclusion Report (statistical annex) on common indicators of poverty and social exclusion, following the Laeken European Council in December 2001, recommends the modified OECD scale as the method of equivalising household income (EC, 2003).

2. What other equivalisation scales are available? What are their main characteristics and differences compared to the modified scale, and who uses them?

A selection of the most commonly used equivalence scales are discussed below. However, Buhmann, Rainwater, Schmaus and Smeeding (1988) and Atkinson, Rainwater and Smeeding (1995) cover a range of over 50 equivalence scales, including references to a number of nationally defined scales in different countries. Coulter, Cowell and Jenkins (1992) have also discussed the derivation of different equivalence scales in depth.

Oxford (original OECD scale)

The OECD website, while emphasising that there is no accepted method for deriving equivalence scales and that the OECD does not recommend the use of any specific equivalence scale generally, notes that in the 1982 OECD list of social indicators the Oxford scale (the old OECD scale) was put forward "for *possible* use in '*countries which have not established they own equivalence scale*'" (OECD, n.d., p. 1, italics in original).

The modified OECD scale is based on the original OECD scale, as described in the previous section.

Square root (Luxembourg Income Study (LIS) scale)

Rainwater's (1974) analysis of the Boston Social Standards Survey concluded that an equivalence scale of the cube root of family size captured the survey respondents' perception of the growth in income necessary to maintain the same standard of living with increasing family size. In applying the power relationship to other contemporary equivalence scales he found that the number of household members raised to the power of 0.5 (i.e. the square root of household size) fit the implied tax equivalence scale calculated by Seneca and Taussig. Such a scale does not take into account the ages, or other differences in need, of household members.

This scale is popular among researchers for comparative research and also commonly employed by researchers for the OECD, Eurostat and LIS as well as in the US and other countries (Brown & Prus, 2003; Burniaux, Dang, Fore, Förster, Mira d'Ercole & Oxley, 1998; Sutherland, 2001; Rio Group, 2006).

McClements (BHC/AHC)

McClements (1977) at the Department of Health and Social Security developed the scale based on econometric analysis of the 1971 and 1972 waves of Family Expenditure Survey (FES) in an attempt to improve on the equivalence scales in use at the time. The scale was developed explicitly to take into account the effects of the number of children, and the ages of the children, on the living standards of the household. Unlike the OECD scales, the McClements scale equivalises the household income to the reference unit of an adult couple.

The McClements equivalence scale was traditionally used in the main results of the UK government statistics *Households Below Average Income* (HBAI) until the publication of the 2005/06 HBAI results in 2007. Results using the modified OECD scale were reported in an appendix. From that date, the modified OECD scale was adopted for the main results (DWP, 2005a; DWP, 2005b; see also Scottish HBAI: SG, 2008).

HBAI results are reported both before and after housing costs and therefore a 'companion scale' to the modified OECD scale has been developed for UK figures on low-income households after housing costs following user and expert consultations (see DWP, 2005b).

The McClements scale has traditionally been the scale favoured by researchers in the UK as it has allowed for comparability with results from government research.

Minimum Income Standard (MIS)

The MIS project used a combination of the consensual budget standards method (discussion groups with members of the general public) and input from expert professionals. While the budgets were derived through the group work based in the English Midlands, further groups in Scotland, Wales and London were used to test the applicability of the results across Britain. The MIS equivalence scale is based on the budgets derived separately for pensioner and non-pensioner households and for families with and without childcare costs (Bradshaw et al., 2008).

Comparison tables

The tables below provide comparisons of the equivalence scales discussed in this section, with the addition of the Poverty and Social Exclusion survey scale mentioned in section 4 below in relation to equal sharing within the household. Table 1 compares values of each adult and child household member for the original and modified OECD scales, the companion scale now used in HBAI reports for after housing costs figures, and the McClements and PSE survey scales, all rescaled to a single adult as the reference unit.

Table 2 shows the same scales and the MIS equivalence scale compared with the square root (LIS) scale as household size increases.

Table 1

Comparison of selected equivalence scales													
	1st Adult/ Head of H'hold	Spouse	First additional adult	Second additional adult	Subsequent adult	Age of child						
						0-14						15+
Oxford (original OECD scale)	1	n/a	0.7	0.7	0.7	0.5						0.7
Modified OECD scale	**1**	**n/a**	**0.5**	**0.5**	**0.5**	**0.3**						**0.5**
Companion scale (HBAI - AHC)	1	n/a	0.72	0.72	0.72	0.34						0.72
						Age of child						
McClements[1]						0 - 1	2 - 4	5 - 7	8 - 10	11 - 12	13 - 15	16 - 18
BHC	1	0.64	0.75	0.69	0.59	0.148	0.295	0.344	0.377	0.41	0.443	0.59
AHC	1	0.82	0.82	0.82	0.73	0.13	0.33	0.38	0.42	0.47	0.51	0.69
PSE survey[1] Couple	1	0.43	0.64	0.64	0.64	0.5 for first child, 0.43 for subsequent children						0.64
PSE survey[1] Lone parent	1.14	n/a	0.64	0.64	0.64	0.5 for first child, 0.43 for subsequent children						0.64

Source: Sutherland (2001); Gordon et al. (2001). 1 Rescaled to single adult without children = 1.

Table 2

Comparison of selected equivalence scales with the Square root scale						
		1st Adult/ Head of Household	Couple	Couple, 1 child	Couple, 2 children	Couple, 3 children
Square root: $N^{0.5}$		**1**	**1.4**	**1.7**	**2.0**	**2.2**
Oxford (original OECD)		1	1.7	2.2	2.7	3.2
Modified OECD scale		1	1.5	1.8	2.1	2.4
Companion Scale (HBAI -AHC)		1	1.72	2.07	2.41	2.76
McClements[1]	BHC	1	1.64	1.788 - 2.23	1.936 - 2.82	2.084 - 3.41
	AHC	1	1.82	1.95 - 2.51	2.07 - 2.64	2.20 - 2.76
PSE Survey		1	1.43	1.93	2.36	2.79
MIS scale BHC	Without Childcare	1	1.46	1.68	2.13	2.65
	With Childcare	1	1.46	2.36	3.08	3.58
	Pensioner	0.89	1.26	n/a	n/a	n/a

Source: OECD (n.d); Bradshaw et al (2008). 1 Rescaled to single adult without children = 1.

3. Does use of the OECD modified equivalisation scale overestimate the standard of living achieved by disabled people and the families of disabled people?

If one compares the standard of living of two households, one including a disabled person and one not, but otherwise identical in terms of composition and income, the household containing a disabled person is likely to have a lower standard of living. The so-called 'extra costs of disability' arise because disabled people may have to pay for adaptations, equipment and assistance in relation to their impairment, and because they may have to spend more on regular items (for example, more expensive food due to special diets, more heating due to being less mobile, taxis because public transport is inaccessible).

The argument can therefore be made that equivalence scales should adjust incomes to reflect the higher costs faced by households including disabled people, in the same way that they adjust incomes to reflect the higher costs faced by larger households. However, none of the well-established equivalence scales do so. Using incomes which are not adjusted for the extra costs of disability will tend to overestimate the standard of living achieved by disabled people and the families of disabled people, and underestimate risks of poverty, both among the disabled population and overall.

The *Households Below Average Income* publication acknowledges that this is a potential problem with the estimates it presents, and offers a 'sensitivity analysis' in an Appendix. This adjusts the incomes of households including a disabled person downwards by 10 per cent. However this figure of 10 per cent is entirely arbitrary.

Several attempts to quantify the extra costs of disability in the UK have been undertaken, using a range of methodologies, and these are summarised in Table 3. (For a full discussion of the robustness of the different estimates, see Zaidi and Burchardt, 2005). Note that all these estimates are for disabled adults. Much less work has been done on the costs of disabled children; for a summary see Burchardt and Zaidi (2008).

Table 3: Estimates of the extra costs of disability

Study type and name	Data year	Method	Estimates		
			£ per week in 2002 prices		As % average earnings in data year
1. Subjective assessment					
Martin and White (1988)	1985	Face-to-face interview, random sample of disabled adults. N = 9,982	Severity*:		
			1 / 2	7.34	2.6
			5 / 6	13.30	4.7
			9 / 10	20.94	7.5
DIG (1988)	1988	Telephone survey of campaigning organisation's membership: non-pensioners only.	82.41		26.3
2. Consumption patterns					
Matthews and Truscott (1990)	1985	Spending patterns of disabled and non-disabled, controlling for income. Costs for 2-person household.	£7.88 *more* on fuel, services, tobacco, durables;		+2.8
			£8.85 *less* on transport, clothing.		-3.2
Jones and O'Donnell (1995)	1986/7	Engel curves (modified). Working-age physically disabled people only.	Range from 45 % extra (on transport) to 64 % extra (on fuel)		n/a
3. 'Standard of living'					
			Severity*		
Berthoud *et al.* (1993)	1985	Comparison of incomes required to achieve a given standard of living. Estimates for household on equivalent of £186 per week in 2002 prices.	1 / 2:	7	4.6
			3 / 4:	26	17.3
			5 / 6:	38	24.7
			7 / 8:	51	34.0
			9 / 10:	55	36.4
Zaidi and Burchardt (2005)	1996/7	Comparison of incomes required to achieve a given standard of living. Estimates for household on mean income; range for different household compositions.			As % mean income
			Severity*		
		Non-pensioner	Low:	23 to 96	9 to 23
			Medium:	70 to 289	27 to 70
			High:	132 to 536	51 to 133
		Pensioner	Low:	18 to 29	6 to 23
			Medium	55 to 86	20 to 69
			High:	104 to 162	37 to 131

* Severity based on categories developed for 1985 OPCS Survey of Disability; see Martin, Meltzer and Elliot (1998).

Source: adapted from Zaidi and Burchardt (2005)

Zaidi and Burchardt (2005) explored the impact on estimates of poverty rates in the UK of using (i) unadjusted incomes, i.e. the main HBAI definition; (ii) incomes net of disability extra costs benefits (Attendance Allowance and Disability Living Allowance) [1]; and (iii) fully adjusted income, using the Zaidi and Burchardt estimates of extra costs as the basis for an equivalence scale. The results are shown in Table 4.

It can be seen that omitting the relevant benefits from household income is not a good approximation of full equivalisation for the costs of disability. Many disabled people with extra costs do not qualify for these benefits, and even among those who are eligible, take-up is comparatively low. Furthermore the rates of benefit are not closely related to the scale of extra costs, so many recipients receive less than they need to offset their extra costs, while others receive more than their extra costs are estimated to be. Finally, taking this route to disability equivalisation would mean that increasing the amounts, or rates of take-up, of disability benefits would not show up as an improvement in living standards or as a reduction in the risk of poverty, a somewhat perverse effect.

Table 4: Poverty rates in the UK, 1996/7, using adjusted and unadjusted incomes

	(i) HBAI definition of income	(ii) Income net of disability benefits	(iii) Income adjusted for extra costs of disability
Non-pensioners			
No disabled person in household	20.7	20.5	18.4
Disabled persons in household	**29.4**	**35.5**	**45.0**
Total	22.4	23.5	23.7
Pensioners			
No disabled person in household	33.4	33.2	26.5
Disabled persons in household	**34.9**	**42.7**	**60.9**
Total	34.1	37.7	42.9
All			
No disabled person in household	22.4	22.2	19.6
Disabled persons in household	**31.5**	**38.2**	**50.9**
Total	24.7	26.3	27.5

Source: adapted from Zaidi and Burchardt (2005)
Original data source: 1996/7 Family Resources Survey Disability Follow-Up
Notes: Poverty threshold 60% median income, after housing costs. Definition of disability based on OPCS severity categories of disability. Equivalisation for household composition in all columns using McClement's scale. Disability benefits in column (ii) are Attendance Allowance and Disability Living Allowance. Equivalisation for extra costs of disability in column (iii) based on Zaidi and Burchardt estimates shown in bottom panel of Table 3 above, and are for adult disability only.

[1] Other disability-related benefits, such as Incapacity Benefit, are designed to replace earnings rather than to compensate for the extra costs of living incurred by disabled people.

4. Is the assumption that income is shared equally amongst all members of the household a fair one?

Since income is measured at a household level, but the primary interest is usually in the living standards of individuals, some assumption must be made about how resources are shared within households. Equivalisation scales implicitly assume that resources are shared equally within the household, because the same equivalised income is attributed to each member of the household. It is widely acknowledged that this is an unrealistic assumption, but replacing it with an allocation that more accurately reflects reality is far from straightforward. The extent to which different members of the household benefit from various types and items of expenditure is difficult to determine. For example, should expenditure on DIY products count as household expenditure, benefitting each member equally, or as individual expenditure, because it is a hobby enjoyed by a particular person, or some mixture of the two?

Research suggests that parents in low income families tend to protect their children from the effects of poverty. Within couples there are also gender differences. While men are more likely to hold back a proportion of the household income for personal use, women and especially mothers are likely to prioritise the needs and preferences of other family members at the expense of their own well-being and even health (Bennett, 2008; Bradshaw, Finch, Kemp, Mayhew & Williams, 2003; Daly, 1992; Pahl, 1989). Further evidence of the effects of unequal allocation of resources within couples derives from findings that while mothers have lower disposable income following divorce, they report that the greater control over their own finances and spending options is preferable to the higher total household income prior to the divorce (Bradshaw, Finch, Kemp, Mayhew & Williams, 2003).

One attempt to look at intra-household poverty is the Poverty and Social Exclusion (PSE) Survey working paper which looked at deprivation for partners in families with and without children, both for all income levels and specifically for low-income families. A similar pattern to that described above emerged: women were more likely than men to suffer deprivation, while both mothers and fathers were more likely to 'go without' by prioritising the needs of their children. Children were affected by poverty only in the severest cases of low-income, deprivation and social exclusion. This is despite the fact that the PSE survey used an equivalence scale with more generous child weighting than either the McClements or the modified OECD scale (Adelman, Middleton & Ashworth, 2000).

Thus the assumption that all members of a household below the poverty line based on equivalised income are poor, and that no members of a household above the line are poor, does not seem to be supported in all cases (Daly, 1992). If the assumption of equal sharing within the household is false, equivalence scales can underestimate the poverty among women while potentially overestimating the extent of male and child poverty (Findlay & Wright, 1996; Glendinning & Millar, 1989).

Clearly, however, larger households do benefit from economies of scale, and income and resources are shared to some extent in most households. The extent to which the sharing is (in)equitable is difficult to estimate. The HBAI report (Adams et al., 2008) acknowledges that the assumption of equal sharing may not hold and that therefore

the figures disaggregated by gender may underestimate the difference in poverty between men and women, as they reflect only the difference between single men and women (which is "diluted" by the information on couple households).

The Women's Budget Group (2005) has suggested that rather than simply acknowledging that the assumption of equal sharing may not always hold, analyses could be presented based on different assumptions, ranging from no sharing (each partner retains the income she or he brings to the household) to equal sharing. Findlay and Wright (1996) estimated male and female poverty shares based on assumptions ranging from equal sharing of resources to women sacrificing up to half of their share for their husband and children. However, there is no more rigorous basis for these alternative assumptions than for the assumption of equal sharing.

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