

# Comparing incomes when needs differ: Equivalisation for the extra costs of disability in the UK

Asghar Zaidi and Tania Burchardt

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Centre for Analysis of Social Exclusion  
London School of Economics  
Houghton Street  
London WC2A 2AE  
CASE enquiries – tel: 020 7955 6679

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Email: [j.dickson@lse.ac.uk](mailto:j.dickson@lse.ac.uk)  
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Tania Burchardt

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## **Editorial note**

Asghar Zaidi is a Research Officer in the Economic and Social Research Council Research Group *Simulating Social Policy in an Ageing Society* (SAGE) at the London School of Economics, and also a Research Affiliate of German Institute for Economic Research (DIW), Berlin. Tania Burchardt is a Research Fellow in the Economic and Social Research Council *Centre for Analysis of Social Exclusion* (CASE) at the London School of Economics. This paper has also appeared as SAGE Discussion Paper 10.

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## **Abstract**

Equivalisation of incomes for household size and composition is accepted practice when measuring poverty and inequality; adjustments to take account of other variations in needs are rarely made. This paper explores the financial implications of one possible source of additional needs: disability. Using two UK household surveys, we seek to establish whether there are extra costs of living associated with disability, and to quantify them using the ‘standard of living’ approach. The underlying theory is that a household’s standard of living is a function of income and needs. The extra costs of disability can be derived by comparing the standard of living of households with and without disabled members at a given income, having controlled for other sources of variation.

Results show that the extra costs of disability are substantial, especially for disabled people living alone, and that these costs rise with severity of disability. To bring out the policy implications of these results, we compare and contrast three different income distributions which differ in their adjustment for the extra costs of disability, for the population as a whole and for various subgroups. We find that unadjusted incomes significantly understate the problem of low income amongst disabled people, and thereby in the population as a whole.

Keywords: Equivalisation; disability; standard of living; income distribution  
JEL numbers: I32, I38

## 1. Introduction

Household or family income is the usual starting point for analysis of poverty and economic inequality. In this context, income is implicitly (and occasionally explicitly) being used as a proxy for standard of living, since it is not money income itself but the value of the consumption it can generate which is of intrinsic interest (cf. Ringen 1996). Although income appears to be a good proxy, (i.e. higher incomes tend to translate into higher standards of living), there are two main problems. Firstly, income is not correlated with some aspects of standard of living (such as access to public goods). Secondly, even for those aspects of standard of living which are income-related, the rate at which individuals can translate income into a standard of living varies. Thus the same level of income represents different standards of living for different people.

It is this second problem which the empirical work in this paper is designed to address. In one particular form, namely, variations in need arising from differences in household size and composition, recognition of the problem is widespread, and it is standard practice to equalise incomes for household size. But there are other sources of variation in the ability to convert income into standard of living. This paper is chiefly concerned with one such source of variation, namely, disability.

There are wide variety of differences in needs across individuals. Amartya Sen (1992, 1999 and elsewhere) has drawn attention to five broad categories of differences in the rate of conversion of household income into well-being:

- personal heterogeneities (including disability),
- environmental diversities (for example, weather and epidemiology),
- economic setting (including availability of public goods),
- social norms (determining what must be purchased in order to ‘appear in public without shame’, for example), and
- distribution within the household.

Sen argues that measuring specific outcomes (e.g. the standard of living), and, if possible, the overall opportunity for achieving such outcomes (capabilities), is preferable to using income as a proxy. Thus, deprivation should be judged not only in terms of income deprivation but also in the degree of adversity in converting income into gainful outcomes (the phenomenon referred to as ‘coupling of disadvantages’, Sen, 1999: 88).

At least some of the sources of variations in converting income into outcomes can be identified using techniques established within the standard economics literature, such as equalisation (see, inter alia, McClements, 1978; Buhmann et al., 1988; Coulter et al., 1992). Equalisation makes allowance for variations

in needs by adjusting downwards the incomes of individuals (or households) with greater needs. In principle, it can be applied to any additional need which can be quantified in terms of an income gap. It can be argued that a move towards identifying and accounting for a fuller set of people's needs will lead us towards the operationalisation of Sen's capability approach.<sup>1</sup>

The possibility that the income of a household which includes a disabled person has to stretch further than the income of a comparable household without a disabled member is recognised in the UK's official statistics on low income (DWP, 2002). An illustration in the appendix to that volume applies an equivalence scale for households containing a disabled adult; however, the value chosen is arbitrary. Among the working age population, 15 per cent of adults are disabled, and among pensioners, the figure rises to 41 per cent, so adjustment for the extra costs of disability can have significant effects on overall estimates of poverty and inequality in the population. The effect of adding 0.1 to the equivalence scale for households containing a disabled adult is to raise the estimated number of people in households below half mean income in Britain by 571,000 or 6.8 per cent.

The rest of this paper is organised in four sections. Section 2 provides a brief review of various approaches used in estimating the extra costs associated with differences in needs. Section 3 describes the standard of living approach and various empirical choices that one has to make in its implementation. Section 4 presents the empirical results. Section 5 provides the main conclusions, in particular the policy implications of the findings of this paper.

## **2. Approaches to estimating costs of differential needs**

The extra costs which might be incurred by disabled people include additional expenditure on items which non-disabled people also purchase (such as heating, laundry and transport), as well as expenditure on items specifically relating to disability (incontinence pads, information in Braille, etc.). The magnitude and composition of extra costs are likely to vary by type and severity of impairment, as well as the stage of the life-cycle and living circumstances of the individual concerned, and according to how much is provided at a subsidised rate by public services and charities.

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1 Sen himself makes this suggestion: "For example, the income level of a family may be adjusted downwards by illiteracy and upwards by high levels of education, and so on, to make them 'equivalent' in terms of capability achievement" (1997, p.215).

Although in principle there is no difference between estimating the extra costs of a child and estimating extra costs of disability, yet there have been relatively few attempts to estimate the latter. Accordingly, this section begins with a general overview of equivalence scale estimation methods before focusing on extra cost estimates specifically for disability that are produced using analogous measurement techniques.

### ***2.1 Equivalence scales derived from consumption-expenditure patterns***

Two of the simplest and most common econometric models used to estimate equivalence scales are derived from Engel (1895) and Rothbarth (1943).

- The Engel method of estimating equivalence scales is based on the idea that the welfare of a household is reflected by the expenditure share on food, and that larger households require more money, or expenditure, to reach the same standard of living. Engel proposed this method in view of the negative relationship between food share and total expenditures.
- Rothbarth departed from this method by focusing on goods that are specific to adults' well-being only (rather than the well-being of the whole household). This method is used to estimate extra costs of children, and not suited for estimating additional costs associated with additional adults in the household. For instance, in two couples with the same income, one with a child and the other without, the difference between the households' expenditures on alcohol or tobacco provides an index of the extra cost of the child. The expenditure on adults' goods (such as alcohol, tobacco and adult clothing) is taken to be the measure of adult well-being. A variant of the adult good is given by the use of 'fixed costs' as an indicator of personal welfare of adults (see Coulter et al. 1992: 89).

Rothbarth-type measures focus on adult conditional utility, where children have an impact on the utility of parents only insofar as they affect consumption of adult members of the household. This framework can be contrasted with the one specified in terms of unconditional utility, where the increase in utility derived by parents from their offspring is explicitly taken into account.

Use of the unconditional form is based on the idea that failure to include children in the utility function results in an over-estimate for the cost of children. In their widely cited article, Pollak and Wales argue that "conditional equivalence scales ... cannot be used to make welfare comparisons" (Pollak and Wales 1979: 220). The majority of the contemporary literature on estimation of equivalence scales has interpreted family well-being in terms of utility, where the equivalence scales are estimated using the consumer demand theory (see, e.g. Deaton and Muellbauer 1986). This framework is useful because, unlike the Engel and Rothbarth methods, it can capture the effect that a demographic change has on household preferences. We refer to Coulter et al. (1992: 85-95)

for a more detailed description of various econometric techniques to estimate equivalence scales and, also, their limitations in deriving scales that can be used for distributional analyses.

## ***2.2 Equivalence scales derived from subjective data***

The subjective approach offers another way to derive equivalence scales. This approach involves asking questions to a sample of the general population about what levels of income correspond to different standards of living, and then to derive equivalences from the relationship between income, a subjective evaluation of their standard of living and their family composition (see, e.g. Kapteyn and Van Praag 1976). Multivariate econometric modelling is used to control for other differences across these households.

One problem associated with this approach is that people's welfare-to-income evaluation is income-contingent, i.e. people on different levels of income associate different income levels with a given standard of living. This problem, referred to as the 'preference drift', is resolved in the Leyden approach (Kapteyn and van Praag, 1976), by selecting the welfare-income relationship for which the equivalent income and household's own income coincides. Mainly due to doubts about the usefulness and the reliability of the subjective data, but also due to other assumptions used in their estimation, the subjective approach to measurement of equivalence scale has not gained wide popularity.

## ***2.3 Equivalence scales derived from experts' judgement on minimum budgets***

In this approach, equivalence scales are derived from the relationship between costs of living on a subsistence minimum for families of varying size and composition, as judged by a panel of experts. This approach comes under attack mainly because costs of living estimates are contaminated by value judgements of budget experts about the basket of goods and services: 'what items to be included', 'the quantity of items that are required', and 'the price that should be fixed to the items' (Bradshaw et al. 1987: 169). One advantage of this approach is that the experts' judgements, though subjective, are explicit, in contrast to the subjective approach.

## ***2.4 Equivalence scales derived from the social security system***

These scales are derived from the relativities observed in the social assistance that families of different sizes and composition are entitled to in the country in question. The most obvious problem with these scales is that they regard the relativities implicit in the benefit system as an appropriate scale to be used in the comparison of heterogeneous groups of households. Benefit levels may not in fact have been set with respect to a carefully calculated subsistence minimum, and even if they were, the calculation may not have been revised to

keep up with changes in the contents or prices of the basket of minimum necessary goods and services. Moreover, there are often a wide variety of social benefits, and it makes a significant difference which components are included in the calculation of relativities between different family types. One additional difficulty is that these scales may not be very useful for distributional analysis of the whole income distribution since they are derived on the basis of information in the bottom tail of the distribution.

## 2.5 *Previous estimates of extra costs of disability*

Here, we provide a review of scant literature on attempts to estimate extra costs of disability in the UK. Table 1 gives the estimates of the disability costs obtained using a subjective approach. None of these controlled for the level of income of respondents, or other differences between households. For the sake of comparability, all estimates have been up-rated to 2001 prices, and relate to regular items of expenditure (excluding, for example, the cost of purchasing special equipment and adaptations).

**Table 1: Subjective estimates of regular extra costs of disability**

<b>Study reference</b>	<b>Data year</b>	<b>Method</b>	<b>Estimates £ per week in 2001 prices</b>	
Martin and White (1988)	1985	Face-to-face interview, random sample of disabled adults. N = 9,982	Low <sup>1</sup>	7.24
			Moderate <sup>1</sup>	13.09
			Severe <sup>1</sup>	20.59
DIG (1988)	1988	Telephone survey of campaigning organisation's membership. <sup>2</sup>		81.06

Notes:

- 1 'Low' is OPCS disability severity category 1 or 2, 'Moderate' is severity category 5 or 6, 'Severe' is severity category 9 or 10. See Martin, Meltzer and Elliot (1998) for details.
- 2 Non-pensioners only.

The subjective approach has advantages, in that it is transparent, and that those who incur the expenditure – here, disabled people – provide the estimates. However, for items on which some expenditure would be incurred whether or not the individual was disabled (such as heating and laundry), it is difficult for respondents to evaluate the counterfactual ('what would you spend if you were not disabled?'), so the method is likely to be more accurate for items which are

purchased only by disabled people. A further disadvantage of the subjective approach is that the estimates are budget-constrained: they reflect what disabled people are actually spending, not what they would spend on disability-related goods and services, if they had the resources to do so. Since disabled people are disproportionately poor, this produces a downwards bias in the estimate.

Table 2 gives the results from previous attempts to estimate extra costs based on consumption patterns. Both studies control for income in calculating additional costs, but restrict themselves to making comparisons within specific areas of expenditure, rather than giving an overall estimate.

**Table 2: Estimates of extra costs of disability based on consumption patterns**

<b>Study reference</b>	<b>Data year</b>	<b>Method</b>	<b>Additional costs for 2-person household</b>
Matthews and Truscott (1990)	1985	Spending patterns of disabled and non-disabled, controlling for income.	£7.75 more on fuel, services, tobacco, durables. £8.70 less on transport (2001 prices)
Jones and O'Donnell (1995)	1986/7	Engel curves (modified). Working-age physically disabled people only.	45% (transport) to 64% (fuel)

The relativities in the British social security system between disabled and non-disabled claimants have not been used as the basis for estimating extra costs – perhaps because the levels are known to have been set with regard to political expediency rather than underlying differences in needs. However, as an illustration Table 3 shows a number of different estimates derived from current (2002) benefit levels. Social assistance benefits are available on a means-tested basis and reflect the minimum the government expects an individual to live on. The amount of benefit varies by age and severity of disability (shown as ‘minimum’ and ‘maximum’ in the table). Eligibility for extra costs benefits depends on severity of disability, but is not income-contingent.

**Table 3: Estimates of extra costs of disability based on social security benefit levels, 2002**

	Non-disabled £ pw	Disabled Minimum £ pw	Disabled Maximum £pw	Implied range of extra costs £ pw
<i>Single person aged 25-59/64</i>				
Social assistance	53.95	91.85	191.05	37.90 to 137.10
Extra costs benefits only	0	14.90	95.55	14.90 to 95.55
<i>Single person over pension age</i>				
Social assistance	98.15	135.80	195.95	37.65 to 97.80
Extra costs benefits only	0	37.65	56.25	37.65 to 56.25

Source: Department for Work and Pensions website <http://www.dwp.gov.uk/>

Most measures of the income distribution in the UK include these benefits as income but fail to take account of the additional costs towards which the benefits are designed to contribute. This introduces a serious upwards bias in the estimates of disabled people's position in the income distribution, and thereby a downwards bias in the estimates of those on low incomes or below various poverty thresholds. The implications are explored further in section 4 below.

### **3. Standard of living method**

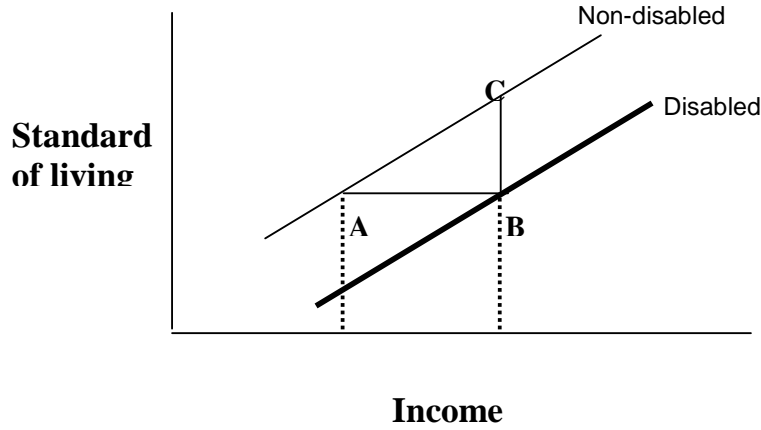
#### **3.1 Theory**

The underlying assumption for the approach adopted in this paper is that disabled people may experience a lower standard of living than their non-disabled counterparts with the same level of income, as a result of the diversion of scarce money resources to goods and services required because of the disability. This method was proposed by Berthoud, Lakey and McKay (1993) and implemented on 1985 survey data. It estimates the extra costs of living that people incur as a result of their disability, such as additional heating, laundry and transport costs, or special equipment. The opportunity cost of ill health and disability – i.e. loss of personal earnings, or earnings foregone by friends and relatives in providing unpaid care – is not included.

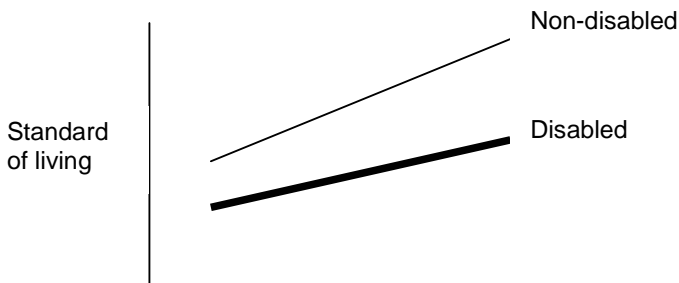
Figure 1a highlights the theoretical relationship between income, standard of living and disability used in this approach.

**Figure 1: Standard of living, income and disability**

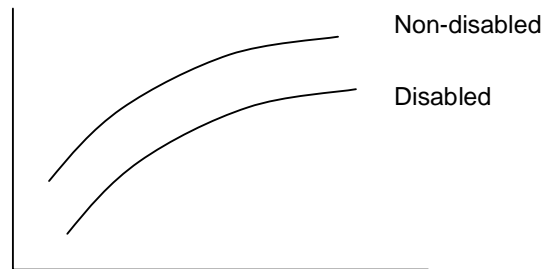
**Figure 1a**



**Figure 1b**



**Figure 1c**



Standard of living is assumed to rise with income for all households, but for a household with greater needs – for example, one containing a disabled person – the same income results in lower standard of living (as is shown by the shift to the bold line for a disabled person that is lower than the line for a non-disabled person). Conversely, the same standard of living can be achieved by a household with greater needs if it also has a higher income. Thus in Figure 1a, income B for a disabled household translates into the same standard of living as income A for a non-disabled household, and B minus A gives an estimate of the extra costs of disability.

Algebraically, if:

$$S = \alpha Y + \beta D + \gamma X + k \quad [1]$$

where  $S$  is an indicator of standard of living,  $Y$  is household income,  $D$  is disability status,  $X$  is a vector of other characteristics, including household composition.

Following equation [1], the extra cost of disability,  $E$ , is given by:

$$E = \beta / \alpha \quad [2]$$

This can also be verified graphically.  $\beta$  gives the distance  $BC$  between the two lines in Figure 1a, while  $\alpha$  gives their slope, or  $BC$  over  $AB$ . Thus  $\beta / \alpha = BC / (BC/AB) = AB$ , which is the extra cost of disability.

Figure 1a, and equation [1], illustrate the simple case where the extra costs associated with disability are a fixed amount, independent of level of income, and where the relationship between income and standard of living is linear. In equivalisation for household size, it is usually assumed that extra costs are a proportion of income – thus a couple with a child may be deemed to need 1.6 times or 60 per cent more income than a couple alone. That sort of relationship is shown in Figure 1b and equation [1] would have to be modified to include an interaction term between  $Y$  (income) and  $D$  (disability).

Figure 1c also shows extra costs rising with income, but where there are diminishing returns to income in terms of standard of living. In that case the  $Y$  component of equation 1 might be log income, or square root of income.<sup>2</sup>

The nature of the relationship between income and extra costs has important implications: the standard equivalisation for household size, for example, implies that an additional child costs more in a rich family than a poor one. By contrast, social security benefits for children, and for the extra costs of disability, are set at a flat rate, reflecting an assumption that extra costs are not related to income at all (as in Figure 1a).

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2 If extra costs rise with income, there is a potential circularity in calculating the amount of income required to raise a disabled person to the same standard of living as a non-disabled person. If compensation is given to the disabled person on the basis of their pre-compensation income, their income will be increased, and hence their extra costs will rise, so further compensation will be required. However if the objective of the exercise is horizontal equity, the first round of compensation is sufficient: the compensation is enough to raise the disabled person to the same standard of living he or she would have had, were he or she not disabled. One implication is that equivalisation for extra costs of disability should be implemented on pre-compensation incomes.

Which functional form is appropriate can be determined empirically. Berthoud et al. (1993) found that income minus income squared was the best specification, indicating that the marginal return to income in terms of standard of living decreases as income rises, and that extra costs of disability rise with income. The estimates of extra costs of disability they derived are shown in Table 4, up-rated to 2001 prices. These will be compared with our own results below.

**Table 4: Estimates of extra costs of disability based on standard of living method**

Severity category	£ per week in 2001 prices at income of £183 pw	As % of income
1 / 2	8	4 %
3 / 4	26	14 %
5 / 6	38	21 %
7 / 8	50	27 %
9 / 10	54	31 %

Source: Adapted from Berthoud et al (1993) Table 5.12, for a “central estimate” of extra costs at £100 per week in 1985 prices.

The standard of living approach for measuring extra costs of disability is analogous to the subjective approach to equivalisation (by concentrating on the relationship between standard of living and income), and on the consumption-patterns approach (by using objective data on incomes and consumption). At the same time, the standard of living approach does not suffer from many of the drawbacks associated with other approaches (cf. Berthoud et al., 1993; Ford, 1997). In particular, the debate between conditional and unconditional measures, discussed in section 2.1 above, appears to be irrelevant since, firstly, no-one chooses to be disabled, and secondly, the standard of living approach is restricted to measuring the extra costs of living: it does not attempt to make an overall welfare comparison (in which case an assessment of the direct utility or disutility of being disabled would be necessary). In contrast to the subjective approach and minimum budget approach, neither individuals nor experts are required to make judgements for the standard of living method about hypothetical levels of consumption with and without disability. Instead, the differences are deduced from observations of the relationship between standards of living and income. The standard of living approach also avoids the arbitrariness associated with deriving equivalence scales from social security benefit levels.

### **3.2 *Modelling approach***

A multivariate modelling approach is adopted to analyse the underlying relationship between living standards, income and other attributes (e.g. disability status, tenure, age, gender). The dependent variable is an indicator of the household's standard of living, and the explanatory variables include household income and disability status of different members of the household, as well as other attributes that are important as control factors in the relationship between income and living standards.

It is important to bear in mind that the purpose of this empirical work is not to specify a model that could explain variation in the standards of living. Rather, the aim is to quantify how income is related to a standard of living indicator (i.e. obtain an estimate of an income curve), and how disability – by shifting the income curve to the right – reduces the standard of living. All other attributes are used as control factors: they are of interest if either the income or the disability coefficients change. The interaction terms (with income, disability status, or both) are also of interest. For instance, it is interesting to test whether tenants have different costs of disability as compared to home-owners, and whether low-income households require different resources when compared to high income households because of differences in their style (and thus costs) of living.

### **3.3 *The data sources***

The empirical work reported in the paper presents a case study of the UK population. We use data from two major household surveys:

(a) The first is the 1996/97 Family Resources Survey (FRS). The FRS is an annual, nationally representative household survey run by the Department for Work and Pensions, with a sample size of 25,000 households in the UK. The survey is designed to collect information on gross and net incomes from all sources (earnings, self-employment, state benefits, private pensions, savings, maintenance and other transfers), housing costs and family circumstances.

In 1996/97, adult sample members in the FRS who indicated a long-term health problem or impairment were invited to participate in a Disability Follow-Up, which asked more detailed questions on disability, ability to perform various tasks and functions, and use of services. These more detailed questions support the derivation of the so-called OPCS severity scale of disability, which is regarded as the 'gold standard' in the UK for analysis of disability in a non-medical setting. A score of 0 on the scale indicates no impairment, while 22 is the maximum score of any individual in the dataset. Appendix 1 presents 'pen pictures' describing the kinds of functional limitation associated with a range of severity scores.

The FRS also includes information on access to a range of consumer durables (video, microwave, washing machine, etc), access to a car, and whether the family has any savings. These variables are used to construct indicators of standard of living, described in more detail below.

(b) The second source of data is the ninth wave of the British Household Panel Survey (BHPS), interviews for which were carried out in 1999/2000. The BHPS began in 1991 as a nationally representative survey of 5,000 households in Britain, run by the Institute for Social and Economic Research at the University of Essex. Original sample members have been re-interviewed year on year, along with any other members of their household at that time. As with any panel study, there has been some attrition for the original sample. At the first wave of the BHPS, at least one interview was obtained in 74 per cent of eligible households, a response rate comparable to that of other large-scale British surveys. 64 per cent of individuals who gave full interviews at Wave 1 also gave a full interview at Wave 9. Weights to counteract possible attrition bias are available but are not usually considered necessary or desirable in multivariate analysis.

The BHPS collects information on a wide range of topics, including income, consumer durables, health and disability, household composition, housing and family circumstances. For the purposes of this paper, the variables used to construct an indicator of disability are derived from the standard SF-36 questionnaire. Disability is identified with a restriction in social and economic activities arising due to physical health or emotional problems.

In this paper, we present results only from cross-sectional analysis of Wave 9. In future work, we plan to make use of the panel structure of the BHPS to investigate the impact of becoming disabled on an individual's standard of living.

### ***3.4 Choosing an indicator of living standards***

This approach requires that we find a standard-of-living indicator that is not simply a statement of income. Moreover, the indicator should consist of goods and services preferences which are not systematically related to disability status. The effect of disability is captured through the allocation of resources towards meeting additional costs, thereby reducing the resources available to contribute towards standard of living. So for example, expenditure on home helps would not be a good indicator of standard of living since preference for home helps over other goods and services is increased by (some forms of) disability. In general, the closer an indicator comes to representing a universally-valued functioning (e.g. being able to get out and about), and the further removed it is from a specific form of consumption, the better.

Variations in preferences or tastes are problematic only if they are systematically related to the characteristic of interest (in our case, disability); other variations will be 'averaged out'. Ford (1997) argues that composite indicators, based on a range of different items, may help, since even if there is a systematic relationship between need and preferences on one item for a particular sub-group, the relationship is unlikely to be replicated across different items.

The indicator should be available at the same unit of analysis as income, and the time periods over which income and the standard of living indicator are measured need broadly to coincide.

Elasticity in the relationship between the standard of living indicator and income is important so that the indicator will be sensitive to changes in available resources. Food expenditure is relatively inelastic, since a minimum is a necessity and there is a limit to how much one can consume, while ownership of consumer durables may be more responsive to income. Elasticity, or responsiveness to changes in income, may itself vary with income. For example, the proportion of households with access to a telephone increases quickly with income at the bottom of the income distribution, but hardly at all above the median (since nearly 100 per cent of richer households have access).

Choosing an indicator which is sensitive to the bottom of the distribution means the results will reflect extra needs (necessities) but may not discriminate well for higher-income households. Choosing an indicator which is sensitive at the top of the distribution means the results will reflect extra expenditure (luxuries). Again, a combined indicator may help to cover the full range. However it is important to remember that the indicator is not intended to measure standard of living overall – it is necessary only that it should be elastic with respect to disposable income for households with a range of tastes.

Comparing families containing more and less severely disabled individuals using the 1985 OPCS Survey, Berthoud et al. (1993) found a combined indicator based on ownership of seven consumer durables and five questions about budgeting (including ability to save) behaved reasonably well. In the present case, for the Family Resources Survey, indicators of consumer durables similar to those used by Berthoud et al. were tried initially. Indicators which were found to be responsive to income over a reasonable range of income were selected and combined into a composite measure. Details of the full list and composite measure are given in Appendix 2.

A second set of variables relating to savings was also tested. The question on whether the household has any savings performed well: highly responsive to

income over the full range. This is a particularly satisfactory result since theory predicts that households with greater disposable income will be more likely to save, and correspondingly that additional needs will reduce prevalence of savings. Overall, 26 per cent of non-pensioner households had no savings, and 25 per cent of pensioner households.

Some households containing a disabled person may have a stronger preference to save as a precaution against future expenses, but other households may exhibit weaker preferences to save on the grounds of shorter life expectancy. Disincentives to save exist for recipients or would-be recipients of means-tested social assistance and more disabled people are likely to qualify for such benefits than non-disabled people. However for a given level of income the incentives and disincentives to save created by the social security system are the same for disabled and non-disabled people. Overall, it is assumed that a similar range of attitudes towards saving exists among households containing a disabled person as among other households.

The BHPS contains many variables that could be used as an indicator of standard of living. In our specification search, we experimented with several of these indicators, and decided finally to use results for the indicator reporting on the self-assessed financial situation of the household. This indicator, for which information was collected by means of a direct subjective question, turned out to be the most responsive to income. Responses to this direct question on the household's financial situation fell into four categories:

1. 'Living comfortably',
2. 'Doing alright',
3. 'Just about getting by', and
4. 'Finding it difficult'.

### ***3.5 Choosing the income indicator***

The income indicator should reflect the resources that can be disposed of according to the needs and preferences of the household in question. This suggests income should be measured net of direct taxes and social insurance contributions, and at a household level. In the UK, a further consideration is whether income should be measured before or after housing costs; the answer depending on the extent to which housing costs are considered to be at the discretion of the household. For tenants in social housing, or in receipt of housing benefit, an increase in rent raises their before-housing-costs (BHC) income without providing any additional disposable income, suggesting an after-housing-cost (AHC) measure is preferable. On the other hand, for relatively wealthy individuals, housing quality is clearly one of the consumption decisions they make, indicating a before housing costs measure. Following the convention adopted in official statistics, we use both BHC and AHC measures,

although concerns about data quality means that we confine ourselves to BHC income in the British Household Panel Survey. Household income is not equivalised for household size or composition; instead we include variables for numbers and ages of adults and children in the models.

### ***3.6 Choosing the disability variable***

The disability indicators discussed above (in subsection 3.3) are used here to obtain the relevant explanatory variable: OPCS severity score in the case of FRS and SF-36 in the case of BHPS. Unfortunately, these variables are not available for children and as a result our estimates are restricted to the extra costs of disabled adults. An important extension of this work would be to estimate the costs of disabled children.

We distinguish between households which consist solely of pensioners ('pensioner households') and households which contain at least one adult of working age ('non-pensioner households'), and between single-adult and couple households. For couple households, various specifications of the disability variable in FRS were explored, including: individual's score and dummy variable for whether partner disabled; individual's score interacted with partner's score; and sum of individual's and partner's scores. This last specification produced the best fit. We omitted households with three or more adults. This is mainly due to the heterogeneity of this subgroup. For instance, it contains elderly disabled people living with their adult (non-disabled) children, as well as disabled young adults still living with their parents. Any further subdivision to account for these different households reduced the cell size of 3-plus person households even further. Thus, we decided to perform our estimations for single-adult and two-adult households only.

### ***3.7 Choosing other explanatory variables***

The explanatory variables tested were determined by our hypotheses about their importance in the relationship between standard of living, income and disability. For instance, tenure is included (as in previous studies) since it is expected that people with the same level of income but differences in terms of home ownership will have different standards of living. Similarly, regional dummies are included to reflect geographical differences in costs of living. Age, gender, and number and ages of children are other important explanatory variables. Interaction terms were also tested. The inclusion of explanatory variables in the final models was governed by their statistical significance.

## 4. Results

### 4.1 *Estimates of extra costs of disability*

Table 5 provides an overview of results for different household types for the final model, using FRS data. The subsequent tables (Tables 6 to 10) illustrate the procedure which was followed to arrive at the final results and various sensitivity tests. The dependent variable in Table 5 is whether the household has any savings; consequently a logistic regression was used.<sup>3</sup> A log income specification was found to provide the best fit. The coefficients on income and severity score (the two coefficients used to calculate extra costs) are statistically significant at the 5% level or below for each household type. The pseudo R-squared statistics – a measure of the explanatory power of the models – while not high, are reasonable for analysis of this kind.

Estimates of extra costs are shown in the bottom two rows of the table, expressed firstly as the percentage of income by which extra costs increase for each additional point on the severity score, and secondly as an amount in £ per week (in 2001 prices) for a household on mean income for each of three levels of severity of impairment.

For both non-pensioners and pensioners, the estimated extra costs as a percentage of income are higher for single-adult households than for couple households. This is as one would expect. In a couple where only one person is disabled, some substitution of unpaid care for disability-related expenditure may be possible, thereby reducing the extra costs of disability. In a couple where both are disabled, some sharing of equipment and other disability-related resources may be possible, thereby reducing the extra cost per person. However, it is important to note that in couples where both individuals are disabled, the absolute amount of extra costs is likely to be higher than in other household types, since their combined severity score is likely to be higher.

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3 As shown in equation [2], the extra cost of disability is calculated by the ratio of two gradients with respect to disability and income. In logistic regression, the same can be achieved by the ratio of the two coefficients, which is equivalent to the ratio of the corresponding marginal effects.

**Table 5: Summary of results from final models**

(Standard of living indicator: any savings)

<b>Non-pensioner/ Pensioner: Household type:</b>	<b>Non- pensioner Single</b>	<b>Non- pensioner Couple 1 disabled</b>	<b>Non- pensioner Couple Both disabled</b>	<b>Pensioner Single</b>	<b>Pensioner Couple 1 disabled</b>	<b>Pensioner Couple Both disabled</b>
AHC income, log	0.753***	0.842***	0.833***	0.630***	1.421***	1.609***
Severity score	-0.035***	-0.036***		-0.049***	-0.041***	
Combined severity score			-0.033***			-0.020**
Age	Y	Y	Y	Y	Y	Y
Region	Y	Y	Y	Y	Y	Y
Tenure	Y	Y	Y	Y	Y	Y
Children	Y	Y	Y			
<i>Pseudo R2</i>	<i>0.19</i>	<i>0.16</i>	<i>0.17</i>	<i>0.11</i>	<i>0.15</i>	<i>0.15</i>
<b>Extra costs estimate</b>						
as % of income, for each point on score (0-22 single; 0-34 combined)	<b>4.6%</b>	<b>4.3%</b>	<b>4.0%</b>	<b>7.8%</b>	<b>2.9%</b>	<b>1.2%</b>
<i>95% confidence interval</i>	<i>+/- 2.9</i>	<i>+/- 1.6</i>	<i>+/- 1.5</i>	<i>+/- 3.4</i>	<i>+/- 1.4</i>	<i>+/- 0.9</i>
<b>At mean income, £pw</b>	<b>(£170)</b>	<b>(£392)</b>	<b>(£405)</b>	<b>(£122)</b>	<b>(£273)</b>	<b>(£276)</b>
Low severity (score 3)	<b>£23</b>	<b>£51</b>	<b>£97</b>	<b>£28</b>	<b>£24</b>	<b>£20</b>
Medium severity (score 9)	<b>£70</b>	<b>£152</b>	<b>£292</b>	<b>£86</b>	<b>£71</b>	<b>£60</b>
High severity (score 17)	<b>£133</b>	<b>£287</b>	<b>£551</b>	<b>£162</b>	<b>£135</b>	<b>£113</b>

Notes: All monetary figures are expressed in 2001 prices

'AHC' = After Housing Costs

Statistical significance at \*\*\* 1% level \*\* 5% level \* 10% level n.s. not significant

Source: Family Resources Survey (1996/97)

Turning to the illustrations of extra costs for households with mean income, it can be seen from the lowest panel of Table 5 that extra costs associated with a low severity of impairment range from £20 (pensioner couple households, both disabled) to £97 (non-pensioner couple household, both disabled). Much of the variation arises from differences in mean income by household type. For a high level of severity, extra costs for a household with mean income range from £113 to £551.

Table 6 shows some of the specifications for income and disability variables which were tested to arrive at the final models. Model 1 is the most basic model, assuming a linear relationship between income and standard of living (in

this case indicated by whether the household has any savings), as shown in Equation 1 above, and including only controls for numbers and ages of children.

**Table 6: Testing income specifications**  
(Population subgroup: Non-pensioner single adults)  
(Standard of living indicator: any savings)

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7 = final
AHC income, linear	0.009***	0.009***					
AHC income, log			1.088***	1.087***			0.753***
AHC income, squared					2.2 x 10 <sup>-5</sup> ***		
AHC income, square root						0.173***	
AHC income interacted with severity score		0.000		0.002			
Severity score	-0.058***	-0.072***	-0.062***	-0.070***	-0.059***	-0.065***	-0.035***
Children	Y	Y	Y	Y	Y	Y	Y
Region							Y
Tenure							Y
Age							Y
<i>Log likelihood</i>	-2363	-2363	-2287	-2287	-2426	-2394	-2123

‘AHC’ = After Housing Costs

Statistical significance at \*\*\* 1% level \*\* 5% level \* 10% level n.s. not significant

Source: Family Resources Survey (1996/97).

Model 2 introduces an interaction term between income and disability status, on the assumption that the effect of disability on standard of living might vary by income. The interaction term is not significant.

Model 3 uses log income, on the assumption that the marginal returns to standard of living of income decrease as income rises. In other words, an additional £1 makes more difference to the standard of living of a poor person than a rich person. The coefficients on both the income and disability terms remain significant and the model is a better fit, as indicated by the higher log likelihood statistic. The fit is not improved by interacting log income and disability (Model 4).

Model 5 tests the opposite assumption, namely that there are increasing returns to income, by using income squared. The assumption is rejected. Model 6 uses square root of income, as an alternative to the log income specification but with roughly the same shape. It is not as good a fit as Model 3 using log income.

Finally, Model 7 uses the income specification which has been found to produce the best fit – log income – and introduce controls for age, region and housing tenure. These controls improve the fit of the model considerably, as confirmed by a likelihood ratio test.

Table 7 compares results for pensioners based on the FRS and the BHPS. For ‘before housing costs’ income, a square root specification was found to give a better fit than log income.

**Table 7: Comparing Family Resources Survey with British Household Panel Survey**

(Population subgroup: Pensioner households)

<b>Source:</b>	<b>FRS</b>	<b>BHPS</b>	<b>FRS</b>	<b>BHPS</b>	<b>FRS</b>	<b>BHPS</b>
Standard of living indicator:	Any savings	Financial situation	Any savings	Financial situation	Any savings	Financial situation
Household type	Single pensioner		Couple pensioner, 1 disabled		Couple pensioner, both disabled	
BHC income, square root	0.1831*	0.218***	0.207***	0.172***	0.237***	0.172***
Disability		-0.712***		-0.248*		-0.745***
Severity score	-0.053***		-0.031**		-0.023*	
Region	Y	Y	Y	Y	Y	Y
Tenure	Y	Y	Y	Y	Y	Y
Age	Y	Y	Y	Y	Y	Y
<i>Log likelihood</i>	-1619	-1404	-1180	-1010	-954	-1010
<b>Extra costs estimate as % mean income</b>	<b>43%</b>	<b>50%</b>	<b>16%</b>	<b>16%</b>	<b>20%</b>	<b>50%</b>
(& mid severity for FRS)						

‘BHC’ = Before Housing Costs

Statistical significance at \*\*\* 1% level \*\* 5% level \* 10% level n.s. not significant

Sources: Family Resources Survey (1996/97) and British Household Panel Survey (1999/2000)

Despite the fact that the results use different datasets, different indicators of standard of living (for BHPS, self-assessed financial situation), and different definitions of disability, the estimates for extra costs for single pensioners and couples where only one person is disabled are reassuringly similar. For couples where both are disabled, BHPS produces a higher estimate than FRS. It is difficult to assess which is the more accurate, although compared to estimates

for other household types, the FRS figure is perhaps rather low (as shown in Table 5, for example).

Table 8 illustrates another sensitivity test, this time by using different standard of living indicators within the same dataset (FRS), for non-pensioners. The two indicators are an index of consumer durables, and whether the household has any savings (the indicator used for the summary of results in Table 5). In general, the consumer durables indicator produces slightly lower estimates of extra costs as a percentage of income, but they are of the same order of magnitude as for ‘any savings’.

**Table 8: Comparing standard of living indicators**  
(Population subgroup: Non-pensioners)

Type of household: Standard of living indicator:	Single		Couple, 1 disabled		Couple, both disabled	
	Consumer durables	Any savings	Consumer durables	Any savings	Consumer durables	Any savings
AHC income, log	0.657***	0.753***	0.522***	0.842***	0.518***	0.833***
Severity score	-0.027**	-0.035***	-0.007	-0.036***		
Combined severity score					-0.011**	-0.033***
Age	Y	Y	Y	Y	Y	Y
Region	Y	Y	Y	Y	Y	Y
Tenure	Y	Y	Y	Y	Y	Y
Children	Y	Y	Y	Y	Y	Y
<i>Pseudo R2</i>	<i>0.10</i>	<i>0.19</i>	<i>0.05</i>	<i>0.16</i>	<i>0.04</i>	<i>0.17</i>
<b>Extra costs estimate</b>	<b>4.1%</b>	<b>4.6%</b>	1.3% n.s.	<b>4.3%</b>	<b>2.1%</b>	<b>4.0%</b>
as % of income, for each point on score (0-22 single; 0-34 combined)						

‘AHC’ = After Housing Costs

Statistical significance at \*\*\* 1% level \*\* 5% level \* 10% level n.s. not significant

Source: Family Resources Survey (1996/97).

Finally, Table 9 shows an extension of the methodology to estimating how extra costs vary by type of impairment.<sup>4</sup> In order to achieve sufficiently large cell

4 Note that ‘Independence’ is a rather unsatisfactory category in the original OPCS measure, and refers to ability to carry out self-care activities like toileting and feeding.

sizes, different household types are combined, the only distinction being retained is that between pensioners and non-pensioners. Instead, the number of the adults in the household is entered as a control variable. Of course, an individual may have more than one type of impairment. Here individuals are classified according to the dimension on which they had the highest score (i.e. the most severe impairment), with any ‘ties’ being decided in favour of the impairment type higher up the list.

**Table 9: Variation in extra costs by type of impairment**  
(Standard of living indicator: any savings)

<b>Type of household:</b>	<b>Non-pensioner</b>	<b>Pensioner</b>
AHC income, log	0.823***	0.907***
No disability [omitted]	0	0
Locomotion	-0.452***	-0.227**
Reaching/dexterity	-0.308***	-0.174
Seeing/hearing	0.037	-0.011
Continence	-0.022	0.027
Mental health	-0.327***	0.044
Independence	-0.428***	-0.555***
Other	-0.286	-0.535
Age	Y	Y
Region	Y	Y
Tenure	Y	Y
Adults	Y	Y
Children	Y	
Pseudo R2	0.19	0.13

‘AHC’ = After Housing costs

Statistical significance at \*\*\* 1% level \*\* 5% level \* 10% level n.s. not significant

Source: Family Resources Survey (1996/97).

For non-pensioners, those with locomotion impairment, limited independence, mental health problems and difficulties in reaching or dexterity are found to have significant extra costs. The categories of locomotion and independence correspond quite closely to the eligibility criteria for Disability Living Allowance mobility and care components respectively, but mental health and reaching/dexterity may be less well accommodated. Pensioners with limited independence and locomotion impairment also face significantly greater extra costs than other groups. Those with limited independence may be eligible for

Attendance Allowance but the lack of an equivalent for Disability Living Allowance mobility component for the over-65s is a serious gap.

#### **4.2 Comparison with previous estimates**

The results derived by Berthoud et al (1993) for 1985 data, summarised in Table 4, are an average of single and couple households, and cover the full age range. They are therefore difficult to compare directly with the results presented here. For the lowest severity category (1 / 2), Berthoud et al estimate extra costs at 4 per cent of income. This category corresponds to an average severity score of 2.3, which translates to an estimate of extra costs based on the results in Table 5 of between 9 and 11 per cent for non-pensioners (3 and 18 per cent for pensioners). There are reasons to believe that extra costs of disability have increased since the mid-1980s, firstly, because of increased availability of aids and adaptations (which nevertheless have to be paid for), and secondly, because charges for social services have increased and become more widespread (Audit Commission, 2000). So it is plausible that the estimates of extra costs derived from 1996/97 data are higher than those derived from 1985 data. The gradient of extra costs with respect to severity appears to have remained relatively unchanged, however: an 8-fold increase from the bottom to the top of the scale in both cases.<sup>5</sup>

#### **4.3 Comparison with extra costs benefits received**

Some individuals receive extra costs benefits, such as Disability Living Allowance (DLA) or Attendance Allowance (AA), in recognition of the extra costs of disability which they incur. Table 10 compares the receipt of such benefits to the estimates of extra costs incurred, derived from Table 5. Of course the majority (88 per cent of non-pensioners and 60 per cent of pensioners) neither receive DLA/AA nor incur any extra costs. A very small percentage – 1 and 2 per cent for non-pensioners and pensioners respectively – receive benefits despite not appearing to face any additional costs. On the other hand, a worryingly high proportion of those who face extra costs receive no extra costs benefits at all: 9 per cent of non-pensioners and almost one-third (30 per cent) of pensioners. The particularly large gap for pensioners may be related to the fact that there is no help with mobility-related costs for those who become disabled over the age of 65.

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5 Comparing category 1/2 with category 9/10 in Table 4, and severity score 2.3 with severity score 18.1 (the mean scores for categories 1/2 and 9/10 respectively) in Table 5.

**Table 10: Extra costs benefits received compared to estimated extra costs incurred**

(Population subgroup: Single adult and couple households)

*Column percentages*

	<b>Non-pensioners</b>	<b>Pensioners</b>
Zero extra costs, zero benefits	88	60
Zero extra costs, some benefits	1	2
Some extra costs, greater benefits	1	3
Some extra costs, smaller benefits	2	5
Some extra costs, zero benefits	9	30
All	100	100

Notes: Extra costs benefits received are Disability Living Allowance and Attendance Allowance. Extra costs incurred are estimated on the basis of results in Table 5

Source: Family Resources Survey (1996/97).

Among non-pensioners who are estimated to face additional costs, the mean percentage of extra costs covered by income from extra costs benefits was 27 per cent, but the median was zero. For pensioners, the mean percentage covered was 33 per cent, and the median was again zero.<sup>6</sup>

#### **4.4 Implications for income distribution and poverty**

Next, we examine how the relative economic position of population sub-groups change when we account for differences in their disability status. Our results show that applying the estimates for extra costs to disabled people's incomes has substantial effects both on their own position in the income distribution, and on overall estimates of poverty rates. Disability equivalisation scales were derived (by household type) from the final estimates in Tables 5 and applied to household-level data from the Family Resources Survey.<sup>7</sup>

Table 11 reports the incidence and severity of income poverty amongst non-disabled and disabled people, further divided into pensioners and non-pensioners. These results are provided for three different income distributions –

6 The gap between mean and median is caused by a small number of cases where benefit income exceeds extra costs by a large margin. 4% of non-pensioners with extra costs receive benefits worth 150% or more of their estimated extra costs, as do 6% of pensioners.

7 The estimates for two-adult households were also used for households containing three or more adults. After applying the adjustment for disability, incomes were equivalised for differences in household size using the standard McClements scale.

A, B, and C – which differ from each other in their adjustment for extra costs of disability. The poverty line used is 60 per cent of median income for the whole population for the particular distribution in question. Income distribution A is obtained using the standard HBAI-type income definition: income includes the disability related benefits received by different members of the household, and equivalisation of household resources is carried out for differences in household size only. Income distribution B is an improvement over distribution A since it deducts ‘extra costs’ disability state benefits (namely, Disability Living Allowance and Attendance Allowance) from household income. The assumption underlying distribution B is that all extra costs of disability are offset by the state benefits available to disabled people. However, as implied by our analysis in the previous section, there is a considerable doubt about the availability and sufficiency of benefits that are available. For instance, not everyone who is disabled receives benefit and the benefits received in some cases fall short of extra costs as calculated in this paper (reported in Table 5). Income distribution C is the result of deducting from total household income the estimated extra costs of disability as calculated in this paper for all those identified as disabled.<sup>8</sup>

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8 Total household income includes Disability Living Allowance and Attendance Allowance. Thus income distribution C takes into account that some disabled people have already been partially compensated for the extra costs of disability through receipt of these benefits.

**Table 11: Percentage below 60% median income and the poverty gap, using three different income distributions**

	Non-pensioners			Pensioners			All		
	Income distribution			Income distribution			Income distribution		
	<i>A</i>	<i>B</i>	<i>C</i>	<i>A</i>	<i>B</i>	<i>C</i>	<i>A</i>	<i>B</i>	<i>C</i>
<i>Non-disabled</i>									
Poverty rate	21.3	21.3	20.6	33.2	33.6	27.2	23.0	23.1	21.6
Poverty gap (%)	7.9	7.8	8.0	6.6	6.3	5.4	7.7	7.6	7.6
<i>Disabled</i>									
Poverty rate	33.3	40.4	60.1	37.2	44.4	61.6	35.1	42.2	60.8
Poverty gap (%)	9.4	11.3	29.0	7.1	8.2	26.7	8.4	9.9	27.9
<i>All</i>									
Poverty rate	22.7	23.5	25.1	34.8	37.7	40.3	25.1	26.2	28.1
Poverty gap (%)	8.1	8.2	10.4	6.8	7.0	13.5	7.8	8.0	11.0

Notes: Income distribution A: Income after housing costs including Disability Living Allowance and Attendance Allowance (i.e. state-provided extra costs disability benefits).

Income distribution B: Income after housing costs, minus Disability Living Allowance and Attendance Allowance.

Income distribution C: Income after housing costs, minus extra costs of disability as calculated in Table 5 of this paper.

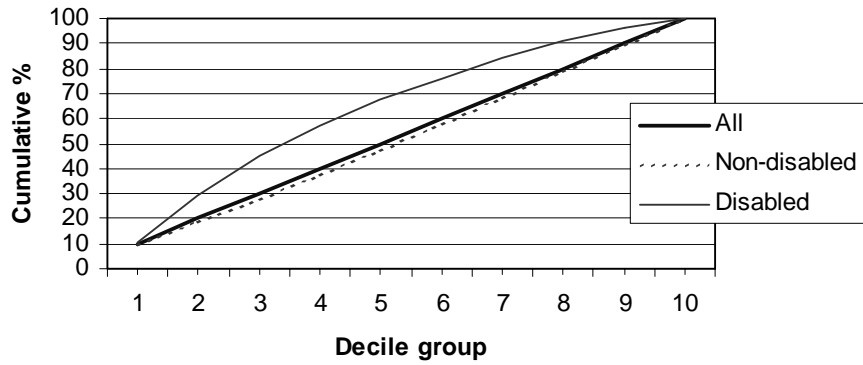
Source: Family Resources Survey (1996/97).

Obviously, a move from distribution A to B and then to C will imply a greater income disadvantage for disabled people in comparison to non-disabled people. Results presented in Table 11 show that income poverty for disabled people is clearly higher in distribution B (40.4% for non-pensioners; 44.4% for pensioners) than in income distribution A (33.3% for non-pensioners; 37.2% for pensioners). As can be expected, there are no significant differences in the poverty rate for non-disabled people between income distributions A and B. These results provide a clear indication of an under-estimation of the poverty incidence amongst the disabled population in the HBAI-type analysis of income distribution.

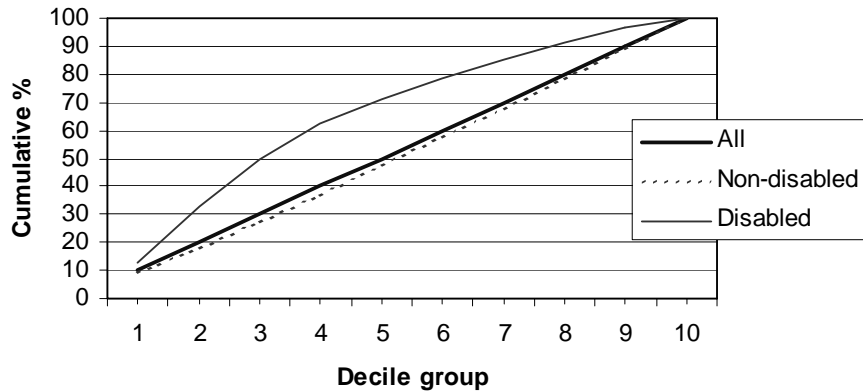
Results for income distribution C indicate even greater disadvantage of disabled people relative to the non-disabled, after adjusting for the extra costs of disability as calculated in this paper. The poverty rate amongst the disabled population overall is very high according to this measure: 61 per cent. The differences in the poverty rate for disabled population across the three distributions provide a good approximation of income disadvantage that disabled people experience as a consequence of extra costs of living associated with disability. The poverty gap results are in line with the patterns observed for the poverty incidence.

Taking account of disability does not just affect the position of disabled households relative to their non-disabled counterparts; it also affects overall estimates of poverty, as shown in the last rows of Table 11. The percentage of the whole population estimated to be in poverty (setting the poverty line at 60 per cent of median income) changes from 25.1 to 28.1 per cent when we use income distribution C instead of income distribution A.

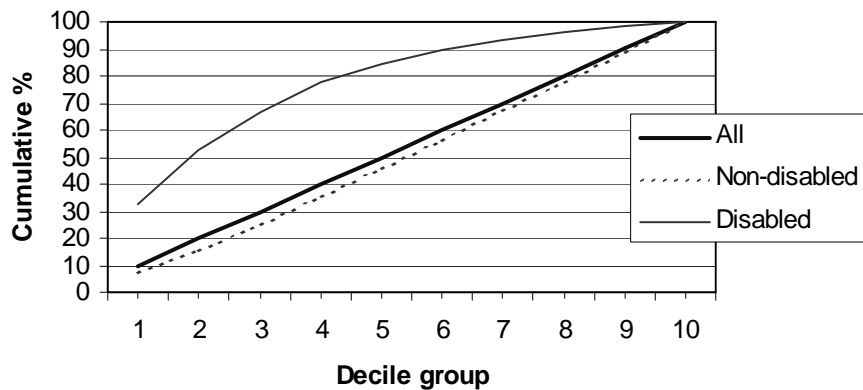
**Figure 2a: Income including disability benefits  
(non-pensioner households)**



**Figure 2b: Income with no disability benefits  
(non-pensioner households)**



**Figure 2c: Disability adjusted income  
(non-pensioner households)**

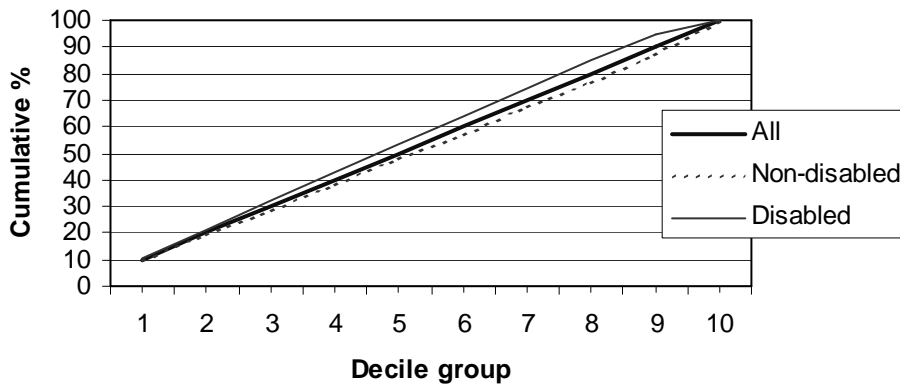


The changes in the relative position of the disabled population can also be observed when we analyse differences in the whole distribution. Figure 2a shows the cumulative percent of non-pensioner households by decile group, using income distribution A. The diagonal 45 degree line represents the whole population (10 per cent in each decile group), the line above the diagonal shows position of households containing a disabled person, and the line below the diagonal shows the position of households with no disabled members. The greater the distance above the diagonal, the greater the concentration of the group in question at the bottom of the distribution; conversely, a line below the diagonal indicates concentration towards the top of the distribution.

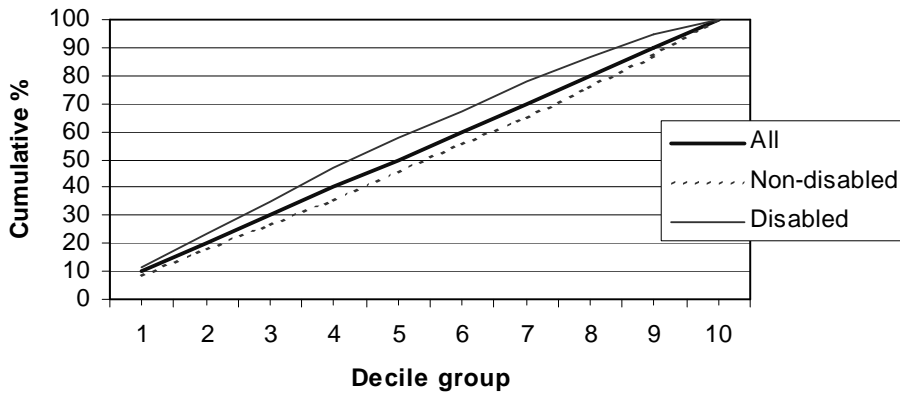
Figure 2b also shows non-pensioner households, but this time with incomes in distribution B. As expected, the lines for disabled and non-disabled have diverged, and the concentration of households with a disabled member at the bottom of the distribution has become more pronounced. Figure 2c makes use of income distribution C and exhibits an even greater concentration of disabled population amongst the low income deciles.

Figures 3a, 3b and 3c make a similar comparison for pensioner households. Pensioner households are already concentrated towards the bottom of the income distribution even before adjusting for the extra costs of disability, and this becomes more pronounced when a disability adjustment is made.

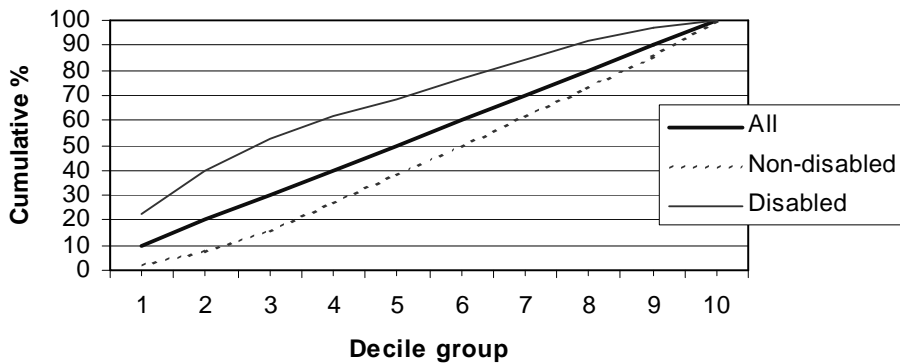
**Figure 3a: Income including disability benefits  
(pensioner households)**



**Figure 3b: Income with no disability benefits  
(pensioner households)**



**Figure 3c: Disability adjusted income  
(pensioner households)**



## 5. Conclusions

The empirical work performed in this paper is motivated by the fact that there are pragmatic and theoretical reasons to take account of variations in different types of needs when using income for the purposes of measuring poverty and inequality. Household size is one such source of variation, and this is commonly acknowledged by equivalising incomes for differences in household size and composition. Disability is another source of variation in needs but equivalisation for this variation has been hitherto largely overlooked. This paper has argued that disability generates significant additional costs of living and that these extra costs should be taken into account in comparing incomes across the population. Moreover, a move towards identifying and accounting for a fuller set of needs will bring us closer to the operationalisation of Sen's capability approach.

Empirical implementation of the standard of living approach to quantifying the extra costs of disability, based on comparing the standards of living for people with and without disability at a given income, has shown that it is feasible to derive an equivalence scale to account for differences in disability status across households. The methodology adopted depends crucially on the choice of a suitable indicator of standard of living and its elasticity with respect to income and disability status. Thus, the paper also performs sensitivity analysis with respect to the choice of standard of living indicators and the income specification in the model. Indeed, one interesting extension of the approach presented here would be to use the panel structure of the BHPS and examine the costs of becoming disabled, after controlling for changes in income and other fixed attributes.

The results show that the extra costs of disability are substantial, especially for disabled people living alone, and that these extra costs rise with severity of disability. These are important findings since they have implications for the adequacy of disability-related state benefits and for devising poverty thresholds when comparing poverty across people with varying severity of disability. Our results show that taking into account the extra costs of disability has a substantial impact not only on the relative position of disabled and non-disabled people in the income distribution, but also on estimated poverty rates in the population as a whole. For UK's population in the late 1990s, the poverty rate among pensioners is about 16 per cent higher after equivalising for disability (using 60 per cent median income threshold), and three percentage points are added to the poverty rate for the whole population.

These results indicate that a careful scrutiny of existing state benefits designed to compensate for the extra costs of disability is essential, since their levels fall

well short of the extra cost estimates obtained by using the standard of living approach in this study. Moreover, the results present a strong case for developing robust disability-adjusted poverty and inequality statistics to present alongside other official figures.

## Appendix 1: Pen pictures of OPCS severity scores of disability

Severity score	Subject	Difficulties
1.50	Man aged 50	Cannot see well enough to recognise a friend across the road Has difficulty seeing to read ordinary newspaper print Difficulty following a conversation against background noise
6.05	Woman aged 31; high tone deafness in both ears	Finds it quite difficult to understand people who know her well Finds it very difficult to understand strangers Often loses track of what's being said in the middle of a conversation Difficulty following a conversation against background noise
10.00	Woman aged 16; mild cerebral palsy	Often gets confused about what time of day it is Cannot read a short article in a newspaper Cannot count well enough to handle money Cannot watch 1/2 hour TV programme right through and tell someone what it was about Thoughts tend to be muddled or slow Finds it very difficult to understand strangers Can only walk up and down a flight of stairs if goes sideways or one step at a time
13.90	Man aged 31; addicted to tablets	Gets so upset that hits other people Gets so upset that breaks or rips things up Feels the need to have someone present all the time Finds relationships with people outside the family very difficult Sometimes sits for hours doing nothing Is impossible for strangers to understand Is quite difficult for people who know him well to understand
17.55	Man aged 30, mentally retarded	Cannot pick up and hold a mug of coffee with either hand Cannot squeeze out water from a sponge with either hand Has difficulty serving food from a pan using a spoon or ladle Cannot pick up and carry a 5lb bag of potatoes with either hand Gets so upset that hits other people or injures himself Gets so upset that breaks or rips things up Feels the need to have someone present all the time Finds relationships with members of the family very difficult Has fits once a year but less than 4 times a year Loses consciousness during a fit Cannot walk up and down a flight of 12 stairs Finds it quite difficult to understand people who know him well Loses control of bowels occasionally
19.05	Man aged 55, stroke	Cannot walk at all Cannot feed self without help Cannot carry out the following without help: get in and out of bed wash all over get in and out of a chair wash hands and face dress and undress get to toilet and use toilet Cannot carry out any activities involving holding, gripping and turning Cannot put either arm behind back to put jacket on or tuck shirt in Has difficulty holding either arm in front to shake hands with someone Is very difficult for strangers to understand Loses control of bladder at least once a month Cannot see well enough to recognise a friend across the road Has difficulty seeing to read ordinary newspaper print

Source: Martin, Meltzer and Elliot (1988), pp.13-15

## Appendix 2: Details of variables used in the analysis

### *Standard of living indicators in Family Resources Survey*

For the consumer durables indicators (pensioner and non-pensioner), the following variables were tested individually for responsiveness to income:

- \*† Video player
- \*† Tumble dryer
- \*† Dishwasher
- \*† CD player
- \*† Access to a motor vehicle
- \* Microwave
- \* Mobile telephone
- \* Washing machine
- \* Home computer
- † Satellite TV
- Central heating
- Fridge/freezer
- Telephone

Those marked \* were included in a composite indicator for non-pensioner households and those marked † were included in a composite indicator for pensioner households. For non-pensioners, the composite was scored 1 to 6, with 1 representing ownership of two or less of the items (17 per cent of households), and 6 representing ownership of seven or more items (10 per cent of households). For pensioners, the composite was scored 1 to 4, with 1 representing ownership of no items (27 per cent of households) and 4 representing three or more items (26 per cent of households).

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