The Influence of Economic Incentives on Reported Disability Status

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Summary

Self-reported disability status is often relied upon in labour force participation models, but this may be reported with error for economic or psychological reasons and can lead to a bias in the effect of disability on participation. In this paper, we explore the possibility that reported limitations in daily activities are misreported, in particular for those who define their labour force status as disabled, and assess if financial incentives influence this group to mis-report. The main questions we wish to address are (1) was there state dependent reporting error and did financial incentives play a role, and (2) did this change over the years 1995 to 2001? Using a generalised ordered logit model, we find preliminary results indicating that the disabled group did over-report and the difference between actual and predicted probabilities fluctuated between 1995 and 2001. We discuss two particular institutional changes in Ireland that help to explain how economic incentives influenced reporting behaviour.

Keywords Reported disability; economic incentives; generalised ordered logit model

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1. Introduction

Several authors have found a negative relationship between disability and labour force participation, e.g. Bound (1991), Kreider (1999) and Lindeboom and Kerkhofs (2002). However, self-reported disability status is very often what we have to rely on in studying the impact of disability on labour force participation. The fact that some individuals may be prone to mis-reporting their disability or health status is also well documented (see e.g. Bound 1991). It may be subject to serious measurement error that could bias the estimated effects of disability and other variables. Bound (1991) and Lindeboom and Kerkhofs (2002) set out the main types of measurement error involved in estimating the effect of disability on labour force participation. Firstly, there may be problems with the measurement of the disability variable and lack of comparability across individuals may lead to underestimates of the effect of disability (via classical measurement error). Secondly, economic or psychological incentives may affect an individual's response to questions on disability, leading to differential measurement error within the self-reported measure of disability in the participation model. Kreider (1999), Bound et al. (1999) and Lindeboom and Kerkhofs (2002), have all established that reporting errors lead to a bias in the effect of disability in a labour force participation model. Kerkhofs and Lindeboom (1995) show that self-assessed health reporting varies by labour force status and financial incentives, with the disabled group more likely to mis-report. In this paper, we explore the possibility that reported limitations in daily activities are misreported, in particular for those who define their labour force status as disabled and assess if financial incentives influence this group to mis-report.

The main questions we wish to address are (1) was there state dependent reporting error and did financial incentives play a role, and (2) did this change over the years 1995 to 2001? In answering these questions we need to account for endogeneity arising from unobservables and differential reporting, so we follow a model of health reporting proposed by Kerkhofs and Lindeboom (1995). This involves conditioning on an objective measure and other explanatory variables, so that labour force status does not have any additional effect on the latent true disability variable. Using this model, we remove any observed factors of reporting differences by comparing subjective and objective measures of disability and then determine if any differences

remain across labour market states. If so, we have evidence of state dependent reporting errors. If there are changes in reporting behaviour over time, we will expect to find changes in the state dependent reporting errors.

Lindeboom and Kerkofs (1995), using data for the Netherlands, propose this model to assess the extent of state dependent reporting error in subjective health - they propose a model that accounts for systematic misreporting. In this model, we can separate the difference between true health and reporting bias across labour market states. In terms of financial incentives to mis-report, they assume that the labour market state sufficiently describes the income relative to previous earnings, so do not include replacement ratios or wages (but they state that this could be included in the set of additional exogenous variables used to describe reported health). The social welfare system is different in Ireland – there are less specific areas of labour force status. In the Netherlands, individuals are either at work, disabled (receiving DI), unemployed (receiving UI) or retired early (on ER scheme). In Ireland the system is more complicated so in order to identify financial incentives on reporting behaviour, replacement ratios could be included in the reporting model. From this we will determine if there are financial incentives to mis-report. We then look at the extent of reporting bias in each year and see if there are any evident changes over the years 1995 to 2000. In our discussion we put forward some reasons for any potential change.

In summary, the aim of this paper is to establish if there are reporting errors, did any bias change over time, and did financial incentives matter? This is achieved by comparing subjective health and objective health and any remaining differences are evidence of systematic reporting bias (Kerkhofs and Lindeboom, 1995). The contribution of this paper is that we are exploring reporting bias in work related health/disability as opposed to subjective self-assessed general health previously researched (with the exception of Lindeboom and Kerkhofs (2002)). The results will indicate if financial incentives in Ireland influence any mis-reporting in disability status and to date this research has not been done. The estimation methods are different to previous research, where we use generalised ordered logit models rather than generalised ordered probit models. The generalised ordered logit models are

straightforward to estimate in Stata whereas previous research relied on programming the generalised ordered probit models within Stata or Gauss.

In Section 2 we outline the context for this paper, describe the social welfare system in Ireland and data employed in the estimation. In section 3 we set out the model and estimation procedures. This is followed in section 4 with a description of the data and variables. Section 5 provides results and discussion. Section 6 concludes the paper.

2. Irish System and Data

Labour force participation changed dramatically in Ireland during the 1990s. The numbers in employment increased dramatically, and by 2001 there was almost full employment leaving an unemployment rate of 3.6%. For those who were still out of work, the eligibility rules for receiving unemployment assistance became more stringent whereby unemployed persons must have proved they were actively seeking work to ensure continued receipt of unemployment assistance. The replacement rate—the ratio of unemployment benefits to after-tax wage income—was reduced from a high of 77 percent to 64 percent in 1994, a level below the OECD average. The Irish welfare system traditionally provided "more or less permanent support for the unemployed" with no maximum duration for unemployment assistance. In recent years, however, recipients in some age groups have been required to register in a public employment or training program if they wish to continue to receive benefits after their first six months on the rolls (Tille and Yi, 2001).

As pointed out in the introduction, individuals that do not wish to work may seek an alternative explanation for their non-participation. Psychological and financial incentives may influence them to state that there are unable to work. Perhaps some individuals who do not want to work would have claimed they had a disability in order to (1) get disability social welfare assistance, or to (2) justify themselves for not working. In Table 1 we show that the proportion of the population receiving either Disability Allowance or Benefit increased between 1995 and 2000. This could be a reflection of improved access and information to social welfare payments for people with disabilities. On the other hand, it will be interesting to see if in fact there has been mis-reporting of disability status. In Table A1 we show how receipt of disability

payments varied by age to see if this increase is simply a reflection of people getting older. However, we show that the proportions receiving benefit fluctuate for all age groups indicating that it is not just because individuals are getting more disabilities as they get older, but that there are other reasons for the fluctuation in the proportions getting these payments.

Table 1 Recipients of Disability Payments 1995-2000

	1995	1996	1997	1998	1999	2000
Disability Allowance	32699	37054	43192	47126	50431	54303
% of population	0.9	1.0	1.2	1.3	1.3	1.4
Disability Benefit	41830	42460	43500	43766	45535	46940
% of population	1.16	1.17	1.19	1.18	1.22	1.24

Source: Statistical Information on Social Welfare Services, Department of Social, Community and Family Affairs

Similar to the case of individuals who state their labour force status as unemployed, those who are near retirement age may also be prone to exaggerating their disability status. A pre-retirement allowance is available for individuals who have been unemployed for over a year and are aged 55 and over. However, for those who wish to 'retire' at an earlier age, social assistance is less available. Individuals must prove they are unable to find work, so in this case they may be more inclined to report a disability and apply for disability benefits. The health and retirement literature has focused on this issue for the US, UK and the Netherlands, but to date there is no comparable analysis for Ireland, possibly because of data limitations.

We now show in Table 2 that there are differences in reported disability and associated limitations across labour force status categories. For those who are employed there is a high proportion reporting no restriction or disability, as expected. Although 6.6% are restricted in some way, we would not expect to see that employed workers would mis-report (Kreider, 1999) as there seems little incentive for them do so. But we will return to this again, as there may be some motivation provided by the Employment Equality Act 1998. This would mean that we couldn't rely on the assumption that workers report without error, a fundamental assumption of our model, as we will explain in Section 3. Unemployed individuals on the other hand are more likely to report a disability and we will need to disentangle whether this is true disability or mis-reporting with a view to obtaining disability allowance in the future.

This may be difficult to do - it could be that due to lack of information they are claiming unemployment assistance rather than disability allowance, or it may be that they prefer to state their labour force status as unemployed rather than disabled, to avoid any potential discrimination. The disabled group have a large proportion who say they are restricted in daily activities, as expected. About 14 per cent say that they are not restricted or have no disability. This is slightly higher than the figure presented for the Netherlands in 1993, where 11% of those aged 58-63 and in the labour force group of disabled, report no restrictions. The corresponding figures for the age groups 53-57 and 43-52 are 8 and 6 per cent respectively (Kerkhofs and Lindeboom, 1995).

Our hypothesis is that the disabled group may over-report for financial and psychological reasons, but this could also be true for the retired group. We show in Table 2 that over 30 per cent report a limitation, so given that previous literature has found mis-reporting for this group, (Lindeboom and Kerkhofs, 2002), we also hypothesise that this group over-reports their disability status.

The next group are the self-employed and we would expect that they have no incentive to mis-report – about 11% of them are restricted in some way. Finally, the other group include all those on training schemes and farmers. While these groups are not the focus of the paper, it will be interesting to comment on their disability reporting behaviour.

Table 2 Labour Force Status by Restrictions in Daily Activities, LII 1995-2001, age <65

	Severe	**Some**	**None**	**No Disability**	**N**
Employed	0.81	5.76	3.49	89.9	25873
Unemployed	1.63	9.02	2.65	86.7	1962
Disabled	*33.0*	*52.67*	*4.76*	*9.52*	*1050*
Retired	*8.83*	*23.25*	*8.57*	*59.35*	*770*
Self employed	1.67	9.13	4.72	84.47	6789
Other	1.88	9.24	4.19	84.69	5260
All	2.33	8.61	3.84	85.22	37709

The second objective of this paper is to determine if the proportion mis-reporting a disability changed in any year. If so, this provides motivation for looking at changes in reporting behaviour and why this may have occurred. In Table 3 we show some administrative figures to support our proposal that individuals may have changed their reporting behaviour over the period. First of all in 1996 the administration of Disability Allowance (*a weekly allowance paid to people with a disability who are aged 16 or over and under age 66. The disability must be expected to last for at least one year and the allowance is subject to both a medical suitability and a means test*) was transferred to another government department, so we do not have data on the numbers in receipt of this in 1995 and 1996. What we do see though is that the number of applicants deemed as unqualified or who did not attend medical examination increased over the years. This could be the result of increased surveillance on this social welfare payment. This could also suggest that individuals were claiming they had a disability in an attempt to receive disability allowance. The increasing number of cases referred for examination but then not qualifying could support this view. Secondly, for Disability Benefit (a payment made to insured people who are unable to work due to illness) the number of applicants also increased dramatically up to 1998. Higher proportions were found capable of work after 1998 also. This also suggests that individuals may have been over-reporting their disability status.

Table 3 % of unqualified and non-attendance to medical examinations

	1995	1996	1997	1998	1999	2000
Disability Allowance						
Cases referred for examination			6423	7229	8862	10285
% Unqualified			28	32	30	28
% Non-attendance			25	26	27	33
Disability Benefit						
Cases referred for examination	54226	52059	55089	63927	59224	45037
% Capable of Work	14.8	12.8	13	11.8	12.5	15.6
% Non-attendance	29	31.4	30.3	32.0	30.7	27.6

Source: Statistical Information on Social Welfare Services, Department of Social, Community and Family Affairs

3. Model and Estimation

As mentioned earlier there are two types of possible endogeneity of disability within a labour force model – (1) true disability status and work could be related through unobservables or a direct effect of labour market state on disability (2) subjective reported disability and labour market state could be correlated – i.e. there could be state depending reporting error. Kerkhofs and Lindeboom (1995) suggest an approach that assumes away the first type endogeneity – but this only applies if we are looking at a disability-reporting model only. In their later paper, (2002) they demonstrate how this endogeneity must also be controlled for in a participation model. In this paper, we are only interested in the disability-reporting model so we follow the approach of Kerkhofs and Lindeboom (1995).

We define reported disability as D^s (subjective reported disability), latent true disability as D^* and objective disability as D^0. The model is based on the assumption that conditional on the objective measure and other explanatory variables, labour force status provides no further information about true health. The conditional probability density function is assumed to be identical for all respondents, so then any effect of labour force status on self reported health is taken as reporting behaviour $pdf(D^* \mid D^0, x_1, s) \equiv pdf(D^* \mid D^0, x_1)$. This means that even though there could be endogeneity via the effect of labour market status on disability, once we condition on objective health and other exogenous variables, then this does not matter. Any effect of S on H^* is captured by the objective measure of disability and the exogenous variables x_1 so any remaining effect of S on reported disability is evidence of state dependent reporting bias. This is the key identifying assumption of the model.

Following previous research, the aim of the model is to compare subjective and objective measures of limitations and if there are any remaining differences for any particular groups we can assume this is evidence of state dependent reporting bias. This model has been previously used by Kerfhofs and Lindeboom (1995) and Lindedoom and van Doorslaer (2004) in the context of self assessed health. The question is how closely related is the objective measure to the subjective measure. If its not a close substitute, then we must look at how individual characteristics are important, [*it may be that unobserved characteristics are also important – this makes*

the process more complicated though as would need to estimate ordered logit models that account for correlated heterogeneity.]

This type of model has previously been estimated by a generalised ordered probit model (see (Kerkhofs and Lindeboom 1995, 2002 and Hernandez-Quevado et al, 2004). Instead we focus on the generalised ordered logit model – it serves the same purpose and is straightforward to estimate within Stata. We assume there is an unobservable latent disability measure D^* that is determined by objective health and exogenous variables:

$D_{it}^* = D_{it}^0 + x_{it}\beta + e_{it}$ where the error has a standard logistic distribution.

We wish first of all to determine if there are any differences across labour market states so estimate a pooled ordered logit model without the objective measure and adjust the standard errors for clustering at the individual level. The unknown cut-points (or threshold parameters) are $\alpha_1 < \alpha_2 < ... < \alpha_j$ and we define

$D_{it}^s = 0$ if $D^* \le \alpha_1$

$D_{it}^s = 1$ if $\alpha_1 < D^* \le \alpha_2$

$D_{it}^s = j$ if $D^* > \alpha_j$.

For now we assume the cut-points do not vary over time and the parameters α and β are estimated by maximum likelihood, where the log likelihood is

$$l_{it}(\alpha,\beta) = 1[D_{it}^s = 0]\log[\Lambda(\alpha_1 - x_{it}\beta)] + 1[D_{it}^s = 1]\log[\Lambda(\alpha_2 - x_{it}\beta) - \Lambda(\alpha_1 - x_{it}\beta)]$$
$$+$$
$$1[D_{it}^s = 2]\log[\Lambda(\alpha_3 - x_{it}\beta) - \Lambda(\alpha_2 - x_{it}\beta)] + 1[D_{it}^s = 3]\log[1 - \Lambda(\alpha_3 - x_{it}\beta).$$

In implementing the ordered logit model of disability limitations we do not allow for the fact that the thresholds may vary depending on the characteristics of the individuals involved. It is most likely that reporting behaviour will vary by labour force status, but could also vary by age, education or other explanatory variables. Effectively in an ordered logit model, equations are run for each of the categories, and

it is assumed that the slope for each is similar (parallel) but the intercept may be difference. We would find similar coefficients in each equation. The ordered logit model is based on the assumption of parallel slopes but this may be unrealistic, for example if reported disability varied by labour force status. We therefore estimate a pooled ordered logit model and use the brant test of the parallel regression assumption. The Brant (1990) test assesses whether or not the coefficients are the same for each group of the dependent variable (Long and Freese, 1992). This produces Wald Tests to test the hypothesis that the coefficients in each independent variable are constant across categories of the dependent variable. Significant test statistics provide evidence that this assumption has been violated. These results are useful in two respects. Firstly they indicate to us that we should perhaps be estimating a generalised logit model, and secondly they suggest to us what variables may be used in determining the thresholds.

A more appropriate model therefore is the generalised order logit model whereby thresholds vary by individual characteristics:

$$\alpha_j = \tilde{\alpha}_j + x_{it}\gamma_j$$

The log likelihood is:

$$l_{it}(\alpha,\beta) = 1[D_{it}^s = 0]\log[\Lambda(\alpha_1 - x_{it}(\beta-\gamma_1)] + 1[D_{it}^s = 1]\log[\Lambda(\alpha_2 - x_{it}(\beta-\gamma_2) - \Lambda(\alpha_1 - x_{it}(\beta-\gamma_1)] + 1[D_{it}^s = 2]\log[\Lambda(\alpha_3 - x_{it}(\beta-\gamma_3) - \Lambda(\alpha_2 - x_{it}(\beta-\gamma_2)] + 1[D_{it}^s = 3]\log[1 - \Lambda(\alpha_3 - x_{it}(\beta-\gamma_3)].$$

This model is estimated using the gologit command in Stata. If we wish to let the thresholds vary by some variables only, we can restrict the γ to equal zero, i.e. use the gologit2 model in Stata v9.0. This model will be used when we consider that along with labour force status some other variables may affect reporting behaviour and thresholds will therefore vary by these variables also.

4. Data

The data on disability and labour force participation in Ireland are from the Living in Ireland Survey 1995-2001. The Living in Ireland Survey is the Irish component of the European Community Household Panel, conducted by the ESRI for Eurostat. We wish to focus on individuals of working age, hence we exclude those aged 65 and over. A full listing of the variables used are given in Table 4.

Table 4 Variable definitions for Dependent and Independent Variables

Variable	Definition
Reported Disability	=0 if severely restricted in daily activities =1 if restricted to some extent in daily activities =2 if not restricted in daily activities =3 if no disability reported
Unemployed	=1 if labour force status is employed, =0 otherwise
Disabled	=1 if labour force status is disabled, =0 otherwise
Retired	=1 if labour force status is retired, =0 otherwise
Self employed	=1 if labour force status is retired, =0 otherwise
Other	=1 if labour force status is training, home duties, education, =0 otherwise (Base category=Employed)
Female	=1 if female, =0 otherwise
Secondary Education	=1 if highest level of education completed is secondary, =0 otherwise
Third Level Education	=1 if highest level of education completed is third level, =0 otherwise (Base category=No qualifications or highest level of education completed is primary)
Married	=1 if married or living with a partner, =0 otherwise
Age	= age in years
GP Visits	=Number of GP visits during last 12 months
Hospital Visits	=Number of Hospital Visits during last 12 months
Specialist Visits	=Number of medical specialist visits during last 12 months (includes out-patient but excludes consultation during hospitalisation)
Cut Down	=1 if cut down on normal activities due to illness or injury, or emotional or mental health problems, =0 otherwise
GHQ12	Index of psychological well-being

An ordered measure of reported disability is constructed from the Living in Ireland survey on the basis of individual responses to the following question:

"Do you have any chronic, physical or mental health problem, illness or disability?"

We use responses to a follow-up question concerning the impact of the disability to distinguish between severe, to some extent and no limitations in daily activities. We should note that employers in Ireland as in many other industrialised countries are obliged by law to make 'reasonable accommodation' for those affected by disability, by changes in the work environment or in the way a job is performed to enable a person with a disability to fully do a job and enjoy equal employment opportunities. For this reason, in the survey a person may respond as not limited in daily activities, but without adaptation it is possible that they should be classified as severely limited.

In the Living in Ireland Survey, detailed information on current labour force status was obtained. This variable is constructed from a range of questions so is most likely to be measured without error. In our analysis we categorise individuals into 6 different labour force states. We are assuming the employees report their disability without error so they are the reference group against which we compare reporting behaviour of the unemployed, disabled, retired, self employed and others. Reporting behaviour may also vary by gender, age, education status and marital status so we control for these in our analysis.

Our model implies that the objective measure used to compare to subjective reported disability should be reliable. The most appropriate measure would be physicians' reports but this is usually not available in individual surveys. Previous research has used other less objective but relevant health measures for this purpose. For example, in their assessment of self-assessed health, Lindeboom and van Doorslaer (2004) use the McMaster Health Utility Index, a generic health status index developed at McMaster University and measures both quantitative and qualitative aspects of health. This measure also relies on self-reporting but the advantage is that respondents are only required to answer to 8 health attributes and then using weights (derived from a different valuation survey and different sample) an overall health utility score on a scale of zero to one is derived. Hernandez-Quevedo et al (2004) use the SF36 questionnaire and compare it to self-assessed health. This includes 36 items that measure health across 8 dimensions of health. Kerkhofs and Lindeboom (1995) note that to find an objective measure that is correlated with work related health is a difficult task and for that reason focus on self-assessed health. However, they go on in a later paper (2002) and compare the same objective measure to work related health.

The aim of this paper is to focus on limitations in daily activities so we will need to find suitable objective measures for comparison purposes in our model. In the Living in Ireland data there is no complete objective disability measure suitable for the purposes of this model. We therefore use various proxies of disability status. In Table 5 we set out our objective measures of disability/health status and summary statistics across all labour force states. Kerkhofs and Lindeboom (1995) suggest using GP visiting rates - there is an expectation that individuals with a higher number of GP visits per year will most likely be less healthy than individuals who do not visit their GP to the same extent. In Table 5 we show that the difference is the same across all labour force states suggesting that these objective measures represent the health of all individuals. For the same reasons, we use hospital visiting rates and specialists visiting rates.

Other questions related to health/disability may also be objective, for example individuals are asked if they have had to cut down in daily activities in the last two weeks due to physical or mental health problems. We show that individuals with disabilities are more likely to cut-down compared to others. A range of questions with regard to psychological well-being are also asked, and these are combined into and index known as GHQ12 (Generalised Health Questionnaire). Anyone with an index of 3 or over is known to have psychological or mental health problems. Again, the data suggests that individuals with an illness or disability score higher on this index, and this difference is evident across all labour market states.

Table 5 Summary statistics of objective disability across labour force states

	GP Visits (annual N)		Hospital Visits (annual N)		Specialist Visits (annual N)		Cut down %		GHQ12 (score)	
	Disability	No Disability	Disability	No Disability	Disability	No Disability	Disability	No Disability	Disability	No Disability
Employed	6.1	1.8	1.9	0.4	1.7	0.4	2.0	0.3	1.8	0.7
Unemployed	7.6	2.0	2.6	0.3	1.2	0.2	3.0	0.3	2.9	1.4
Disabled	11.8	6.8	5.9	2.5	2.6	0.8	5.0	1.0	3.3	1.5
Retired	8.4	2.0	4.1	0.7	1.7	0.4	3.0	0.4	2.5	0.6
Self employed	8.1	2.4	2.3	0.5	1.8	0.4	3.0	0.2	2.5	0.8
Other	8.4	2.1	2.9	0.5	2.1	0.4	3.0	0.3	2.5	0.8

Other variables that we could use as an objective measure include Body Mass Index, mobility and conditions. In the Living In Ireland data questions on weight and height are asked in the 1998 and later surveys only, so we do not use this variable in our analysis. In previous research (e.g. Campolieti, 2002) conditions have been used as an objective instrument for self-reported health. However, in the LII data this is only available for individuals who report a disability or chronic illness, so this would not give any variation in the model of reported disability status. Similarly the mobility question is only asked of those who report a chronic illness or disability. (Nonetheless we may be able to use this on the basis that individuals either have mobility problems or do not).

Finally, to include the influence of financial incentives into the model we could include a replacement ratio (rate of disability benefits/average wage). Kerkhofs and Lindeboom (1995) do not include replacement rates or wages as a determinant of disability. In the Netherlands, conditional on the labour market state, they see no reason why there would be an independent effect of the replacement ratio on the probability to report with error – the labour market state sufficiently describes the effects of financial incentives. In Ireland, the system is different so it would be interesting to look at any possible additional effect of replacement rates. We could simply calculate the replacement rate as the ratio of disability benefits to 2/3 of average industrial wage but this involves making several assumptions regarding household members. [for the moment we exclude replacement rates but will return to this again].

Our sample includes all individuals aged 16-65 and the pooled number of observations is 37,582.

5. Results

In Table 6 we present results from a pooled ordered logit model where the dependent variable is an ordered categorical variable with 4 values. We recall from Table 4 that a value of 0 indicates severe limitations while a value of 3 represents no disability. The β coefficient itself is of limited interest but we can use it along with estimates of the cut-points to calculate response probabilities and marginal effects. The signs of the

coefficients are informative only for the probabilities associated with the first outcome and last outcome, and cumulative probabilities.

Table 6 Ordered Logit of reported Disability Status

	Coefficient
Unemployed	-0.5018**
Disabled	-3.7882**
Retired	-1.3585**
Self Employed	-0.4383**
Other	-0.4098**
(reference=employed)	
Age	-0.0253**
Female	-0.2023**
Secondary Education	0.4027**
Third level Education	0.5986**
(reference group=primary or no qualifications)	
Married	0.0628
Year	-0.0305**
α^1	-5.695
α^2	-3.575
α^3	-3.145
Pseudo R^2	0.1211
N	36403

$**p \leq 0.05, *p \leq 0.10$

The results show that all labour force groups will have a lower probability of no disability and higher probabilities of severe limitations, compared to the employed. The negative coefficients on age, female and year indicate that for older people, women and in later years in the sample, the probability of severe limitations is higher compared to younger people, men and in earlier years respectively. The positive coefficient on education shows that with increased education the probability of no disability will increase and that of severe limitations will decrease. All of these results are as expected.

The coefficients on labour force status would suggest that the disabled and retired groups are even less likely to report 'no disability'. To establish the extent of these differences we use estimates of the cut-points and the coefficients to calculate marginal effects for each outcome, and present these in Table 7. As suggested by the estimated coefficient in the previous table, the disabled and retired groups have a much higher proportion either severely or to some extent restricted compared, to the employed. The marginal effects suggest that the retired have a probability of 3 percentage points higher than the employed of being severely restricted, giving an overall proportion of 3.6% of retired having a severe restriction. The additional effect of being disabled in terms of labour force status means that the proportion reporting severe restrictions is 30.6%. For some restrictions, we find that almost 19% of the retired report disability of this type, compared to 4.7% of the employed. The unemployed have a higher probability of reporting some restrictions in the order of 42 percentage points, giving an overall proportion of 47%.

Table 7 Marginal Effects form Ordered Logit of Reported Disability Status

	Severe	Some	None	No Disability
Unemployed	0.0066**	0.0389**	0.0174**	-0.0630**
Disabled	0.2908**	0.4157**	0.0288**	-0.7354**
Retired	0.0286**	0.1439**	0.0515**	-0.2241**
Self employed	0.0056**	0.0336**	0.0151**	-0.0545**
Other (training, education, home duties)	0.0045**	0.0275**	0.0129**	-0.0450**
Age	0.0003**	0.0016**	0.0008**	-0.0027**
Female	0.0021**	0.0131**	0.0062**	-0.0215**
Secondary Education	-0.0044**	-0.0270**	-0.0127**	0.0442**
Third level education	-0.0052**	-0.0329**	-0.0164**	0.0545**
Married	-0.0007	-0.0041	-0.0019	0.0067
Year	0.0003**	0.0019**	0.0009**	-0.0032**
P(y=J)	0.0106	0.0713	0.0388	0.8792

$**p \leq 0.05, *p \leq 0.10$

These marginal effects clearly indicate that the disabled and retired have a higher propensity to report restrictions in daily activities. At this stage however, we cannot determine whether this reflects differences in true disability or differences in reporting behaviour. The ordered logit model is also known as the proportional odds model

because the odds ratio of an event is independent of the category j, and is assumed to be constant for all categories. Essentially, the ordered logit model simultaneously estimates j-1 multiple equations so as our dependent variables has 4 outcomes, we have 3 equations - (1) compares category 1 to 2,3,4 (2) compares category 1 and 2 to that of 3 and 4 and (3) compares categories 1,2 and 3 to category 4. The ordered logit model however produces one set of coefficients for each independent variable so assumes parallel regression and expects that the coefficients for the variables in the equations would not vary significantly if they were estimated separately. We apply the Brant (1990) test for the parallel regression assumption this compares the slope coefficients of the J-1 binary logits implied by the ordered regression model. If any of the test statistics are significant, this provides evidence of violation of the parallel regression assumption and indicates that the ordered logit model may not be an appropriate specification to model reporting behaviour. We consider in this paper that reporting of disability differs by labour force status and hence individuals across groups would differ in terms of their 'thresholds' of disability/health. Therefore these groups should violate the parallel regression assumption. If we look at the significance of the results in Table 8 we see that the only group to not violate this assumption are the self-employed - they have the same thresholds as the employed when evaluating their disability status. We also find that other explanatory variables do not violate the parallel regression assumption. For example, the results suggest that for those with secondary education have different thresholds to the reference group of primary/no education qualifications. These are useful results, and we return to these later when we consider what variables influence reported and/or true disability. The main question, for now, however is whether or not reporting 'bias' exists and does it vary by these characteristics, so we return to this below. The fact that the variable year is significant is also interesting, as we also want to explore any changes in reporting behaviour and bias.

Table 8 Brant test of parallel regression assumption

	Brant test p>chi 2
Unemployed	0.000**
Disabled	0.040
Retired	0.000**
Self employed	0.364
Other (training, education, home duties)	0.000**
Age	0.001**
Female	0.337
Secondary Education	0.255
Third level education	0.009**
Married	0.247
Year	0.000**

$^{**}p \leq 0.05, ^{*}p \leq 0.10$

We are most interested in state dependent reporting behaviour so we mainly focus on the effect of labour force status. Before we determine if there is state dependent reporting behaviour of disability, we firstly establish that there are actual differences in reported disability across labour market states. We saw in Table 6 that the disabled and retired were more likely to report a limiting disability, so in the next Table we present the results from a simple generalised ordered logit model of limitations where the thresholds are allowed to vary by independent characteristics, and the reference group is employed individuals. We first concentrate on letting the thresholds vary by labour force status only. We should bear in mind that we have yet to control for other observed factors including a measure of objective health.

In Table 9 we present results from the basic generalised ordered logit model. The three columns reflect the three equations within this model. Column 1 presents results from comparing severe restrictions to the other three categories of some restrictions, no restrictions and no disability. Being unemployed reduces the probability of reporting at least some restrictions, no restrictions or no disability compared to the employed. This means that the unemployed are less likely to report better health overall. The disabled group have an even lower probability of reporting no restrictions or disability, compared to the employed. The retired group also have a lower probability of reporting better health but not to the same extent as the disabled. The second column compares severe and some restrictions to no restrictions or no disability. Again, we see stronger effects for the disabled and retired groups compared

to the employed. In the final column, the coefficient compare severe, some and no restrictions to no disability. The disabled and retired groups are less likely to report no disability. We also estimate this model and let the thresholds vary by year - the coefficients are generally the same and the year variable is significant for the third column only. Individuals are less likely to report no disability later on in the 1995 to 2001 period – we return to explanations for this result once we establish how disability reporting fluctuated over the period.

Table 9 Generalised Ordered Logit of Limitations

	>=some restrictions (ie. Group 2,3,4)	>=no restrictions (i.e. group 3,4)	No Disability (i.e. group 4)
Unemployed	-0.9965**	-0.7541**	-0.4801**
Disabled	-4.3900**	-4.6726**	-4.606**
Retired	-2.7616**	-2.1306**	-1.9761**
Self employed	-1.0232**	-0.7702**	-0.6606**
Other	-1.1409**	-0.8019**	-0.6437**
Employed (ref. Group)			
Constant	5.096**	2.8808**	2.3546**
N	37582		
Log likelihood	-18565.71		
Pseudo R^2	0.1100		

From the generalised ordered logit, we calculate predicted probabilities for each labour force status group. Given that we have not yet controlled for the objective measure of disability we would expect these probabilities to be quite similar to the actual proportions reported. In comparing the probabilities presented in Table 10 to the actual proportions reported earlier in Table 2, we find that the disabled and retired groups have similar proportions reporting severe restrictions.

Table 10 Generalised Ordered Logit of Limitations –predicted probabilities

	Severe	Some	None	No Disability
Unemployed	0.0061	0.0899	0.0258	0.8679
Disabled	0.3299	0.5267	0.0471	0.0961
Retired	0.0876	0.2308	0.0873	0.5942
Self employed	0.0169	0.0922	0.0045	0.8463
Other	0.0187	0.0923	0.0400	0.8488
Employed (ref. Group)	0.0061	0.0468	0.0327	0.9143

The next question is whether or not these differences in the probability of reported disability status are actually reporting behaviour or simply a reflection of true

disability. To establish this as we demonstrated in section 3, we would need to introduce an objective measure and then look at the cut-points following the approach of Kerkhofs and Lindeboom (1995) who use the comparison between subjective and objective to identify state dependent reporting errors. We estimate a generalised ordered logit model, where we firstly assume that the only factor affecting thresholds is labour force status. We suspect that the objective measures used here are not highly correlated with the subjective measure of disability, so we included other explanatory variables into the model, i.e. age, education, gender and marital status. These results are shown in Table 11. Compared to results in Table 10, the coefficients on the cut-points are smaller but still quite large for disabled and retired people.

Table 11 Generalised ordered logit with thresholds varying by LFS only and objective health included

	Coefficients on variables not varying by threshold	**>=some restrictions (ie. Group 2,3,4)**	**>=no restrictions (i.e. group 3,4)**	**No Disability (i.e. group 4)**
GP	-0.0876**			
HOSP	-0.0167**			
SPEC	-0.0818**			
CUT DOWN	-1.6759**			
GHQ12	-0.1265**			
Age	-0.0290**			
Female	0.1276**			
Seceduc	0.2943**			
Terteduc	0.5373**			
Married	0.0842**			
Year	-0.0563**			
Unemployed		-0.5139*	-0.6262**	-0.2778**
Disabled		-1.9822**	-3.0419**	-2.9141**
Retired		-1.3500**	-1.0138**	-0.9385**
Self employed		-1.0746	-0.2493	-0.2376**
Other		-0.3526**	-0.4049**	-0.2905**
Pseudo R^2	0.2409			
Log likelihood	-12784.232			
N	31004			

Again, we estimate predicted probabilities and show now that there are lower probabilities of reporting severe restrictions for the disabled and retired groups. Figure A1 in the appendix shows the differences in graphical form.

Table 13 Generalised Ordered Logit of Limitations –predicted probabilities

	Severe	Some	None	No Disability
	0.0138	0.0964	0.0233	0.8665
Unemployed				
Disabled	0.2811	0.5447	0.0504	0.1232
Retired	0.1084	0.2833	0.1046	0.5036
Self employed	0.0148	0.0842	0.0541	0.8469
Other	0.0259	0.1260	0.0525	0.7955
Employed (ref. Group)	0.0065	0.0481	0.0342	0.9112

The decision on what variables to include in the reporting part of the model is a matter of judgement, so to facilitate this we estimate the model while at the same time testing the parallel assumption for each variable. If a variable fails the parallel assumption test, then it should be included in the reporting part of the model, where the thresholds vary by that variable. [*to do yet*]

Our preliminary results suggest that reporting disability does depend on labour force status. In particular, we could say that the retired and disabled are prone to over-reporting their disability. These are similar to results obtained for the Netherlands (Kerkhofs and Lindeboom, 1995). In interpreting their results, the authors assume that labour force status sufficiently describes the effect of financial incentives in the Netherlands social welfare system. However, in Ireland, this may not be true so we may need to introduce replacement ratios into the model to capture the full effect of financial incentives on reporting behaviour.

The second part of this paper explores whether or not the reporting behaviour changed in any year. We begin this by looking at the probabilities estimated from the generalised ordered logit model for each year. Figure A2 includes a comparison of the actual and predicted probabilities for each year. The most notable aspect of this graph is that there appears to be no difference in the probabilities for the employed group, but there are for the disabled group. The differences for the latter group fluctuate between 1995 and 2001 (*we currently do not show results for 1999 as the generalised ordered logit did not work*). Looking at predictions of reporting severe restrictions, the graph shows that between 1995 and 1997 the difference in probability got smaller i.e. it appears there was much more over-reporting in 1995. This increased in 1998, reduced again in 2000 and became very small in 2001. For the employed group, there

was almost no difference between actual and predicted probabilities in all years up to and including 1998. In 2000-2001, we see a slight overestimation in the number reporting a disability.

This yearly analysis of reporting behaviour requires further work but for now we propose some explanations for the differences between actual and predicted probabilities of the disabled group. Economic incentives may play a role in mis-reporting of disability status, and we discuss two possible influences that may have changed reporting of disability over 1995 to 2001. Firstly, in 1996 the administration of Disability Allowance (a weekly allowance paid to people with a disability who are aged 16 or over and under age 66. The disability must be expected to last for at least one year and the allowance is subject to both a medical suitability and a means test) was transferred from the Department of Health to the Department of Social, Community and Family Affairs. The purpose of this was to integrate income maintenance payments and to streamline the process for social welfare payments for the disabled more generally. Before 1996, an individual may have mis-reported disability but post-1996, the incentive to do so may have been reduced as the social welfare process may have become more efficient. It is possible that non-working people with disabilities would give incorrect reports of disability, but for employed people their reports of disability should be correct. Kreider (1999), analysing the effect of 'biased' disability limitations on non-work, assumed that workers report correctly but non-workers do not.

The second potential contributor to reporting behaviour is the Employment Equality Act 1998, whereby disability is one of the grounds on which discrimination in the workplace cannot occur. The effect of this legislation on mis-reporting of disability could work in two ways - previous research has shown negative effects of similar legislation in the US where employers were less likely to hire individuals with disabilities as it became more costly with the new requirements (Acemoglu and Angrist (1998) and DeLeire (2000)). In this case demand was reduced, and unemployment for people with disabilities increased. This could influence people with disabilities to underreport. On the other hand, now that people with disabilities may feel they could be less discriminated against by employers, they might be inclined to either report their true disability status or even over-report their disability

status. In this case the unemployed may be more likely to mis-report. Employees reporting behaviour should not be affected by the Employment Equality Act 1998 – unless they are in work already and are seeking employment rights as set out by this Act. This is an important assumption in the model outlined earlier - it assumes that currently employed individuals do not respond in anticipation to future events (Lindeboom and Kerkhofs, 2002). Even though we show in Figure 2 that employed individuals are more likely to over-report in the years 2000 and 2001, the magnitude is very small (a difference of 0.01) so we maintain the assumption that workers report without error and compare results of the other labour force groups to the employed.

6. Conclusions

In this paper, we explored the possibility that reported limitations in daily activities are misreported, in particular for those who define their labour force status as disabled, and assess if financial incentives influence this group to mis-report. The main questions addressed were (1) was there state dependent reporting error and did financial incentives play a role, and (2) did this change over the years 1995 to 2001? Using a generalised ordered logit model, we find preliminary results indicating that the disabled and retired groups did over-report. We take this as evidence of economic incentives influencing reporting behaviour, but we also need to include replacement rates into the model in order to determine the precise nature of financial incentives. Furthermore, we need to establish the most appropriate variables used to determine the thresholds in the generalised ordered logit model.

The difference between actual and predicted probabilities fluctuated between 1995 and 2001. We discussed two particular institutional changes in Ireland that help to explain how economic incentives influenced reporting behaviour. These were the change in administration in 1996 and the introduction of the Employment Equality Act 1998.

In future work we will derive a cleansed measure of disability and include this into a model of labour force participation. The model employed in this paper allowed us to condition out endogeneity arising from unobservables and the direct effect of

participation on disability. However, when we include the cleansed disability in a model of participation we will need to account for unobservables once again.

References

Acemoglu, D. and J. Angrist, Consequences of Employment Protection? The Case of the Americans with Disabilities Act, *Journal of Political Economy*,2001, 109(5):915-957.

Bound, J, Schoenbaum, M., Stinebrickner, T.R. and T. Waidmann. The Dynamic Effects of Health on the Labor Force Transitions of Older Workers. *Labour Economics*, 1999, 6(2): 179-202.

Bound, J. Self-Reported versus Objective Measures of Health in Retirement Models. *The Journal of Human Resources* 1990; XXVI[1]:106-138.

Brant, R. Assessing Proportionality in the Proportional Odds Model for Ordinal Logistic Regression, *Biometrics*, 1990, 46:1171-1178.

Campolieti, M. Disability and the Labour Force Participation of older men in Canada, Labour Economics, 2002, 9(3):405-433.

DeLeire, T. The Wage and Employment Effects of the Americans with Disabilities Act. *Journal of Human Resources* 2000, 35(4): 693-715.

Hernández Quevedo C, Jones AM, Rice N. "Reporting bias and heterogeneity in self-assessed health. Evidence from the British Household Panel Survey". 2004 ECuity III Working Paper #19.

Kerkhofs, M. and M. Lindeboom Subjective Health Measures and State Dependent Reporting Errors, *Health Economics* 1995, 4:221-235.

Kreider, B. Latent Work Disability and Reporting Bias. *The Journal of Human Resources* 1999; XXXIV[4]:734-769.

Lindeboom, M. and M. Kerkhofs. Subjective Health Measures, Reporting Errors and the Endogenous Relationship between Health and Work. Working Paper 2002.

Lindeboom, Maarten & van Doorslaer, Eddy. Cut-point shift and index shift in self-reported health," 2004, *Journal of Health Economics*, 23(6):1083-1099.

Tille, C. and K. Yi. Curbing unemployment in Europe: Are there lessons from Ireland and the Netherlands, Current Issues in Economics and Finance, Federal Reserve Bank of New York, 2001, 7(5).

Appendix

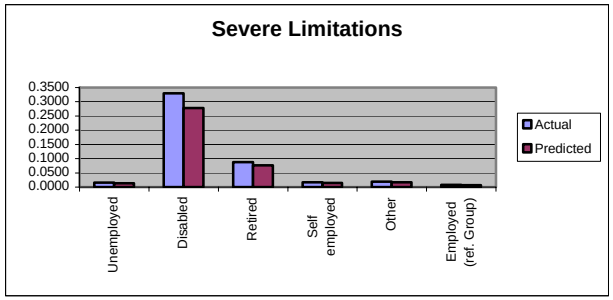
Table A1 Recipients of Disability Benefit 1995-2000 by Age

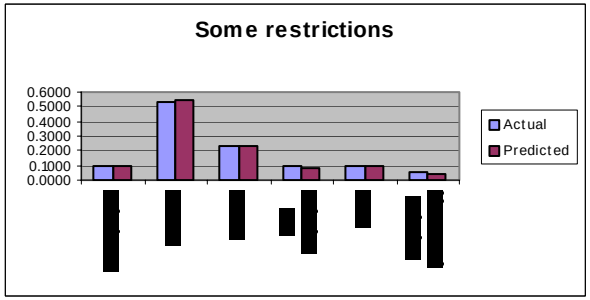
	1995	1996	1997	1998	1999	2000
Under 25	0.08	0.16		0.15	0.13	0.16
25-29	1.04	1.39		1.21	1.23	1.23
30-34	1.80	1.91		1.92	2.02	2.06
35-39	2.11	2.09		2.13	2.30	2.32
40-44	2.07	2.07		2.24	2.30	2.33
45-49	2.30	2.20		2.30	2.37	2.33
50-54	2.98	2.73		2.66	2.70	2.68
55-59	3.62	3.41		3.23	3.28	3.15
60-64	4.68	3.99		3.72	3.59	3.49
65 and Over	0.21	0.08		0.09	0.09	0.07

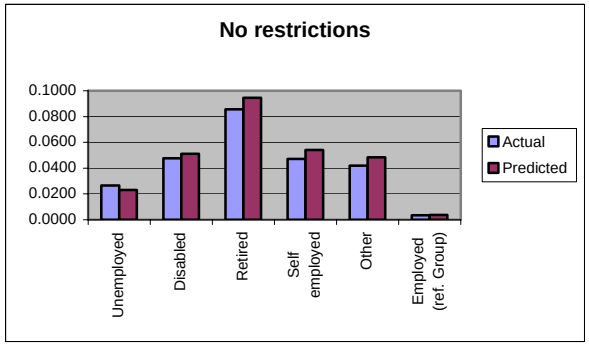
Note: 1997 gives age breakdown as u25,25-44, 45-64 and 65+

Source: Statistical Information on Social Welfare Services, Department of Social, Community and Family Affairs

Figure A1 Actual v Predicted Probabilities –average of 1995-2001







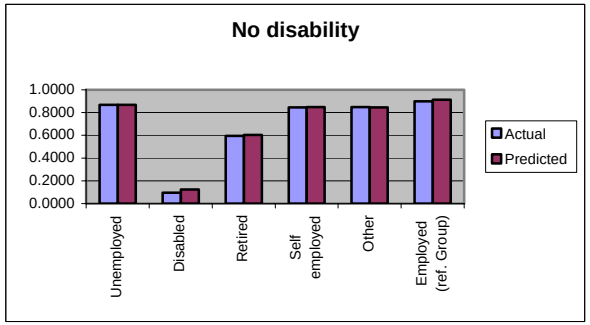


Figure A2 Difference between Actual and Predicted Probabilities by Year 1995-2001