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New Estimates of the Cost of Disability in Ireland Using the Standard of Living Approach

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Abstract

Addressing the extra economic costs of disability seems a logical step towards alleviating elements of social exclusion for people with disabilities. This paper estimates the economic cost of disability in Ireland in terms of the additional spending needs that arise due to disability. It defines and estimates models of the private costs borne by families with individuals who have a disability in Ireland when compared to the wider population, both in general and by severity of illness. Our modelling framework is based on the standard of living approach to estimating the cost of disability. We extend on previous research by applying an ordered logit modelling approach to Living in Ireland survey data 1995-2001 to quantify the extra costs of living associated with disability in Ireland. We also derive estimates of the cost of disability for 'pensioner' and 'non-pensioner' households, as well as over time. Our findings suggest that the economic cost of disability in Ireland is large, varies by severity of disability, and across household types. Overall our findings have important implications for measures of poverty in Ireland.

1. Introduction

In considering the extent and impact of disability it is important to understand the association between disability and poverty. Interventions to promote the wellbeing and social inclusion of people with disabilities include policies to ensure adequate income for people living with disabilities or those caring for a person with a disability. Despite this the proportion of disabled or long-term ill in Ireland who are in households at risk of poverty is twice that of households with no disability or long-term illness (Gannon and Nolan, 2007). Similarly, these households are twice as likely to be deprived of basic items such as clothes, food or heat. In this context

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addressing the extra economic costs of disability seems a logical step towards alleviating elements of social exclusion for people with disabilities.

Providing a definition of disability appropriate for use in empirical analysis has proved problematic, and many studies have acknowledged the varying ways of describing disability. Historically the *medical model* of disability was viewed appropriate but in recent years a *social model* is widely accepted. Ireland is one of the few countries to adopt the social theory of disability, where disability is viewed as an outcome of social attitudes and environment, and the *Disability Act 2005* was passed into law with a view to establishing a civil rights approach for people with disabilities. The European Commission (2000, 2006) has acknowledged that social exclusion is a multidimensional phenomenon that requires knowledge of several indicators of quality of life. The challenge then to policymakers is to address the structural barriers that are highlighted from evaluation of these indicators. Characteristics of social exclusion include low income, poverty, education, employment and social participation among others. We believe that addressing the extra cost of disability incurred by disabled individuals can have a substantial impact on standing of living and social inclusion.

The Irish government provides a range of public supports for the disabled, as do many non-governmental organisations and private individuals. The level and nature of government assistance are ultimately determined by social and political choices, but the design of the relevant policies should benefit from evidence on how disability affects the economic welfare of affected individuals. In this paper we define and estimate models of the private costs borne by individuals with a disability in Ireland

when compared to the wider population, both in general and by severity of illness or condition. Our modelling framework is based on the standard of living approach to estimating the cost of disability as developed in Berthoud *et al.* (1993) and Zaidi and Burchardt (2005).

The definition of additional costs implied by this approach is the sum required to bring the standard of living of a household containing a person with a disability up to the same level as a comparable household where no members have a disability, controlling for relevant socio-demographic characteristics. This concept of additional cost represents an approximation of the cost for any given group considered (e.g. by severity of disability) and involves averaging across individuals within a group. The resulting cost estimates include direct costs and additional costs of living associated with disability, but omit opportunity costs such as potential foregone income.

Our paper contributes to the literature in a number of ways. We present, for the first time, estimates of the economic costs of disability in Ireland by severity of condition, as well as for pensioner and non-pensioner households. Our paper also presents cost of disability estimates over time, from 1995 to 2001, using the Living in Ireland surveys. This paper improves on previous studies for Ireland by providing more up-to-date and specific estimates, as well as by using more appropriate data to identify households containing an individual with a disability.

The paper is organized as follows: Section 2 reviews the literature on estimating the cost of disability and relevant previous research. Section 3 presents the standard of living approach for estimating the economic cost of disability, while Section 4

presents the data and discusses the variables used in our modelling. Section 5 presents estimation results and cost of disability estimates, while Section 6 sets out concluding remarks.

2. Literature and Previous Research

Literature

Previous research, both in Ireland and internationally, has drawn on three principal approaches to quantifying the economic costs of disability, namely direct survey approaches (DSAs), expenditure diary approaches (EDAs) as well as indirect approaches (IAs)[1], each of which is now discussed.

The DSA to estimating the economic cost of disability, also known as the subjective approach, involves directly asking individuals with a disability (or their carer) how much extra they spend on specific expenditure items. The implicit counterfactual is the same individual's expenditures, assuming they did not have a disability. The DSA is in practice the most straightforward approach as any additional costs identified can be aggregated to give an estimate of total extra costs arising from a disability. Furthermore, it is relatively straightforward and inexpensive to implement. There are however a number of crucial disadvantages associated with the DSA. For example, it assumes that survey respondents are in a position to provide accurate estimates of current expenditures, which is often not the case. More crucially however it can be especially difficult for respondents to conceive of, and estimate, their expenditures in the counterfactual scenario. Thus the DSA is unlikely to provide accurate estimates of the additional costs of disability (Berthoud *et al*., 1993).

Expenditure diary approaches (EDAs), also known as comparative approaches, tackle some of the problematic issues with DSAs. They involve analysing detailed measurements of expenditures for a sample of persons with a disability, relative to corresponding expenditures for a sample of individuals without a disability. A comparison of expenditures can be used to identify those areas where persons with disabilities tend to face additional expenditures. Again, however, the EDA is problematic for a number of reasons. The costs of data collection for DSAs tend to be large, and interpretation of the results difficult. This is because an analysis of expenditure patterns tends to lose important variation through the effects of averaging and detailed information on the nature and severity of the disabilities in question would be required to separate out the effects, which is generally not available through these data sources. Another key problem with EDAs is that "expenditure is an accurate indicator of consumption only if it is assumed that disabled and non-disabled people buy at the same prices. In practice disabled people may sometimes have to pay more for the same goods or services. A trip to the shops, for example, might require a taxi fare instead of a bus ride" (Indecon, 2004).

A third approach for estimating the economic cost of disability is an indirect approach known as the standard of living (SoL) approach. The approach assumes that resources, in the form of income, determine a household's SoL and that for a given income there will be a reduction in SoL where additional needs arise due to disability. This reduction is a result of diverting scarce resources to disability-related goods and services. Operationally the cost of disability is defined as the extra income required by a disabled household to achieve the same standard of living as an equivalent household. We consider the SoL approach in more detail in Section 3.

Irish Research

Three previous studies have assessed the economic cost of disability in Ireland. First, the National Rehabilitation Board, using a DSA, surveyed 59 individuals with a disability in relation to the costs associated with disability and other disability-related issues (NRB, 1995). Additional costs were identified in a number of expenditure areas including regular purchases such as food and medication, food, clothing and footwear, home heating, equipment, aids and furniture, as well as adaptations to homes. Indecon (2004) updated the NRB estimates to 2003 prices implying that "the extra cost associated with items specifically related to disability amounted to up to €48 per week". A second study, Nexus Research (1996), focussed on the extent and severity of disabilities faced by people with MS, and the implications for employment, income adequacy, and other issues. A total of 260 persons interviewed reported relatively low levels of income as well as significant additional costs from their disabilities, further reducing the adequacy of their incomes.

A study by Indecon (2004) represents the most comprehensive study of the costs of disability in Ireland to date and used DSA, EDA and SoL approaches. The study estimated the cost of disability to be €143 per week for non-elderly households, at the median income level, using the SoL approach – this approach was favoured in the report over the other approaches. However the Indecon estimates were derived using data which utilised an imperfect measure of household disability status based on whether the household was in receipt of a disability related payment. The Indecon estimates may therefore be subject to measurement error bias through the disability indicator variable. Furthermore the data used did not allow for the direct estimation

of the impact of severity of disability on the cost estimates nor did the study provide estimates of the cost of disability for pensioner households. In this paper we provide more robust and comprehensive estimates of the cost of disability in Ireland using the standard of living approach than Indecon (2004). It should be noted however that the Indecon report had a much wider terms of reference than is the case for this paper and provided a very welcome and detailed study of the nature and scale of disability-related costs in Ireland.

International Research

A number of studies have considered the cost of disability internationally, particularly in the UK and Australia - Tibble (2005) provides a good summary of the former. Overall the international research has employed a variety of estimation techniques and consequently there has been considerable variation in estimates across studies.

Three previous international studies have employed the SoL approach. The methodology was first proposed by Berthoud *et al.* (1993), who used 1985 survey data from the UK in their estimations of the cost of disability. The study estimated the cost of disability by severity of disability and found that "extra costs reach about £30 per week [1985 prices] in the highest severity grade". Zaidi and Burchardt (2005), also for the UK, utilised the same approach in the context of an 'income equivilisation' study. They found that the "extra costs associated with a low severity range from £18 (pensioner couple households, one disabled) to £96 (non-pensioner couple households, both disabled)." The estimated costs rise significantly by severity however and "for a high level of severity, extra costs for a household with mean income range from £104 to £546" per week. Finally, Saunders (2006) utilises the

standard of living approach for Australia and finds "the costs of disability correspond to 29 per cent of equivilised income" although this measure increases to 37 per cent when an alternative, and probably more realistic, measure of disability is used.

3. Standard of Living Approach

The standard of living approach starts from the premise that disability status will reduce the living standards of households containing an individual with a disability by causing them to divert a portion of their resources (income in our model) to cover disability-related costs. This diversion of resources can be quantified, taking account of other factors that affect measured standard of living. The standard of living approach has advantages over direct attempts to measure the cost of disability. It does not require estimates to be made of the sources or levels of specific costs associated with disability, which may require expert knowledge and the exercise of judgement on the part of respondents. Moreover, it is suited to estimation using large-scale micro datasets collected for wider purposes, so it is unlikely to be vulnerable to strategic response behaviour among those surveyed.

The method is essentially a "top-down" approach that aims to provide estimates of the economic cost of disability at a household level. While it does not specifically identify the items that contribute to these additional costs, depending upon available data it can account for variations in the level of costs across disabilities and conditions, as well as by severity. It does however ignore foregone earnings and other potential opportunity costs of ill health or disability.

The SoL approach to estimating the cost of disability is closely related to methods employed in assessments of material (or 'life-style') deprivation. Following Townsend (1979), considerable empirical research has been undertaken to identify 'deprived' individuals or households that are excluded from a specified minimum way of life or standard of living because of their lack of resources – for a survey see Perry (2002). Recent contributions to this literature treat deprivation as a latent variable and estimate it using methods that integrate traditional income-based measures with newer outcome-based indicators of social and economic exclusion - see for example Whelan *et al.* (2006). Outcome-based indicators have been particularly influential in Ireland, forming the basis of the 'consistent poverty' measure used in the National Anti-Poverty Strategy.

The outcome-based indicators used in these analyses of deprivation are very similar to the standard of living indicators employed in the remainder of this paper. The main difference is that the deprivation indicators tend to focus on consumption items associated with a minimum adequate standard of living, whereas we wish to examine the effects of disability status over as wide a range of socio-economic outcomes as possible. Nevertheless, because these studies employ standard of living indicators, and we have earlier suggested that disability should reduce measured standard of living *ceteris paribus*, we should expect them to find a positive association between disability and deprivation. This is indeed the case. For example, Whelan and Maître (2006) report a highly significant positive relationship between an illness/disability indicator and membership of the 'maximally deprived' group identified in their analysis.

The SoL approach is illustrated in Figure 1 using a simplified model based on Zaidi and Burchardt (2005). For a given level of income Y_0, a household containing a person with a disability is predicted to have a standard of living of S_0^D. The corresponding standard of living for a comparable household without a person with a disability is higher at S_0^{ND}. Graphically the 'line' representing the relationship between standard of living and income for so-called 'disabled households' lies below and to the right of the line for 'non-disabled households'. The implication is that the disabled household could enjoy the same standard of living as the non-disabled household, but would require a higher income to do so. In Figure 1 for example, an income level of Y_1 gives the disabled household the same standard of living as the non-disabled household achieves at Y_0 i.e. $S_1^D = S_0^{ND}$.

In the simple (deterministic) model represented in Figure 1, the standard of living of a household is expressed only as a function its income and disability status. (We subsequently introduce other control variables as well as a stochastic element in the econometric estimations). For the linear case in Figure 1 we can relate standard of living to income and disability status as:

$$S = \alpha + \beta Y + \delta D \qquad [1]$$

where Y represents disposable household income, D is an indicator variable defining the disability status of the household and α, β and δ are the equation parameters. Thus in this simple case the additional cost of disability for a given standard of living is estimated as $\frac{dY}{dD} = -\frac{\delta}{\beta}$, or as $Y_1 - Y_0$ in the terms in Figure 1.

The relationship between SoL and income may of course be non-linear and the most appropriate functional form can be tested for empirically. Furthermore, we can also test for potential convergence or divergence in living standards with respect to income i.e. whether the *D* and *ND* lines in Figure 1 get closer together or move apart, as income rises. This determines, in part, the relationship between the cost of disability and income, a matter that has important policy implications. We return to both issues in the Section 5.

4. Data and Variables

The data we use is from the Living in Ireland (LII) surveys 1995-2001[2]. The LII surveys represented the Irish component of the European Community Household Panel, now replaced by EU-SILC. The sample is representative of private households in Ireland and administered as a face-to-face interview. This longitudinal survey provides information on the social situation, financial circumstances and living standards of a panel of households. Within the sample there is considerable attrition over the period, with 7,254 individuals responding in 1995 and only 3,670 of these still present by 2000[3]. The sample was thus boosted in the year 2000, with 1,500 additional households.

The dependent variable in the model is a proxy for each respondent household's unobservable standard of living. Following Berthoud *et al.* (1993) and Zaidi and Burchardt (2005), composite indicators of SoL comprising a set of individual indicators (e.g. does a household own a dishwasher) were considered. There are two desirable characteristics for the individual indicators that comprise the composite indicator and thus, by association, for the composite indicator. First of all, the

individual indicators should be elastic with respect to income and, secondly, they should not be systematically related to disability status. Interested readers should consult Zaidi and Burchardt (2005) for a more complete discussion of the SoL variable.

The first desirable property is easily tested for empirically by undertaking, for example, a logit regression across households of each individual indicator on income and considering the estimated relationship. Indicators found to be significantly related to income (in an economic and statistical sense) are deemed suitable for inclusion in the composite indicator, provided they fulfil the second desirable property. This second property is also worth considering however. According to Zaidi and Burchardt (2005), "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'". Therefore we would like to know that preferences for each of our individual indicators are not systematically related to disability status. Zaidi and Burchardt (2005) - nor the other studies that have utilised the SoL approach - do not test this second property empirically. Zaidi and Burchardt (2005) reference Ford (1997) and state that "composite indicators, based on a range of different items, may help, since even if there is a systematic relationship between need and preference on one item for a particular sub-group, the relationship is unlikely to be replicated across different items." Unfortunately, given our data, it is not possible to test for this impact empirically.

Based on tests of the first desirable property of the individual indicators[4], and following previous studies, we use a composite SoL indicator derived as a function of

household ownership of a number of 'goods' as well as whether the household took a holiday last year. The household goods considered are a microwave, a television, a car, a video, a freezer, a dishwasher and central heating. For each good a household in the LII survey is given a score of 1 if it owns the good (or if it took a holiday in the last year in the case of that variable). These scores are then totalled for each household. A composite indicator of SoL is then constructed by scaling the total score. It takes a value of 1 if a household scores a total of 0, 1 or 2, a value of 2 if it scores 3 or 4, a value of 3 if the household scores 5, and so on until a maximum value of 6 where a household scores 8 'positive' responses. This scaling process was chosen in order to provide reasonably similar proportions in each of the composite indicator classes. We tested the robustness of the model estimates to changes in this method for creating the composite indicator and found it had little effect on the overall estimates and our key findings and conclusions. We also considered different subsets of indicators and again found little impact on the estimates of interest. It should be noted however that implicitly the approach gives equal weight to each item within the composite indicator and thus to the standard of living measure, which is a possible weakness in the method.

As a further check on the robustness of our results we also considered a second composite measure derived using two measures of a household's financial 'well-being'. Specifically we an alternative composite indicator using separate indicators for whether a household reported having any savings and for whether it could meet its financial needs. Using this alternative measure of standard of living was not found to significantly change the key findings of our analysis.

Once measured, standard of living is modelled as a function of a number of explanatory variables, with the main focus on the disability status of the household. The definition of disability status used in this paper thus warrants some discussion. As stated there is an ongoing shift in focus about the definition of disability from the older *medical model* towards a *social model* (World Health Organisation, 1999), and there is an increased endeavour for greater integration of disabled people into society. The traditional medical form perceived individuals with disabilities as having an impairment that did not allow them to partake in mainstream social activities. The 1980 International Classification of Impairment, Disability and Handicap (ICIDH-1) proposed by the World Health Organisation (WHO) is a prime example of disability defined in medical terms. On the other hand, the social theory of disability stresses the discriminatory barriers in society. Disability is therefore an outcome of social attitudes and structures, and the interaction between the person and environmental factors. This was the approach adopted in 1999 by the WHO in the 1999 ICIDH-2 classification. In 2001, the 'International Classification of Functioning, Disability and Health' was approved by the WHO – this highlighted the interaction between the individual and the environment. This paper adopts the social model of disability, and a measure of disability is constructed from the LII survey on the basis of responses to the following question:

> "*Do you have any chronic physical or mental health problem, illness or disability*?"[5]

It may well be however that it is not only the presence of a disability that is important in determining costs, but also the extent to which it limits or restricts a person in their day-to-day lives. The LII surveys allows us to distinguish individuals in terms of

those with either severe, some or no limitations in daily activities. Previous research (Gannon and Nolan, 2007) has exploited the differences in severity of limitations and found significant differences in terms of social inclusion. In the LII survey, respondents are asked:

> "*Are you hampered in your daily activities by this physical or mental health problem, illness or disability?*"

to which they could respond (1) yes, severely, (2) yes, some extent, or (3) no. This data allows us to directly estimate the cost of disability in Ireland by severity of disability for the first time.

For the income variable we include net disposable household income, which is calculated by aggregating net individual income within the household. Net individual income is measured by summing net earnings, social welfare payments and child benefit receipts. We also include a number of other explanatory variables in modelling household standard of living. These include variables relating to household size, the tenure status of the household, the location and region of the household, if there are children in the household as well as the age, gender and marital status of the head of household. The final sample used in our estimations is 17,621 observations over the seven pooled years. For 2001, the latest year for which the data is available, our sample size for estimation is 2,587 households.

5. Estimation and Results

Model

Our model for estimation is:

$$S_i = f\ (Y_i, D_i, \mathbf{X}_i^H, \mathbf{X}_i^{HoH}, \varepsilon_i) \qquad [2]$$

where S_i denotes the standard of living of household *i*, Y_i represents the disposable income of household *i* and D_i is an indicator variable defining the disability status of household *i*. $\mathbf{X}_i^H$ is a vector of household-level characteristics while $\mathbf{X}_i^{HoH}$ is a vector of characteristics relating to the head of the household. The error term is represented by ε_i and the model is estimated at the household level. Our preferred modelling approach is the ordered logit model, which is consistent with previous studies that have utilised the SoL approach. The ordered logit model is based on an underlying latent variable S^* such that:

$$S_i^* = \alpha + \beta Y_i + \delta D_i + \gamma_1 X_i^H + \gamma_2 X_i^{HoH} + \varepsilon_i \qquad [3]$$

with

$$\begin{aligned} S_i &= 1 \quad if \quad S_i^* < \tau_1 \\ S_i &= 2 \quad if \quad \tau_1 \le S_i^* < \tau_2 \\ &\ldots \\ S_i &= J \quad if \quad S_i^* \ge \tau_{J-1} \end{aligned}$$

and τ_j are the cut-points or thresholds in the distribution of S^* (Wooldridge, 2002).

Estimation

Table 1 presents a number of different versions of equation [3] estimated on the pooled data set where different specifications of income and disability status are considered[6]. Model (1) considers SoL as a linear function of income, while Model (2) includes income-squared, effectively testing for diminishing marginal returns of income to SoL. A comparison of (1) and (2) confirm this to be the case. Model (3) interacts income with disability status to investigate if the effect of disability on SoL might vary with income, but this estimated effect is small and not statistically different from zero. In Model (4) disability status is interacted with income and

income-squared and these variables are found to be statistically significant, implying a more complex relationship between SoL, disability and income. There is little to choose between Models (2), (3) and (4) based on a comparison of the Akaike Information Criterion (AIC) statistics and log-likelihood values reported in Table 1, although (4) does give a slightly better fit.

Model (5) considers a specification based on log-income, which again implicitly models diminishing marginal returns. This implies that as income rises, SoL increases but at a decreasing rate. Model (5) is found to fit the data better than Models (1) to (4) on the basis of the measures of goodness-of-fit mentioned. Model (6) interacts disability status with log-income, testing for convergence in living standards between disabled and non-disabled households as income rises. The *p*-value on the interaction term is estimated at 0.106. Thus while not significantly different from zero in a statistical sense, there is some (limited) evidence of convergence in this model. Table 1 also reports a specification using the square-root of income – Model (7) – and one where disability status is interacted with the square-root of income – Model (8). While these models appear to give a better fit than Models (1) to (4), a specification based on log income is preferable to one based on the square root of income. Thus, based on a comparison of the AIC statistics and log-likelihood values reported in Table 1, our preferred equation using the pooled data is Model (5), which models SoL as a function of log income and other explanatory variables but does not include any interaction terms with disability status. Model (6), which is almost the same as (5) in terms of fit, is not preferred as the interaction term is not statistically different from zero at a 10% level of significance and including this

in our model has strong implications for the estimated relationship between the cost of disability and income i.e. it implies convergence in living standards as income rises.

The coefficient on disability status in our preferred model is estimated to be statistically significant from zero at $\hat{\delta}$ = -0.31. SoL is found to be increasing in log income ($\hat{\beta}_{LnY}$ = 1.39) as anticipated. A range of other variables are also found to be correlated with the standard of living measure in the favoured pooled model, including household size, tenure status of the household, the region and location of the household, whether there are children in the household, the age of the head of household, the marital status of the household as well as the year of the survey.

To further test the robustness of our assumed functional form we also estimated the same models presented in Table 1 for data from each of the separate years of the LII survey. Estimation results from 2001, the most recent year of the survey, are presented in Table 2 and confirm the general findings in Table 1. Overall Model (5), based on a log-income specification, is preferred. Model (6) which interacts log-income with disability status also provides a good fit, though the interaction term is again not statistically different from zero with a *p*-value of 0.373. This general pattern was found for each of the years for which we estimated the different specifications. Thus our preferred specification is one based on log-income, without an interaction term with disability status.

Results

Given our preferred specification we also estimate Equation [3] separately for each year and the results are presented in Table 3. In each year the disability status

variable is found to be negative and statistically different from zero. The estimated coefficient varies over time and ranges from -0.25 (in 1997) to -0.38 (in 2001), though the differences are not statistically significant. (We tested for time variation in the disability coefficient by adding time-disability interaction terms to the pooled model). The estimates in Table 3 allow us to estimate the cost of disability as a percentage of income ($\hat{COD}$) for each year by dividing the estimated coefficient on disability status by the estimated coefficient on log-income i.e. $\hat{COD} = -\frac{\hat{\delta}}{\hat{\beta}_{LnY}}$. These estimates are set out in Table 4.

Starting with the estimated cost of disability as a percentage of income, this is shown to vary from 17.6% in 1997 to 29.6% in 2001. The average cost of disability estimated over the pooled sample is equal to 22.2% of weekly disposable income, using Model (5) in Table 1. As 2001 is the latest year in our dataset, we concentrate on that year. While the estimated cost of disability is 29.6% in 2001, the 95% confidence interval is 15.0% to 48.0%. At the median weekly income for disabled households in 2001 of €437.23, the implied cost of disability is €129.42 per week on average, ranging from €65.59 to €209.87 with 95% confidence. If we estimate the cost of disability at the mean income level for disabled households in 2001 of €580.18, the estimated average cost of disability is €171.73 per week, or between €87.03 and €278.49 with 95% confidence.

Although there is some variation over time in our estimates in Table 4, for each year the estimated cost of disability is found to be large. And since the estimates presented represent average costs, the implication is that there will in fact be households facing

additional costs of disability even greater than these already significant weekly averages. Furthermore, as the model is estimated using disposable weekly income, these estimated costs are in addition to supports already received by disabled households. Finally, it is also worth reiterating that the estimated costs do not include any estimates or foregone earnings due to disability.

Table 5 presents our estimates of the cost of disability by severity. As discussed, the LII surveys distinguish by severity of disability on the basis of the extent to which individuals are restricted in the daily activities. Estimating separate models for each level of severity provides the estimates in Table 5. For households with a disabled individual who is not hampered in his/her daily activities, the estimated cost of disability is 8.5% of disposable income in 2001, though this is not statistically significant from zero as evidenced by the 95% confidence interval, which contains zero. For those disabled individuals who are hampered to some extent in their daily activities the estimated cost of disability is 22.7% of disposable income in 2001, below the average of 29.6% in that year. The corresponding estimate for those individuals with a disability who are severely hampered in the daily activities is considerably higher at 44.4% of disposable income. This suggests that the additional costs of disability are borne most heavily by those individuals who suffer the most from their disability in their day-to-day lives.

In terms of average costs per week these percentages translate to an estimated €55.90 per week on average for those not hampered in their daily activities, an average of €101.77 per week for those hampered to some extent, and an average of €163.78 per week for those who are severely hampered. In each case these figures are estimated at

the median income for individuals with a disability in the respective severity classes. Once again the figures are averages so that it is likely that there will be many households facing additional disability-related costs in excess of those reported in Table 5. The relationship between the estimated cost of disability and severity of disability is illustrated in Figure 2.

The magnitude and composition of extra costs are also likely to vary by the stage of the life cycle of the individual. We therefore considered separately an analysis of extra disability-related costs for households where the head is aged over 65 years ('pensioner households') and for those aged less than 65 years ('non-pensioner households'). Results are presented in Table 6.

The cost of disability is estimated to be less for pensioner households, though still significant at 24.8% of disposable income, than for non-pensioner households, where the average is estimated at 38.1% of disposable income. Because pensioner households have considerably lower incomes on average, these estimates translate into much lower cost of disability estimates per week for the respective households (€71.37 versus €228.07). This is most likely a result of a number of factors including medical card availability as well as the differences in average incomes. The estimate for pensioner households is however likely to mask significant variation across pensioner household types if the results of Zaidi and Burchardt (2005) also hold for Ireland. This will be considered in future work.

6. Concluding Remarks

This paper applies the standard of living approach for estimating the cost of disability to Ireland and finds it to be significant and to vary by severity of disability and across household type. The modelling approach followed allows us to derive estimates of the additional costs faced by households with an individual with a disability *after* disability-related payments and supports. These findings are important for considering the effectiveness of policies that aim to address the economic problems associated with disability. They suggest that such policies do not go far enough in addressing the extra costs faced by the disabled community in Ireland.

The findings also have important implications for measurements of poverty in Ireland. Zaidi and Burchardt (2005) who undertook a similar analysis for the UK found that "taking the extra costs of disability into account 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." The implication is that if disability reduces the standard of living of households for a given level of income, poverty measures based on income will underestimate the problem. In common with Zaidi and Burchardt (2005), we therefore suggest that the evidence presented here supports the case for the introduction of disability–adjusted poverty and inequality estimates and equivalence scales.

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Tables

Table 1: Pooled Model Estimates

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disability	-0.3148	-0.3034	-0.3471	-0.6339	-0.3086	-0.7077	-0.3008	-0.4839
	(9.94)**	(9.57)**	(6.43)**	(9.16)**	(9.73)**	(2.84)**	(9.49)**	(5.14)**
Income	0.0031	0.0042	0.0042	0.0041				
	(41.81)**	(39.31)**	(36.44)**	(37.13)**				
IncomeSquared		-7.8E-07	-7.8E-07	-7.1E-07				
		(16.11)**	(15.78)**	(16.42)**				
Disability*Income			0.0001	0.0015				
			-1	(6.22)**				
Disability* IncomeSquared				-1.1E-06				
				(6.53)**				
LnIncome					1.3906	1.3704		
					(48.60)**	(43.99)**		
Disability* LnIncome						0.0701		
						-1.62		
Sqrt(Income)							0.1463	0.1435
							(47.34)**	(42.65)**
Disability* Sqrt(Income)								0.0101
								(2.07)*
Household Size	Y	Y	Y	Y	Y	Y	Y	Y
Tenure	Y	Y	Y	Y	Y	Y	Y	Y
Region Dummies	Y	Y	Y	Y	Y	Y	Y	Y
Location Dummies	Y	Y	Y	Y	Y	Y	Y	Y
Children	Y	Y	Y	Y	Y	Y	Y	Y
Age of HoH	Y	Y	Y	Y	Y	Y	Y	Y
Sex of HoH	Y	Y	N	N	N	N	N	N
Marital Status Dummies	Y	Y	Y	Y	Y	Y	Y	Y
Time Dummies	Y	Y	Y	Y	Y	Y	Y	Y
$\hat{\tau}_1$	-3.9229	-3.6726	-3.6902	-3.7275	2.9119	2.7879	-2.3935	-2.4546
	(34.22)**	(31.68)**	(31.47)**	(31.80)**	(15.23)**	(13.55)**	(19.54)**	(19.48)**
$\hat{\tau}_2$	-2.2483	-1.9818	-1.9986	-2.0280	4.6876	4.5652	-0.6733	-0.7324
	(20.28)**	(17.63)**	(17.58)**	(17.87)**	(24.39)**	(22.12)**	(5.62)**	(5.95)**
$\hat{\tau}_3$	-1.3670	-1.0898	-1.1063	-1.1327	5.6051	5.4832	0.2301	0.1716
	(12.45)**	(9.78)**	(9.82)**	(10.07)**	(28.98)**	(26.44)**	-1.93	-1.4
$\hat{\tau}_4$	-0.2975	-0.0087	-0.0253	-0.0499	6.6922	6.5703	1.3179	1.2595
	(2.72)**	-0.08	-0.22	-0.44	(34.26)**	(31.41)**	(11.00)**	(10.23)**
$\hat{\tau}_5$	1.0363	1.3328	1.3158	1.2900	8.0103	7.8876	2.6581	2.5986
	(9.39)**	(11.87)**	(11.58)**	(11.38)**	(40.47)**	(37.24)**	(21.85)**	(20.80)**
Akaike Information Criterion	2.898	2.886	2.886	2.883	2.870	2.870	2.874	2.874
McFadden's Adjusted R^2	0.181	0.185	0.185	0.185	0.189	0.189	0.180	0.188
Log Likelihood	-25502.12	-25386.81	-25386.31	-25363.36	-25226.76	-25225.45	-25287.55	-25285.41
Observations	17,621	17,621	17,621	17,621	17,621	17,621	17,621	17,621

Note: Absolute value of z statistics in parentheses. * significant at 5%; ** significant at 1%.

Table 2: Model Estimates for 2001

Variable	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Disability	-0.4061	-0.3881	-0.4618	-0.6783	-0.3791	-0.9539	-0.3841	-0.6519
	(4.83)**	(4.62)**	(3.27)**	(3.86)**	(4.51)**	-1.47	(4.57)**	(2.69)**
Income	0.0025	0.0035	0.0034	0.0034				
	(15.06)**	(15.19)**	(13.93)**	(13.61)**				
IncomeSquared		-5.9E-07	-5.9E-07	-5.5E-07				
		(8.21)**	(7.96)**	(7.16)**				
Disability*Income			0.0002	0.0010				
			-0.65	(2.05)*				
Disability* IncomeSquared				-5.5E-07				
				-1.87				
LnIncome					1.2817	1.2508		
					(16.80)**	(14.96)**		
Disability* LnIncome						0.0974		
						-0.89		
Sqrt(Income)							0.1263	0.1225
							(16.78)**	(15.02)**
Disability* Sqrt(Income)								0.0133
								-1.18
Household Size	Y	Y	Y	Y	Y	Y	Y	Y
Tenure	Y	Y	Y	Y	Y	Y	Y	Y
Region Dummies	Y	Y	Y	Y	Y	Y	Y	Y
Location Dummies	N	N	N	N	N	N	N	N
Children	N	N	N	N	N	N	N	N
Age of HoH	Y	Y	Y	Y	Y	Y	Y	Y
Sex of HoH	N	N	N	N	N	N	N	N
Marital Status Dummies	Y	Y	Y	Y	Y	Y	Y	Y
$\hat{\tau}_1$	-5.7483	-5.4571	-5.4938	-5.5201	0.7641	0.5605	-4.2838	-4.3851
	(17.10)**	(16.10)**	(15.98)**	(16.04)**	-1.41	-0.95	(12.05)**	(11.98)**
$\hat{\tau}_2$	-3.8692	-3.5624	-3.5974	-3.6174	2.7463	2.5463	-2.3623	-2.4593
	(12.13)**	(11.05)**	(11.00)**	(11.06)**	(5.08)**	(4.36)**	(6.92)**	(7.01)**
$\hat{\tau}_3$	-2.9002	-2.5812	-2.6153	-2.6317	3.7614	3.5628	-1.3696	-1.4645
	(9.25)**	(8.13)**	(8.13)**	(8.18)**	(6.93)**	(6.08)**	(4.06)**	(4.22)**
$\hat{\tau}_4$	-1.8867	-1.5559	-1.5895	-1.6036	4.7958	4.5977	-0.3369	-0.4309
	(6.08)**	(4.94)**	(4.98)**	(5.03)**	(8.78)**	(7.81)**	-1	-1.25
$\hat{\tau}_5$	-0.5584	-0.2198	-0.2538	-0.2686	6.1156	5.9167	0.9982	0.9033
	-1.8	-0.7	-0.8	-0.84	(11.09)**	(9.97)**	(2.95)**	(2.60)**
Akaike Information Criterion	2.728	2.718	2.718	2.717	2.710	2.710	2.710	2.710
McFadden's Adjusted R^2	0.183	0.186	0.186	0.187	0.189	0.189	0.189	0.189
Log Likelihood	-3499.66	-3485.20	-3484.99	-3482.62	-3469.27	-3468.88	-3476.21	-3475.51
Observations	2,587	2,587	2,587	2,587	2,587	2,587	2,587	2,587

Note: Absolute value of z statistics in parentheses. * significant at 5%; ** significant at 1%.

Table 3: Model Estimates 1995 to 2001 – Log Income Specification

Variable	(1995)	(1996)	(1997)	(1998)	(1999)	(2000)	(2001)
Disability	-0.3323	-0.2918	-0.2473	-0.3049	-0.2545	-0.34479	-0.3791
	(4.43)**	(3.62)**	(3.02)**	(3.63)**	(2.77)**	(4.60)**	(4.51)**
LnIncome	1.3841	1.5035	1.4090	1.4674	1.3308	1.384469	1.2817
	(21.09)**	(20.91)**	(18.75)**	(18.55)**	(16.27)**	(20.89)**	(16.80)**
Household Size	Y	Y	Y	Y	Y	Y	Y
Tenure	Y	Y	Y	Y	Y	Y	Y
Region Dummies	Y	Y	Y	Y	Y	Y	Y
Location Dummies	Y	Y	N	N	N	N	N
Children	Y	Y	Y	Y	N	N	N
Age of HoH	Y	Y	Y	Y	Y	Y	Y
Sex of HoH	N	N	N	N	N	N	N
Marital Status Dummies	Y	Y	Y	Y	Y	Y	Y
$\hat{\tau}_1$	2.8429	3.2905	2.9663	2.9062	2.0439	1.2391	0.7641
	(6.55)**	(6.99)**	(5.89)**	(5.51)**	(3.68)**	(2.69)**	-1.41
$\hat{\tau}_2$	4.6569	5.0088	4.7342	4.6976	3.8061	2.9514	2.7463
	(10.65)**	(10.56)**	(9.33)**	(8.86)**	(6.84)**	(6.42)**	(5.08)**
$\hat{\tau}_3$	5.5518	5.9456	5.6557	5.5872	4.6687	3.9155	3.7614
	(12.61)**	(12.45)**	(11.08)**	(10.47)**	(8.35)**	(8.48)**	(6.93)**
$\hat{\tau}_4$	6.6279	7.0144	6.7757	6.7169	5.8142	4.9772	4.7958
	(14.91)**	(14.54)**	(13.14)**	(12.48)**	(10.31)**	(10.70)**	(8.78)**
$\hat{\tau}_5$	7.9232	8.3635	8.0701	8.0105	7.1153	6.3105	6.1156
	(17.58)**	(17.08)**	(15.45)**	(14.71)**	(12.48)**	(13.44)**	(11.09)**
Akaike Information Criterion	2.939	2.929	2.964	2.918	2.854	2.823	2.710
McFadden's Adjusted R^2	0.175	0.180	0.167	0.173	0.179	0.177	0.189
Log Likelihood	-4713.49	-4156.48	-3794.14	-3539.74	-3000.11	-4477.22	-3469.27
Observations	3,227	2,858	2,580	2,446	2,123	3,187	2,587

Note: Absolute value of z statistics in parentheses. * significant at 5%; ** significant at 1%.

Table 4: Cost of Disability Estimates 1995 to 2001

	1995	1996	1997	1998	1999	2000	2001
Estimated cost of disability as a % of income	24.0%	19.4%	17.6%	20.8%	19.1%	26.5%	29.6%
95% confidence interval for estimated cost of disability as a % of income	12.3% - 38.2%	8.1% - 33.0%	5.6% - 32.3%	8.7% - 35.8%	5.0% - 37.1%	13.1% - 39.2%	15.0% - 48.0%
Number of disabled households	996	856	844	775	654	981	814
Median weekly income for disabled households (€)	313.22	313.61	343.65	365.08	385.30	404.16	437.23
Estimated cost of disability per week at median income level for disabled households (€)	75.17	60.84	60.48	75.94	73.59	107.10	129.42
95% confidence interval for cost of disability per week at median income level (€)	38.53 - 119.65	25.40 - 103.49	19.24 - 111.00	31.76 - 130.70	19.27 - 142.95	52.94 - 158.43	65.59 - 209.87
Mean weekly income for disabled households (€)	402.35	384.72	422.11	462.73	477.98	527.97	580.18
Estimated cost of disability per week at mean income level for disabled households (€)	96.57	74.64	74.29	96.25	91.29	139.91	171.73
95% confidence interval for cost of disability per week at mean income level (€)	49.49 - 153.70	31.16 - 126.96	23.64 - 136.34	40.26 - 165.66	23.90 - 177.33	69.16 - 206.96	87.03 - 278.49

Table 5: Cost of Disability Estimates by Severity in 2001

	Disabled though **not hampered** in daily activities	Disabled and **hampered to some extent** in daily activities	Disabled and **severely hampered** in daily activities	All Households
Estimated cost of disability as a % of income	8.5%[NS]	22.7%	44.4%	29.6%
95% confidence interval for estimated cost of disability as a % of income	(12.1%) - 36.0%	5.7% - 45.0%	17.5% - 80.7%	15.0% - 48.0%
Number of disabled households	229	499	186	814
Median weekly income for disabled households (€)	657.70	448.33	368.87	437.23
Estimated cost of disability per week at median income level for disabled households (€)	55.90	101.77	163.78	129.42
95% confidence interval for cost of disability per week at median income level (€)	(79.58) - 236.77	25.55 - 201.75	64.55 - 297.68	65.59 - 209.87
Mean weekly income for disabled households (€)	784.74	582.62	562.96	580.18
Estimated cost of disability per week at mean income level for disabled households (€)	66.70	132.25	249.96	171.73
95% confidence interval for cost of disability per week at mean income level (€)	(94.95) - 282.51	33.21 - 262.18	98.52 - 454.31	87.03 - 278.49

Table 6: Cost of Disability Estimates for Pensioner and Non-Pensioner Households in 2001

	Pensioner Households	Non-Pensioner Households	All Households
Estimated cost of disability as a % of income	24.8%	38.1%	29.6%
95% confidence interval for estimated cost of disability as a % of income	5.1% - 54.8%	17.6% - 66.0%	15.0% - 48.0%
Number of disabled households	364	450	814
Median weekly income for disabled households (€)	287.80	598.62	437.23
Estimated cost of disability per week at median income level for disabled households (€)	71.37	228.07	129.42
95% confidence interval for cost of disability per week at median income level (€)	14.68 - 157.71	105.36 - 395.09	65.59 - 209.87
Mean weekly income for disabled households (€)	409.10	718.57	580.18
Estimated cost of disability per week at mean income level for disabled households (€)	101.46	273.78	171.73
95% confidence interval for cost of disability per week at mean income level (€)	20.86 - 224.19	126.47 - 474.26	87.03 - 278.49

Figures

Figure 1: The Standard of Living Approach

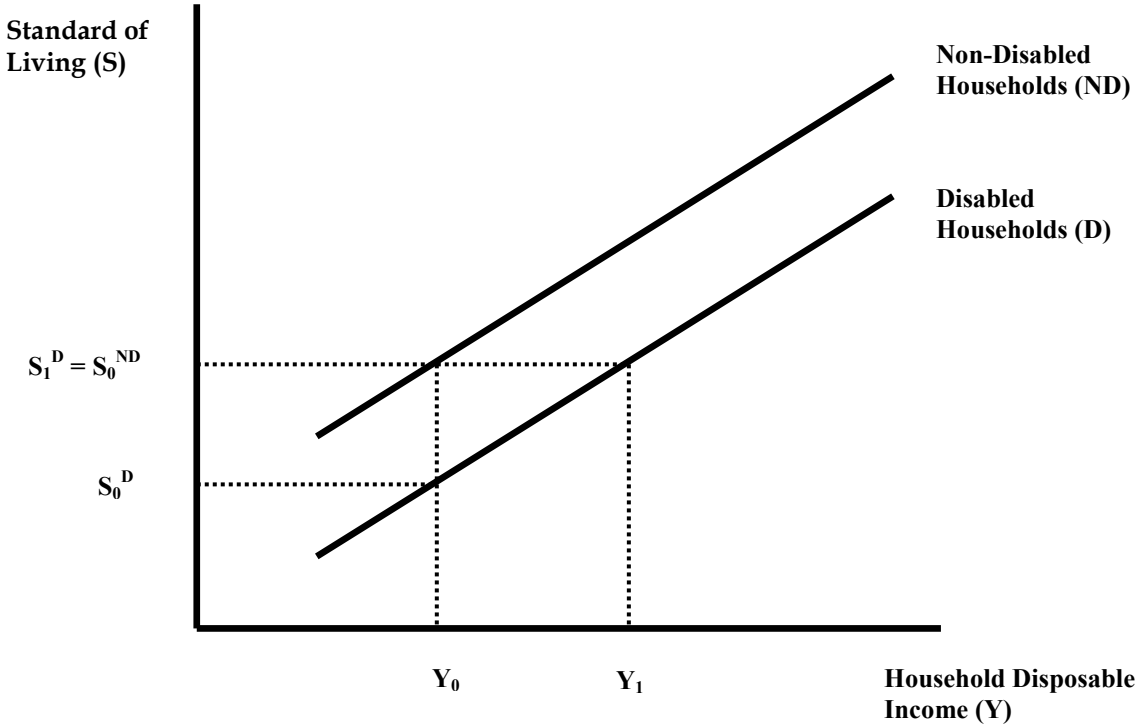
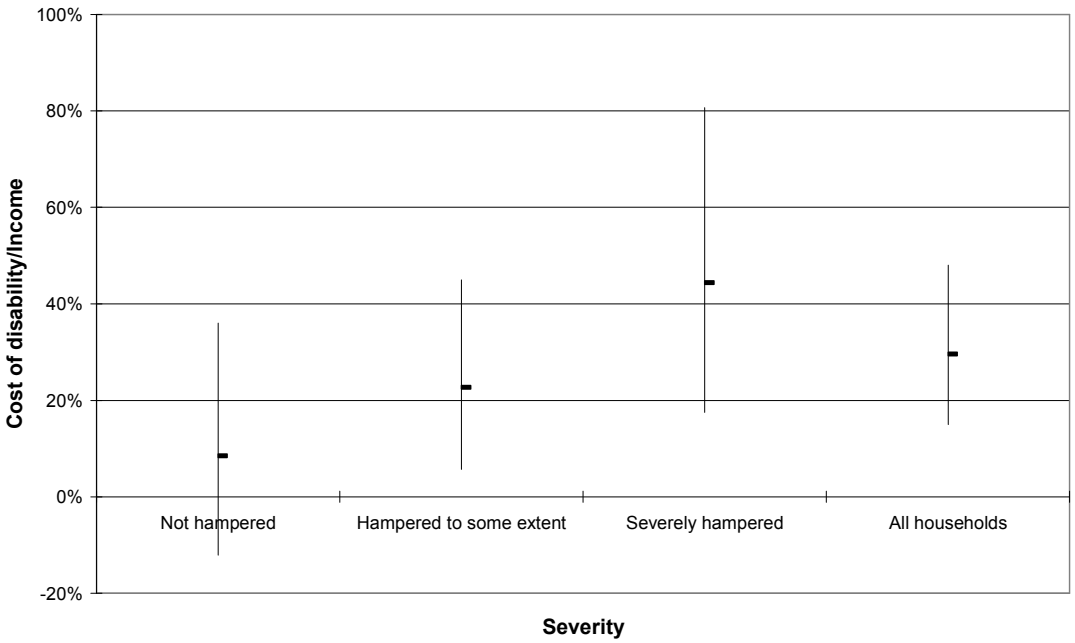


Figure 2: Estimated Cost of Disability as a Share of Income, By Severity (2001)



[1] A fourth potential category is the "budget standards approach" – see Tibble (2005) for a discussion.
[2] The question posed about illness or disability in the initial 1994 LII survey is different to the one used in subsequent years and therefore we do not use data for 1994 in our estimations.
[3] Non random attrition and its impact were tested for in Gannon (2005) and found not to bias estimates of disability in a labour force participation model.
[4] Details of these tests can be provided by the authors on request.
[5] Interviewers are instructed to ask for a disability or a long term health condition that is expected to last at least six months – this avoids inclusion of short-term illness such as flu in the data.
[6] We considered alternative specifications where other explanatory variables were interacted with disability status but these models were not found to significantly improve the explanatory power of the model.