Disability and disadvantage: Selection, onset, and duration effects

Stephen P. Jenkins and John A. Rigg

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Editorial Note

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Abstract

This paper analyses the economic disadvantage experienced by disabled persons of working-age using data from the British Household Panel Survey. We argue that there are three sources of disadvantage among disabled persons: pre-existing disadvantage among those who become disabled (a 'selection' effect), the effect of disability onset itself, and the effects associated with remaining disabled post-onset. We show that employment rates fall with disability onset, and continue to fall the longer a disability spell lasts, whereas average income falls sharply with onset but then recovers subsequently (though not to pre-onset levels).

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1. Introduction

Disabled Britons of working-age face considerable economic disadvantage compared to working-age people without a disability. On average their incomes are about 20 per cent lower than the incomes of non-disabled individuals of working-age, and their employment rates are half the size: see Burchardt (2000b), Grundy et al. (1999), and evidence that we present below. In this paper we argue that such summary statistics provide a potentially misleading picture of the relationship between disability and disadvantage. The reason is that economic disadvantage among currently-disabled individuals may arise from three potential sources: pre-existing disadvantage (a 'selection' effect), effects associated with the onset of disability, and the effects associated with remaining disabled post-onset. We argue that these dimensions should be examined separately, and illustrate our case using data from the British Household Panel Survey.

Our distinction between selection, onset and duration effects is derived from taking a longitudinal perspective to disability and disadvantage. This contrasts with previous analysis of the incomes and employment rates of disabled Britons which has mostly been based on cross-section surveys. Among these, the most important specialist surveys have been the Disability Follow-Up Survey to the Family Resources Survey (Grundy et al., 1999) and the Baseline Survey for monitoring the employment provisions of the Disability Discrimination Act (Meager et al., 1998).

There are three reasons why 'snapshot' information at a point in time for a sample of individuals may provide an inaccurate description of the impact of disability on disadvantage (Burkhauser and Daly, 1996). First, such surveys cannot differentiate between differences in outcomes that are due to factors existing before onset and differences that are due to onset itself. This is of policy relevance because the former may not be eliminated by policy measures targeted at people who are disabled. Second, with a cross-sectional snapshot one cannot learn how the relationship between disadvantage and disability status develops over time from onset and afterwards. Put another way, and from the policy-maker's perspective, one has little information about the time frame within which there are opportunities for intervention. As Burchardt has emphasised, 'disability is not a fixed characteristic of individuals, at least within the working population' (2000a, p. 664), and she argues that disability policy-making would be improved by recognition of disability trajectories and their variety. Third, cross-sectional samples contain a relatively high proportion of long-term cases. (This is a well-known property of 'stock sampling', and is illustrated by, for example, Burchardt, 2000a.) If disadvantage increases the

longer that a disabled person stays disabled, then a cross-section sample can over-estimate the impact of disability onset on economic outcomes.

More generally, the distinction between selection, onset and duration effects helps pin down the sources of the low incomes and employment rates of disabled people. As HM Treasury has stated in a related context, '[s]napshot data can lead people to focus on the symptoms of the problem rather than addressing the underlying processes which lead people to have or be denied opportunities' (HM Treasury 1999: 5). Development of complete models of processes is beyond the scope of this paper, but we offer analysis that aims to take some first steps in this direction. For each of the selection, onset, and duration processes, we use multivariate regression analysis to study the relationships between differences in personal characteristics (such as educational qualifications) and changes in employment rates and income.

Longitudinal data are required in order to trace changes in income and employment over the period stretching from before the onset of a disability to some time after onset. We use the British Household Panel Survey (BHPS), the source for the three existing studies of disability in Britain from a longitudinal perspective. Burchardt (2000a) focused on movements into and out of disability itself. Her report (2000b) also studied employment transitions. Bardasi et al. (2000) compared British disability and disadvantage with patterns reported for the USA and Germany by Burkhauser and Daly (1998). Virtually all other UK studies of disability from a longitudinal perspective have focused on disability benefits rather than total net income (and low income) or employment: see, for example, Holmes et al.'s (1991) study of transitions onto and off invalidity benefit. The contribution of the current paper is its identification, and joint analysis of, the selection, onset, and duration effects, and their impacts on individuals' total net incomes (not only their benefit income or their labour earnings) and their employment rates.

In Section 2, we describe our BHPS samples and definitions of disability, income and employment. In Sections 3 and 4, we analyze selection, onset, and duration effects. We document the extent of pre-existing disadvantage among individuals who subsequently became disabled, and describe how income levels, low-income rates, and employment rates changed when individuals began a spell of disability, and how these measures changed as the spell of disability progressed. Section 5 provides a summary and conclusions.

2. Data and Definitions

2.1 Data: The British Household Panel Survey

Our analysis uses data from the first eight waves of the BHPS, covering the period from 1991–8.[1] The first wave of the BHPS was a nationally representative sample of the population of Great Britain living in private households in 1991. Original sample respondents (including both partners from dissolved wave one partnerships) have been followed, and they and co-resident adults have been interviewed at approximately one-year intervals ever since. Children in original sample households have also been interviewed when they reach the age of 16 years. To account for potential differential non-response in the initial interview wave and for subsequent differential attrition, we used the relevant BHPS sample weights where appropriate.[2]

We focused on individuals of working age: men aged 16–64 years and women aged 16–59 years.

2.2 The definition of disability and its onset

The results reported in this paper use a definition of disability based on whether a person had a work-limiting health condition.[3] Respondents were classified as disabled if they answered yes to the BHPS question that asks 'Does your health limit the type of work or amount of work that you can do?' This definition has also been used extensively by Burchardt (2000a), and is very similar to the definition commonly derived from US social surveys such as the Panel Study of Income Dynamics (see, for example, Burkhauser and Daly, 1996, 1998). (For a useful overview of the relative merits of self-reported and 'objective' measures of disability, see Bound (1991).)

We also explored the consequences of using a disability definition that accounted for severity, counting as disabled only the subset of individuals who

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1 Data from only the first eight BHPS waves were used because the set of health and disability questions changed in wave 9.

2 For more information about the BHPS sample design, representativeness and methods, see Taylor (2001).

3 The work-limited definition of disability falls between definitions implied by the individual and social models of disability (Barnes, 1991; Nagi, 1969; Oliver, 1996). It is based on questions about 'impairment', while relating these to the extent to which a person can engage in particular environments. We also checked the validity of BHPS disability measures with comparisons of prevalence rates based on alternative definitions in other national surveys (a brief Appendix is available from the authors on request).

had a work-limiting health condition as above, *and* either (i) when asked, 'for the work that you can do, how much does your health limit the amount of work you can do?' said that it was 'a lot' or 'somewhat', or (ii) when asked 'does your health keep you from doing some types of work?' said that they 'can do nothing'. Changing to this more restrictive definition reduced the number of people counted as disabled in the cross-section, as expected, but longitudinal patterns – the focus of the paper – were little affected (results available from the authors on request).

We defined disability *onset* to have occurred if an individual was not disabled for at least two consecutive annual interviews and then reported disability at the next two interviews. This is the same definition that Burkhauser and Daly (1996) used, and enabled us to focus on 'long-term', non-transitory, disability experiences, the primary focus of government disability policy.[4] The length of a disability spell was measured in terms of the number of annual interviews at which the relevant individual was counted as being disabled, including the year of onset. One practical problem with our onset definition is that it requires four consecutive years' data to implement, a factor reducing sample numbers. We therefore repeated our calculations using a three-year definition that allowed 'temporary' spells: onset occurred if two interviews without disability were followed by a report of disability at the next interview (resulting in a sample of 803 spells rather than 280 spells). Patterns of results were robust to this change (results available from the authors on request).

2.3 Subsamples used in the analysis

The definitions of disability and its onset led to several subsamples for analysis:

(a) all individuals who were disabled at the date of the annual interview (the 'currently disabled' sample); and

(b) all individuals who were not disabled at the annual interview (the 'currently non-disabled' sample)

(c) the subset of individuals at risk of disability onset who experienced disability onset (the 'onset sample', whom we also followed post-onset);

(d) the subset of individuals at risk of disability onset who did not experience disability onset;

Samples (a) and (b) provided cross-sectional reference points concerning the stock of disabled and non-disabled individuals at a given point in time (as in cross-section surveys). For these two subsamples, we pooled data from BHPS waves 1–8.

[4] See Burchardt (2000*a*) for more about the complexity of the dynamics of disability.

Samples (c) and (d) were the longitudinal samples used to examine selection, onset, and duration effects.[5] They were also constructed by combining data across waves. However when considering disability onset, we restricted analysis to the first spell observed within the eight-year panel in order to abstract from issues arising from repeated disability episodes. (We cannot measure repeat-spell prevalence comprehensively because there is no information about respondents' disability experiences before the first BHPS interviews in 1991.) Among individuals for whom income was non-missing, there were 280 individuals who experienced disability onset (sample c), and 10,753 individuals (20,457 person-years) who were at risk of onset but did not experience it (sample d).

By construction, all individuals in the onset sample were disabled for at least two years. About 80 percent remained disabled a further year, and two-thirds of those beginning a disability spell remained disabled for at least four years.[6] The number of individuals in sample (c) with longer spells was small. For example, there were only about 50 individuals with a disability spell lasting at least five years, and only 20 individuals with a disability spell lasting for at least six years. (This is the maximum possible spell length in an eight-year panel, given that we also need to observe at least two years without a disability as part of the definition of disability onset.) Because of these small cell sizes, our analysis of duration effects (Section 4) focused on incomes and employment in the early years of a disability spell.

2.4 The definitions of economic disadvantage

Economic disadvantage was defined in terms of individuals' employment status, their income, and whether they had a low income.

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[5] We only examined onsets for individuals of working age, thereby excluding onset among children (aged younger than 16). If the economic potential for the latter group is significantly different from that of the former group, then our assessments of the selection effect may be biased. We cannot assess this because the BHPS only interviews individuals aged 16+, but we believe it to be a negligible problem. The prevalence of disability rises sharply with age, which suggests that the number of younger individuals who become disabled is relatively small. For example, individuals aged 16–21 accounted for around five percent of the subsample (a). Moreover, most of these did not report a work-limiting health problem at every wave.

[6] These lifetable estimates are smaller than those reported by Burchardt (2000*a*, Figure 3) using data from BHPS waves 1–7. The reason is that we use a different definition of onset (for the reasons discussed earlier). When we applied a similar definition, the patterns were very similar.

We defined individuals to be working if they were currently employed or self-employed. Respondents were asked whether they did any paid work during the last week (either as an employee or self-employed), or whether they did not do paid work last week but had a job that they were away from.

By 'income' we mean household net income, adjusted for differences in household composition using an equivalence scale. The definition is the same as the 'before housing costs' income measure used in the official low income statistics (Department for Work and Pensions, 2002).[7] Income could not be calculated for households in which there were one or more non-respondents and this reduced sample sizes in some analyses reported below. (Previous research by the authors suggests that such exclusions do not bias analysis.) We also used information about the composition of total income, especially the shares of income from labour earnings and from benefits, when examining trajectories in total income around the time of the onset of disability.

We made no adjustment to incomes for the additional costs associated with being disabled, such as the costs of personal care. Burchardt (2000b, Table 10) estimated that the proportion of disabled people in poverty in 1996/7 would increase from 40 percent to 51 percent if additional costs were taken into account. (She defined poverty to mean having an income less than half the mean income among all adults in non-pensioner families.) Only two-fifths to one half of these additional costs are met through the benefit system (Burchardt, 2000b, Table 12). In the context of the present analysis, adjusting for additional costs would not only reduce the incomes of disabled people, but this 'extra' economic disadvantage would be associated with disability onset. Thus the present analysis potentially understates the effects of disability onset on income.

We defined individuals as having low income if their income placed them in the poorest fifth of the working-age population, where the bottom-quintile threshold was calculated separately for each survey year.

[7] Household net income ('before housing costs') is the sum of cash income from all sources, minus direct income taxes and National Insurance contributions, deflated by the McClements BHC equivalence scale, and expressed in August 2000 prices. For details of the BHPS net income data set, see Bardasi et al. (1999). The data are available from the UK Data Archive (http://www.data-archive.ac.uk, study number SN3909).

3. The Selection Effect

The hypothesis underlying the selection effect is straightforward: that some of the economic disadvantage observed among individuals who are currently disabled arises because a significant fraction of them were already disadvantaged before they became disabled. That is, current disadvantage reflects a pre-existing condition, rather than (or as well as) the effects of disability itself. We label the effect a 'selection' effect, because it is as if the onset of disability selects from the pool of individuals at risk of becoming disabled, those individuals who are already more disadvantaged. For related discussion about the relationship between lone motherhood and economic disadvantage, see Jenkins, Ermisch and Wright (1990).

We examined the selection effect overall (on average), and then also looked in more detail at the characteristics associated with selection into disability. The analysis was based on the sample of all individuals who were at risk of becoming disabled and comparisons of base year incomes and employment status between two groups – those who subsequently became disabled (sample c) versus those who did not (sample d). The base year used in our calculations was the year two years prior to potential onset of a disability.[8] If the selection effect exists, then it should manifest itself in terms of lower incomes and employment rates for the former group compared to the latter.

Table 1 both sets the scene and provides evidence about the selection effect. Columns (a) and (b) summarise the incomes and employment of individuals who were 'currently' disabled and not disabled. The breakdowns show that, on average, disabled people were relatively badly off in the 1990s. Their median income was only 79 percent of the median for non-disabled individuals, and almost one-third were in the poorest fifth of the income distribution (compared to 18 percent among the non-disabled). 42 percent of disabled people were in paid employment compared with almost 80 percent among non-disabled people.

[8] We did not use the year prior to potential onset as the base year for comparisons as this could have mixed up selection effects with the effects associated with disability onset. Arguably one should use a base year more than two years prior to potential offset but, with our eight-wave panel, this would have led to cell sizes that were too small.

Table 1: Incomes, low-income rates and employment rates, by disability status

	Currently disabled	Not currently disabled	At risk of onset and became disabled	At risk of onset and did not become disabled
	(a)	**(b)**	**(c)**	**(d)**
Median income (pounds per week)	254	323	275	313
(As % of median income among those currently not disabled)	(79)	(100)	(85)	(97)
Mean income (pounds per week)	297	374	309	358
(As % of mean income among those currently not disabled)	(79)	(100)	(83)	(96)
Percentage in poorest fifth of working-age population	32	18	21	17
Percentage in poorest half of working-age population	65	48	58	48
Percentage in paid work	42	79	73	80
N (person waves)	6,478	45,602	280	20,457
N (persons)	2,418	10,405	280	10,753

Notes: Incomes, low-income and employment rates refer to current year for samples (a) and (b) and to base year for samples (b) and (d): see main text. For samples (a) and (b), the number of persons refers to the number of persons ever disabled or ever not disabled respectively. Samples (c) and (d) together refer to all individuals at risk of entry to disability (based on longitudinal samples). Income is net current household income, expressed in August 2000 prices, adjusted for differences in household size and composition using the McClements equivalence scale. Income groups were computed separately for each year. Cross-section samples weighted using BHPS cross-sectional respondent weights; longitudinal samples weighted using BHPS longitudinal respondent weights. Source: authors' calculations from BHPS waves 1–8.

We now turn to the evidence for the selection effect based on comparisons among individuals who were at risk of disability onset: see columns (c) and (d) of Table 1. It is clear that incomes and employment rates for those who experienced disability onset were worse than for the individuals who were also at risk of onset but did not experience it. On average, base year median income was twelve percent lower for the onset sample (£275 per week rather than £313), and 21 percent were in the poorest fifth of the working-age population rather than 17 percent. Individuals who experienced onset were also less likely to be in paid work: 73 per cent worked in the base year, compared to 80 per cent of those who did not experience disability onset.

To help understand selection according to prior disadvantage, it is useful to look in more detail at the differences in risk of onset across individuals with different characteristics – how do these differ from the overall onset rate of 1.3 percent? Table 2 shows that onset risks were substantially higher for individuals aged 50+ (2.5 percent), or with no educational qualifications (2.3 percent), those living in households with 2+ children (2.5 percent). By contrast, differences in onset rates by sex, or by numbers of adults in the household, were relatively small.

Although these differences are suggestive about the principal mechanisms through which the selection effect operates, multivariate analysis reveals more. We wish to examine the impact on onset rates of differences in each characteristic while controlling for the impact of other characteristics. Second it is also useful to examine whether the characteristics associated with high onset risks are *also* characteristics that are associated with greater economic disadvantage in general. If they are, one may talk of selection into disability according to that characteristic, rather than just an average selection effect. To implement these ideas, we first estimated a logistic regression model for the probability of disability onset, for which the regressors included the characteristics that were used in Table 2. Second we estimated (cross-sectional) regressions for (log) income, the probability of having low income, and the probability of not being in paid work, in which the explanatory variables were the same as for the disability onset regression. Third, we checked whether the estimated impacts of corresponding explanatory variables on their respective dependent variables were consistent with the hypothesis. Table 3 summarizes the multivariate analysis.[9]

[9] Throughout the paper, we use the same set of explanatory variables in each of the regressions that we report – this is to facilitate comparisons across equations and processes. We also estimated a range of additional models with different explanatory variables and specifications, but they told much the same story as the one reported. The explanatory variables are characterised using a relatively small number of categories in order to avoid small cell sizes.

Table 2: The risks of being disabled and of disability onset, by type of individual (row percentages)

Type of individual	Currently disabled	Not currently disabled	At risk of onset and became disabled	At risk of onset and did not become disabled
	(a)	(b)	(c)	(d)
All individuals	13.0	87.0	1.3	98.7
Woman	12.8	87.2	1.5	98.5
Man	13.2	86.8	1.2	98.8
Age (years)				
16–34	7.4	92.6	1.0	99.0
35–49	12.3	87.7	1.4	98.6
50+	25.7	74.3	2.5	97.5
Highest educational qualification				
No qualifications	24.1	75.9	2.3	97.7
Vocational	16.1	83.9	1.9	98.1
O-levels	9.8	90.2	1.0	99.0
A-levels	9.5	90.5	0.9	99.1
Technical/nursing/other higher	10.3	89.7	1.2	98.8
Degree	7.0	93.0	0.7	99.3
Number of adults in household				
1	15.9	84.1	1.6	98.4
2	12.7	87.3	1.4	98.6
3+	12.4	83.6	1.1	98.9
Number of children in household				
0	10.4	89.6	1.1	98.9
1	9.1	90.9	1.2	98.8
2+	12.6	87.4	2.5	97.5

Note: definitions of samples (a)–(d) and sample sizes are the same as for Table 1.

The selection role of educational qualifications was strongly corroborated. Controlling for other factors, having no educational qualifications not only raised the odds of disability onset (by over 55 percent), but was also associated with having a lower income, a much higher chance of having low income (odds ratio 2.4), and of not being in paid employment (odds ratio 2.5).[10] A similar story can be told about the impact of having a job. Compared to jobless individuals, those in work were not only less likely to become disabled (odds ratio 0.67), but also had a higher income and a lower probability of having low income (odds ratio 0.15). The results for other characteristics were not so clear cut. For example, sex and household composition did not have statistically significant associations with onset risks. Disability onset risks increased with age, but the relationship between the income and employment variables and age was more complicated. For example, although the odds of disability onset were higher for those aged 35–49 than for those aged 16–34, the former group had smaller rather than larger low-income risks.

Although incomes and employment rates for individuals who became disabled were worse than for individuals who did not, they were distinctly better than those for currently disabled individuals (sample a). For example, the median income among currently disabled individuals was 21 per cent lower than the median for currently non-disabled individuals (Table 1), a shortfall one and a half times as large as that for those in onset sample (c). Moreover, the base-year employment rate among the onset sample was almost twice the rate for the currently disabled. This is a reminder that selection effect does not account for all of the economic disadvantage experienced by disabled people. There are also onset and duration effects, to which we now turn.

[10] In the present context, the odds ratio is the probability that a person experiences disability onset relative to the probability that he or she does not experience onset. The coefficients for each characteristic show the effect of having that characteristic on the odds of onset. An odds ratio of one means that a person with a particular characteristic is just as likely to experience onset as a person in the reference category; an odds ratio of two (or half) means that person is twice (or half) as likely to experience onset as someone in the reference category.

Table 3: Multivariate analysis of characteristics associated with disability onset, income, low income, and employment

	Pr(disability onset)	Pr(not in work)	Log income	Pr(low income)
	(1)	(2)	(3)	(4)
Explanatory variables	**Odds ratio**	**Odds ratio**	**Coeff.**	**Odds ratio**
Female	ns	1.679***	0.026***	0.861***
Aged 35–49	1.444**	0.463***	0.071***	0.727***
Aged 50+	2.807***	1.544***	ns	0.725***
No educ. qualifications	1.553***	2.451***	–0.243***	2.364***
In paid work	0.665***	–	0.480***	0.149***
2 adults in household	ns	0.501***	0.311***	0.282***
3+ adults in household	ns	0.635***	0.211***	0.257***
1 child in household	ns	1.487***	–0.213***	1.883***
2+ children in household	ns	2.052***	–0.426***	3.722***
Mean of dependent variable	0.01	0.26	5.73	0.19
N (person-waves)	20,591	51,450	51,311	51,354
R-squared			0.262	
Log-likelihood	–1,430	–27,101		–19,912

Models (1), (3), (4) estimated by maximum likelihood logistic regression; model (2) estimated by ordinary least squares. Model (1) was based on subsamples (c) and (d) combined, with explanatory variables measured at base year values. Models (2)–(4) were based on subsamples (a) and (b) combined, with explanatory variables measured contemporaneously. In all models, robust standard errors were estimated, accounting for repeated observations on the same individuals and from the same household. ns: not significant at ≤ 10% level. **: significant at 5% level; ***: significant at 1% level. Low income: income in the poorest fifth of the working-age population. Regressions also included intercept terms, and controls for respondent's travel-to-work-area unemployment rate, and year of interview. Reference categories: male, aged 16–34, had educational qualifications, not in work, childless, single-adult household, survey year was 1991. Source: authors' calculations using pooled data from BHPS waves 1–8.

4. The Effects of Disability Onset and Duration

We now focus on the subsample of individuals who experienced disability onset, and examine how their incomes and employment changed both around the time of onset, and also as the disability spell lengthened. As with the selection effect, we consider not only overall average effects, but also how experiences differed among individuals with different characteristics.

4.1 Onset and duration effects overall

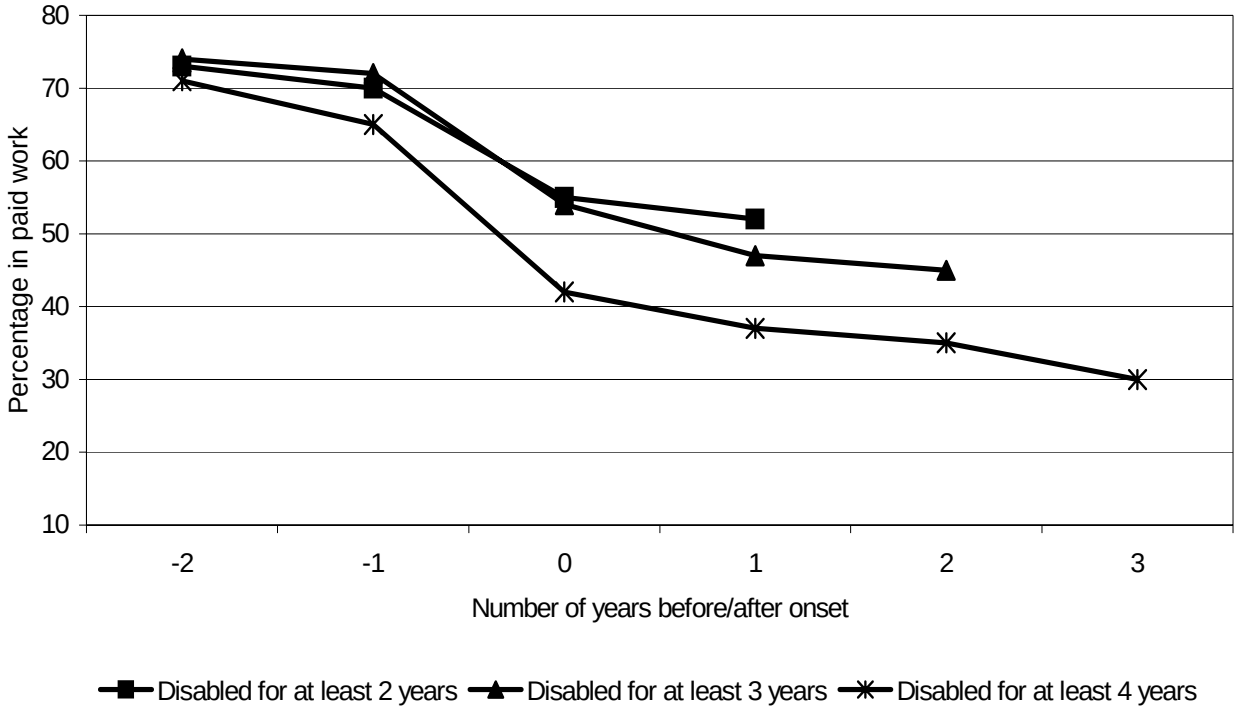
Overall effects were examined by tracing average incomes, low-income and employment rates from two years before onset through to up to three years after onset for those remaining disabled. If the onset effect were strong, we would expect to see a marked dip in employment rates and income in the period surrounding disability onset. The importance of duration effects was gauged from the extent to which employment rates and income continued to fall as spells lengthened.

The results are summarised in Figures 1–3 for three indicators: median income, proportion with low income, and proportion in paid work. Estimates were calculated for three subgroups whose membership was defined according to how long individuals remained disabled post-onset: individuals dropped out of these samples either because their disability spell ended or because the spell was still in progress in the last year of the panel.[11] The outcomes for the subgroups observed for three or four years were generally worse, in each spell year, than the corresponding outcomes for the subgroups observed for a shorter period. This is what one would expect if individuals who leave disability have better economic prospects than those remaining. (It was because of the changing composition of the sample that remained disabled, that we did not pool the various subgroups when calculating outcomes.) We return to this issue below.

Figures 1–3 show that there were substantial falls in the employment rate and median income, and a rise in the prevalence of low-income, between the pre-onset base year (labelled year –2 in the Figures) and the onset year (year 0). Taking the sample of all individuals disabled at least two years for illustration, between the base year and the onset year, the proportion in paid work fell by 26 percent (from 73 to 55), median income fell by 12 percent (from 282 to 249), the proportion with low income rose by 18 percentage points (from 21 to 39). (The increase in the proportion with low income was much greater than the decline in median income, because most of the relevant group were located close to the low-income threshold in the first place.)

[11] For these calculations, we also excluded individuals who had missing income values at any of the interviews during the disability spell. This resulted in samples of 253, 135 and 76 individuals who were disabled for at least two, three and four years, respectively.

Figure 1: Percentage in paid work before and after disability onset

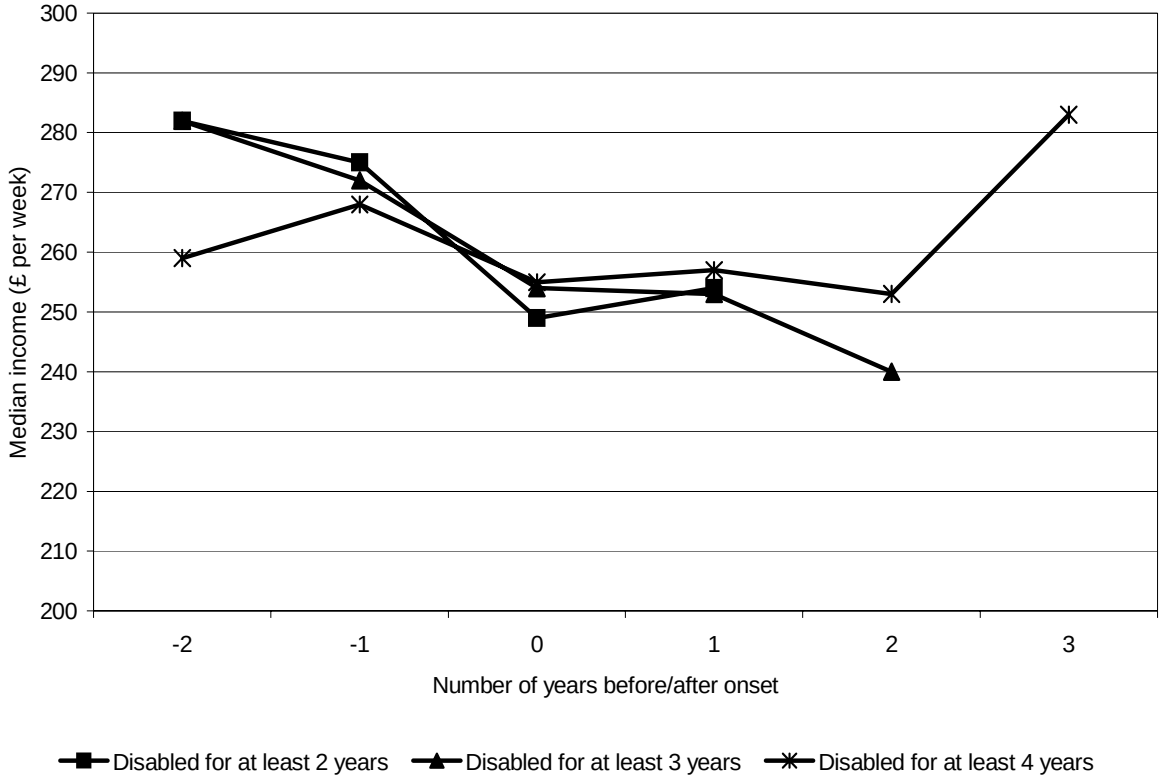


Notes: The year of disability onset is year 0. Source: authors' calculations using pooled data from BHPS waves 1–8.

The falls in employment rates and incomes occurred in both of the years between the base year and the onset year, which suggests that it may be difficult to attribute the changes over the two-year window to disability onset itself. However, contrary to this hypothesis, we would note that the changes were more marked between the pre-onset year (year –1) and the onset year (year 0) than between the base year and the pre-onset year. Moreover one might expect onset effects to be spread over time anyway: onset is often a gradual process rather than a sudden one-time event.[12]

[12] An alternative explanation for the decline over the pre-onset year is that individuals may have an incentive to describe themselves as having a work-limitation following a decline in income (which itself may reflect the loss of a job): disability benefits may be more generous than unemployment benefits. However, we also observed a similar decline in economic circumstances when we defined disability in terms of limitations in daily activities rather than work.

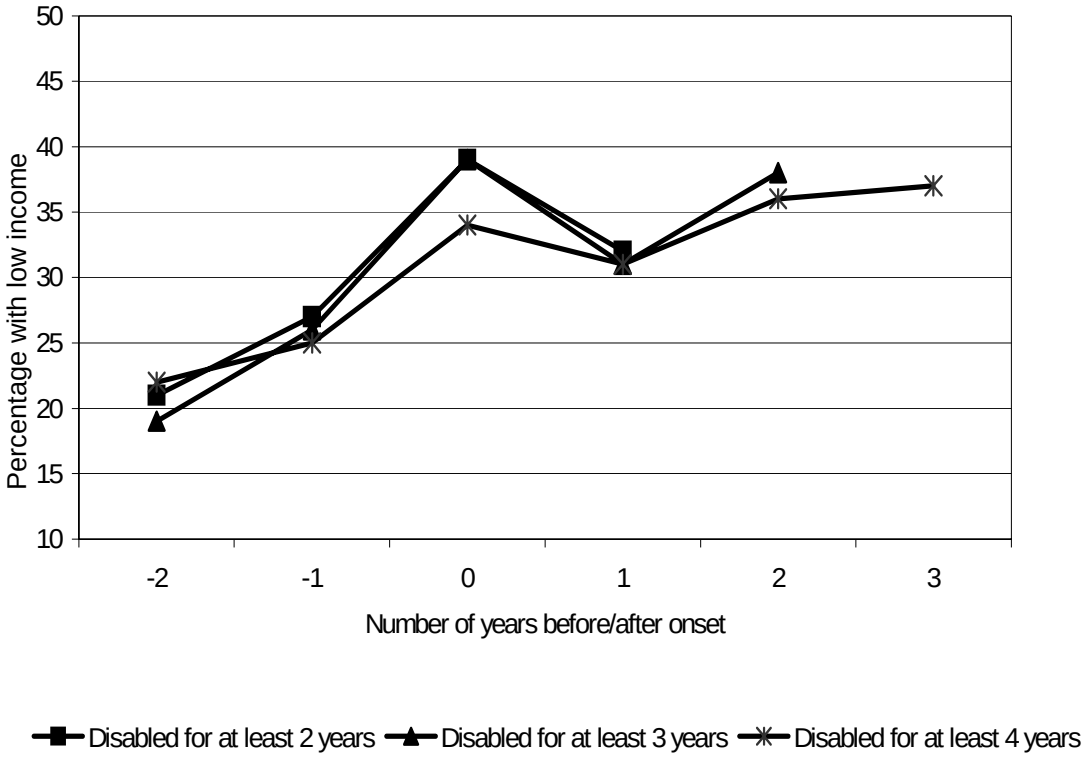
Figure 2: Median income before and after disability onset



Notes: The year of disability onset is year 0. Source: authors' calculations using pooled data from BHPS waves 1–8.

We would expect the income changes to reflect employment changes, and this is what we found. 73 percent of those who were disabled for at least two years worked in the base year and, of this group (n = 185), some 31 percent were no longer in paid employment in the onset year. For this group, median income fell over the two-year period by 29 percent (from £295 to £209) and their low-income rate increased dramatically, from 11 percent to 43 percent. By contrast, among those who remained in paid employment, median income fell by 'only' 5 percent (from £314 to £298) and the low-income rate increased from 9 percent to 21 percent. The reduction in income, despite no loss of employment, may have arisen from reductions in hours worked (for example a shift from full-time work to part-time work).

Figure 3: Percentage with low income before and after disability onset



Notes: The year of disability onset is year 0. A low income is an income in the poorest fifth of the working age population. Source: authors' calculations using pooled data from BHPS waves 1–8.

What about duration effects? Figures 1–3 reveal that post-onset trajectories for employment rates and incomes went in opposite directions. Employment rates declined continuously as disability spell lengthened. For individuals disabled at least two years, the employment rate fell from 55 per cent in the onset year to 52 per cent a year later. For individuals disabled four years or more, only 30 percent were in work in their fourth year of disability, compared to 42 percent in the onset year.

An obvious explanation for the decline is that the longer you are disabled, the fewer opportunities and capabilities to work you have (Meager et al., 1998), but such conclusions need to be made with caution. (The causality may also run in the opposite direction. It may be that the longer that an unemployed disabled individual is without a job, the greater the propensity to report having a work-limiting health condition, for example because it makes the worklessness easier to come to terms with psychologically, because long-term unemployment is bad

for one's health, or because disability benefits may be more attractive than unemployment benefits.)

Median incomes either rose or remained more or less unchanged in the year after onset. The most notable change in income during this period was a rise in median income of 2 percent (from £249 to £254) among those disabled for at least two years, though income remained below its base year level.[13] There is no consistent pattern to the changes in median incomes in the third of fourth years of disability, perhaps reflecting sampling variability given the small cell sizes. In the year after onset, low-income rates typically recovered though not to pre-onset levels (the only group where the low-income rate remained unchanged was those disabled for at least four years). This 'short-term' recovery was not sustained as low-income rates increased in the third and fourth year of disability. Again there was evidence of the importance of employment for understanding the income patterns. For example, among those individuals who were disabled for at least two years, median income increased 14 percent between the onset year and the next year for those who remained in employment, whereas it only increased by half as much (7 percent) among those who remained out of work. Low income rates fell by 32 percent for the first group and 8 percent for the second.

In sum, the longer disability spells were, the lower were employment rates. The pattern of economic disadvantage in terms of income was more complicated. There was a recovery in median income and low-income rates in the year after onset for most individuals, though low-income rates increased in subsequent years of disability. Interestingly, since the post-onset recovery in income occurred despite reductions in average employment rates, there must have been changes in other sources of household income that (partially) offset the decline in earnings. We now examine this in more detail.

4.2 How income sources changed around the time of disability onset

We investigated changes in eight types of income in the years surrounding disability onset for the sample of individuals who were disabled for at least two

[13] The changes in median income should be assessed in the context of a general rise in living standards among the working-age population as a whole over the 1990s. Over the first eight years of the BHPS, median (real) income among working-age individuals increased by an average of approximately two per cent per annum. Thus, the pre-onset median income of £276 for individuals who experienced at least two years of disability would have had to increase to £293 three years later (the second year of disability) in order just to keep pace with the rest of the working-age population (median income for this group was £249 in this year). In contrast, the low-income estimates account for changes in relative incomes, because the low-income cut-off was computed separately each year.

years. Average income levels and shares in total income are shown for each source in Table 4.

Disability onset was associated with an average income reduction of £26 per week, of which some £22 had been regained within a year. (These trends in mean income track those for median income shown in Figure 2.) Post-onset trends in income composition were mostly a continuation of the pattern of change associated with onset. For example, the reduction in mean income between the base year (two years before onset) and the year after onset was largely driven by a £61 reduction in own labour income. Post-onset, own labour income represented only about one third of total net income, compared to 54 per cent pre-onset. This is of course consistent with the trends in employment rates over the same period.

The main source of income replacement was the welfare state. Respondents' own disability benefits and other household benefit income each increased on average by £15 and £12 respectively over the same period. Disability benefits went from a negligible fraction to five percent of net household income, and income from other benefits increased from 12 percent to 17 percent. Although these were the most marked changes, they only partially offset the decline in employment earnings.

Income from personal and occupational pensions also rose, from two per cent of household net income pre-onset, to seven per cent post-onset. (Income from investments and savings also increased but to a lesser extent.) The likely explanation for this is that some of the labour market withdrawal was treated as early retirement (whether explicitly on the grounds of ill-health or not), thereby releasing payments of pensions in advance of the state retirement pension age. In addition, average payments of direct taxes fell by some £23 per week between the base year and the year after onset (largely reflecting the reduction in labour earnings).

Table 4: Income sources before and after the onset of a disability for individuals disabled at least 2 years

Income source (pounds per week)	Two years before onset	Onset year	Year after onset
Household net income	309	283	305
(as % of net income)	(100)	(100)	(100)
Respondent's own labour income	167	113	106
(as % of net income)	(54)	(40)	(35)
Other household labour income	180	152	168
(as % of net income)	(58)	(54)	(55)
Household investment and savings income	8	10	13
(as % of net income)	(3)	(3)	(4)
Household occupational and personal pensions	6	19	21
(as % of net income)	(2)	(7)	(7)
Household private transfers	4	3	7
(as % of net income)	(1)	(1)	(2)
Own disability benefits	1	12	16
(as % of net income)	(0)	(4)	(5)
Household benefits less own disability benefits	39	47	51
(as % of net income)	(12)	(17)	(17)
Household income taxes & NIC	–96	–73	–77
(as % of net income)	(–31)	(–26)	(–25)

Number of individuals = 273. A small number of high income outliers were excluded from the calculations. (From 1115 person-wave observations, 11 person-wave observations with income greater than £1000 were dropped.) Source: authors' calculations using pooled data from BHPS waves 1–8.

4.3 Variations in onset effects between individuals

To what extent did the impact of disability onset vary across individuals? Were certain types of individuals more adversely affected than others? We explored this issue using multivariate analysis of three outcomes: exit from paid work,

change in log income, and the entry into low income. For this exercise, changes and transitions referred to those occurring between the base year and the onset year (years –2 and 0 in Figures 1–3) for all individuals who experienced disability onset and, for the transitions, who were at risk of the relevant events. The explanatory variables were the same as those used earlier. The estimates of the three models are summarised in Table 5.

Table 5: Disability onset: multivariate analysis of changes in log income, entry to low-income, and stopping paid work

	Pr(stopped paid work)	Change in log(income)	Pr(entered low income)
Explanatory variables	**(1)**	**(1)**	**(2)**
(base year values)	**Odds ratio**	**Coeff.**	**Odds ratio**
Female	ns	ns	ns
Aged 35–49	2.754***	ns	ns
Aged 50+	ns	ns	ns
No educ. qualifications	ns	ns	ns
In paid work	–	ns	0.170***
2 adults in household	ns	ns	0.212***
3+ adults in household	ns	ns	0.141***
1 child in household	ns	ns	ns
2+ children in household	0.394*	ns	2.259*
Mean of dependent variable	0.31	–0.08	0.25
N	202	252	204
R-squared		0.044	
Log-likelihood	–118		–93

Models (1) estimated by ordinary least squares; models (2) and (3) estimated by maximum likelihood logistic regression. Samples for (2), (3) are smaller than for (1) because they are based only on the subsamples at risk of the relevant event. Changes are between base year (two years before onset) and year of onset: see text. Also see the notes to Table 3.

About 30 percent of those in work in the base year no longer worked in the onset year (Table 5, column (1)). The main deviations from this average transition rate were associated with demographic characteristics. For example, the odds of stopping work were almost three times as high for individuals aged 35–49 than the odds for those of other age groups (odds ratio 2.8). Individuals in households with two or more children were, on the other hand, much less likely to stop paid work with disability onset (odds ratio 0.4). This may reflect

necessity – a perception that benefits available when disabled would not cover household needs as well as earnings would.

Income declined by 8 percent on average and there were no systematic relationships between changes in log income and personal characteristics: none of the odds ratios for the explanatory variables shown in column (2) were statistically significant. Differences in onset effects across individuals were more apparent when we focused on the chances of entering low income (column 3). Among those who were not in the poorest fifth of the income distribution in the base year, the probability of entering low income in the year of onset was 25 percent. However the odds of low-income entry were very much lower for those in paid work rather than not working (odds ratio 0.17), or in multi-adult rather than single-adult households. Having two or more dependent children more than doubled the risks of entering low income (odds ratio 2.3).

Overall, there are some clear differences across individuals in the risks of stopping paid work, and of entering low income, over the period between the base year and the onset year. It is perhaps surprising that differences in educational qualifications appear not to be associated with differences in effects. (As it happens, point estimates of the odds ratios on the 'no qualifications' variables were all greater than one in the models, as expected.) When we estimated the models using samples based on the alternative definition of onset, i.e. requiring disability at only one rather than two consecutive interviews (see Introduction), it turned out that having no educational qualifications had large and statistically significant associations in the models corresponding to columns (2) and (3). This suggests that having educational qualifications provides better protection against the adverse effects of onset in the case of temporary disability spells.

4.4 Variations in duration effects between individuals

Describing individual differences in duration effects is complicated by the fact that there are two processes that are relevant. For someone beginning a disability spell, the expected disadvantage in spell year *t* is the probability of remaining disabled for at least *t* years multiplied by the disadvantage experienced in year *t* conditional on having remained disabled until then. Characteristics may have different impacts on each of the two processes. Indeed, there is a potential selection process in disability exit (as in disability entry), which changes the composition of the disabled population at risk of experiencing disadvantage. Our analysis examined both the probability of exit from disability and also changes in outcomes among the subsample remaining disabled.

The multivariate analysis of differences between individuals in disability exit probabilities focused on disability exit rates between the onset year and the third year of the spell. (This is year '+2' in Figures 1–3. Recall that our onset definition means that all individuals are disabled for at least two years.) We also estimated more complex hazard regression models, including ones allowing for duration dependence in the exit rate as spells lengthened, but our discussion here refers to the simpler model because it yielded virtually the same conclusions. We were constrained by small sample sizes at longer spell lengths in any case.

Column (1) of Table 6 shows the logistic regression model estimates. There were some systematic deviations in chances of exit from disability from the sample average rate of 26 percent. For example, the odds of leaving disability were some 80 percent higher for women compared to men and, compared to those not working in the onset year, the odds of disability exit for those in paid work were very much higher (odds ratio 3.3). Persons aged 35–49 were half as likely to exit disability as older, or younger, individuals. By contrast, the numbers of children and adults in the household had no statistically significant association with the risk of exit. Although lack of educational qualifications had no statistically significant association with disability exit rates, when we repeated the regression substituting a binary measure of whether the respondent had A-levels or higher qualifications for the 'no qualifications' measure, the estimated odds ratio on the new qualifications variables was 1.46 ($p = 0.03$), with effects for other variables unchanged. This provides some support for our 'selection out of disability' story.

Changes in circumstances over the first two years of the disability spell among individuals remaining disabled at least two years are shown in columns (2)–(4) of Table 6. Among individuals who were working in the year of disability onset, the chances of stopping work were very much higher for those with no educational qualifications: the odds ratio is a massive 4.16. (This is against the background of a decline in the overall employment rate as disability spells lengthened: see Figure 1.) Workers with two or more children were less likely than other workers to stop paid work (odds ratio 0.24).

What about income changes? Looking at income changes over the first two disability years among all individuals who were disabled for at least two years (column 3), we found that women experienced an increase in income of around 14 percent compared to men and, for persons without educational qualifications, income fell by some 14 percent compared to those with qualifications. By contrast, for those who were in paid work in the onset year, income fell by about 15 percent. This reflects the fact that a substantial fraction of these individuals stopped work in the year after disability onset (Figure 1).

Table 6: After disability onset: multivariate analysis of the probability of exit from disability, and changes in income and employment (individuals disabled at least two years)

	Pr(exited disability in year three)	Changes between year of onset and next year		
		Pr(stopped paid work)	Change in log income	Pr(exited low income)
Explanatory variables	**(1)**	**(2)**	**(3)**	**(4)**
(onset year values)	**Odds ratio**	**Odds ratio**	**Coeff.**	**Odds ratio**
Female	1.801*	ns	0.139**	ns
Aged 35–49	0.508*	ns	ns	ns
Aged 50+	ns	ns	ns	ns
No educ. qualifications	ns	4.162**	–0.139*	ns
In paid work	3.272**	–	–0.150**	ns
2 adults in household	ns	ns	ns	3.192*
3+ adults in household	ns	ns	ns	6.484**
1 child in household	ns	ns	ns	ns
2+ children in household	ns	0.244**	ns	0.200**
Mean of dependent variable	0.26	0.17	0.06	0.40
N	214	145	260	88
R-squared			0.112	
Log-likelihood	–115	–52		–52

Models (1), (3), (4) estimated by maximum likelihood logistic regression; model (2) estimated by ordinary least squares. Samples for (2), (4) are smaller than for (3) because they are based only on the subsamples at risk of the relevant event (working, and has high income, respectively). Also see the notes to Table 3.

Column (4) of Table 6 shows estimates of a model of rates of exit from low income between the onset year and the following year. (We report models of low-income exit rather than low-income entry, because the low-income rate fell over this two-year period: see Figure 3.) The only variables with statistically significant associations were demographic ones. Odds of exit were 80 percent lower for respondents with two or more children compared to others. And, compared to single adult households, the exit rates were much higher for individuals in a household with two adults (odds ratio 3.2) or with three or more adults (odds ratio 6.5). The explanation for this is not obvious, but one explanation could be that these variables were picking up moves into work by either the respondent or another household member against the general trend for

falling employment (the more adults there are in a household, the more possible this is).

5. Summary and conclusions

This paper has argued that our understanding of the economic disadvantage faced by those who are disabled at a point in time can benefit from using a longitudinal perspective. Current disadvantage may reflect three different processes: the selection into disability, the impact of disability onset and the impact of remaining disabled post-onset.

Using BHPS data covering 1991–8, we found that individuals who became disabled were typically more disadvantaged before onset than other individuals also at risk of onset but who did not become disabled. Not having any educational qualifications and not being in paid work prior to onset were factors that were associated with this selection effect. Both of these characteristics was associated with a higher chance of becoming disabled and also with having worse economic outcomes more generally.

Selection effects were not the whole story, however: there were also onset and duration effects. Disability onset was associated with marked declines in the likelihood of being in paid work and in average income, and with a rise in the low-income rate. There was variation around these averages, however, particularly in the chances of entering low income between the base year and the onset year. For example, low-income entry chances were smaller for individuals in paid work, or in a multi-adult household. The impact of duration effects on employment were marked and straightforward: employment rates fell continuously with disability duration. The duration effects with respect to income were more complicated. In the year after disability onset, there was a recovery in median income and low-income rates fell, on average, though low-income rates increased in subsequent years of disability. Among persons becoming disabled, the marked decline in income from employment was partially replaced by benefit income (and, to a lesser extent, personal and occupational pension income). Although social security benefits had an ameliorative role in the intended direction, the rate of replacement was low.

Among persons becoming disabled, the marked decline in income from employment was partially offset by higher benefit income (and, to a lesser extent, personal and occupational pension income). Although social security benefits had an ameliorative role in the intended direction, the rate of replacement was low.

What do the results suggest about other (non-benefit-related) measures that have been introduced to support disabled people? These have been wide-ranging in nature, but perhaps the most important of recent initiatives have been the New Deal for Disabled People, introduced in 1998 (with planned extensions in 2003–4 that pilot rehabilitation schemes to keep people in work if they become ill), and the Disabled Persons Tax Credit for low-income working disabled people. Common to these measures is a desire to (re)connect disabled people to the world of employment and for them to retain their jobs when they have them. This is clear from the government's statements that '[a]n increase in the employment rates … of people with disabilities … and a reduction in the difference between their employment rates and the overall rate' are targets against which to assess progress towards reduction in social exclusion and poverty (Department of Social Security, 1999, p. 31). If these employment-targeted policies are successful, then they will help to offset the striking decline in employment rates that occurs not only at disability onset but also continues as disability spells lengthen.

Maintaining employment among disabled people depends not only on the individuals concerned, however. It is also contingent on there being jobs available, and recognition that adaptations to workplaces and reorganisation of jobs may be required. The Disability Discrimination Act (1995), and the Disability Rights Commission, established in April 2000 with the aim of supporting disabled people and their employers and service providers, are steps in the right direction, but they are unlikely to have a major impact on employment rates. As Berthoud has pointed out, the 'Disability Discrimination Act … provides a clear statement of employers' obligations, but its individualised approach – based on one disabled person's experience of applying for one vacancy – is unlikely to have a substantial effect on thousands of firms and millions of candidates' (1998, p. 39). For a review of the limited progress being made on adjustments by employers and service providers, see Meager et al. (2002).

Our findings about selection effects also signal a cautionary note. All the measures cited so far are focused on helping people who are already disabled, but a non-trivial part of their disadvantage reflects circumstances existing prior to the onset of disability. Policies targeted on people who are disabled may not eliminate this aspect. Design of alternative targeting mechanisms is constrained by the fact that it is difficult to ascertain ex ante who is or is not going to become disabled. Our multivariate analysis suggests that there may be pay-offs to various non-specific measures, however. For example, the results pointed to how the possession of educational qualifications helped protect individuals from being 'selected' into disability. (This is over and above any role that educational qualifications may have in determining whether someone has a job or not.) But

even if skill levels can be raised universally, a real policy challenge remains – how to equalise the chances of job entry and retention for disabled and non-disabled persons with the same qualifications and skills – which returns us to the issues raised in the previous paragraph.

Overall, the paper's findings underscore the importance of learning more about the processes underlying disability and disadvantage. They also highlight the relevance of longitudinal surveys for monitoring and modelling disability trajectories. Clearly the BHPS is a rich source of data for examining these issues, but cell sizes remain a constraint on analysis. If there were a new national disability survey, we would recommend adding longitudinal elements to the survey design. The easiest way to do this would be to add questions about disability onset dates and about circumstances prior to onset (including for example employment and benefit receipt histories).

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