What Happens to People Before and After Disability?

Focusing Effects, Lead Effects, and Adaptation in Different Areas of Life

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Abstract

This paper addresses the question of when and to what extent different areas of a person's life are affected by mild and severe disability. Although there is some evidence of lead effects to becoming disabled in more than one aspects of life, the strongest lead effects are found in the health domain. Disability has a negative impact on satisfactions with income, social life, and use of leisure time, but is positively associated with the levels of satisfaction with amount of leisure time. Adaptation takes place in almost all of the affected life domains for both disabled groups, but is often incomplete for the severely disabled. Finally, this paper proposes a two-layer model to study leads and lags in life satisfaction to different life events.

Key words: Disability; Adaptation; Domain satisfaction; Life satisfaction; Focusing effect; BHPS.

1. Introduction

Perhaps one of the most provocative findings in well-being literature comes from studies that find only small differences in the reported life satisfaction or happiness between people with serious physical disabilities – such as paraplegics and hemodialysis patients – and normal control subjects (Brickman, Coates, & Janoff-Bulman, 1978; Riis et al., 2005). The highly counterintuitive result – one would expect people with a disability to be miserable with their lives – has further been bolstered by a handful of longitudinal studies that follow the well-being of chronically ill patients through time. For example, Silver (1982) finds that the affective experiences of paraplegics are significantly improved only a few weeks after their accidents. More recently Oswald and Powdthavee (2008), using large longitudinal data sets, showed that people can recover up to 30% of the drop in their life satisfaction in only three years after first becoming severely disabled. What these observations indicate is that patients are considerably adaptable to their situation (see Frederick & Lowenstein, 1999; Groot, 2000; Easterlin, 2005).

There is little theoretical work in this area. Graham and Oswald (2005) use the concept of hedonic capital to explain how *hedonic adaptation* – to use the Frederick and Lowenstein (1999) term – occurs. The two economists show how adaptation emerges from a model of evolution in which Nature 'rationally' uses happiness as a device to make agents value their lives efficiently. Rayo and Becker (2007) liken hedonic adaptation to the ability of the human eye to adjust quickly to changes in amount of light. The two economists sketch out a model of how Nature might have optimally designed human beings' emotional responses to behave in the same way.

The set-point theory, by contrast, argues that hedonic adaptation is not reducible to the type of adaptation found in the sensory systems. Instead, adaptation occurs because human beings are endowed with happiness set points. According to this theory, which was developed by psychologists, people initially react to events, but then return to baseline factors that are determined by personality factors (Brickman & Campbell, 1971).

While useful as a benchmark, the set-point theory does not explain why adaptations to some life events are quicker and more complete than others. For example, longitudinal evidence has shown that people are unlikely to adapt completely to unemployment (Lucas et al., 2004), divorce (Lucas, 2005), and disability (Lucas, 2007; Oswald & Powdthavee, 2008), whereas adaptation is more likely to be complete for income (Di Tella et al, 2007) and marriage (Lucas & Clark, 2006). It also does not explain why people adapt more to an increase in income compared to a decrease in income (Ferrer-i-Carbonell & van Praag, 2008).

According to Schkade and Kahneman (1998), adaptation is a process which occurs from a reduction of attention from the new circumstance. In the paraplegic case, adaptation occurs when patients' attention is withdrawn from their conditions: spinal-cord injury patients are likely at the beginning to think about their new circumstances many times each day, but the allocation of attention eventually changes, so that they spend most of their time attending to daily experiences such as having breakfast or watching TV (Kahneman et al., 2006). The extent and speed of withdrawal of attention varies, however, from experience to experience (Wilson & Gilbert, 2008; Dolan & Kahneman, 2008). For example, one reason why people adapt to a rise in income much faster than they do with the onset of a severe disability is simply because money is largely in the background, whereas being seriously disabled is full-time. We do not spend most of our waking moments thinking about how much money we

have in the bank. However, we may still be reminded about our disability from time to time if it incapacitates us from doing day-to-day activities such as climbing stairs or getting dressed by ourselves.

What this implies is that the speed and extent of patients' ability to adapt will depend largely on what they are focusing on when prompted to answer an overall judgment question such as "How satisfied are you with your life these days?" Little is known, however, about how disability affects the way we response to the above question. What do the disabled think about when they are prompted to think about their life? Do they worry more about their future incomes or about their current health status? Which aspects of a person's life are most and least affected by disability? Will adaptation occur in all affected life domains, and how does this shape the extent and speed of the overall adaptation in the life satisfaction scale? One could hypothesise that the evidence of adaptation in life satisfaction found in previous studies is merely a reflection of adaptation in spheres of life other than health. A paraplegic may still attend to her conditions when prompted with a question about her health, leading to little adaptation in the health domain, even some several years after her accident. However, the focus on her loss of earnings and/or her social life as a result from becoming a paraplegic may have shifted away from what it used to be a few years ago. These are important questions which have never been explored in previous studies before.

The current study uses a nationally representative longitudinal data of British individuals to examine what happens to seven different areas of life – i.e., health, income, housing, partner, social life, amount of leisure time, and use of leisure time – before and after disability. Because partner satisfaction is considered in the analysis, the sample is pertained only to those who are in couples. Empirical evidence in this area is scarce. Of the few existing cross-

sectional studies, social relationships and income seem to be the domains that disabled people are least satisfied with (Kemmler et al., 1997; Anderson and Vogel, 2003). No attempts have been made to replicate the findings using a longitudinal data set.

A second purpose of this article is to study whether there is a leading effect to disability. This can be done empirically by looking at the coefficients on a series of lead variables to becoming disabled, e.g., within the next two or three years. To date, only Clark et al (2008), Frijters et al (2008), and Angeles (2009) have examined lead effects to different life events, but not including disability and the lead effects in different life domains.

Finally, this paper explores how we can construct a better statistical model, one that would incorporate the different ways disability affects the different areas of our lives, so that we could use them to explain how both becoming and being disabled ultimately shapes the way life satisfaction question is evaluated. This issue arises from the fact that previous cross-sectional and longitudinal studies assume disability to have a direct impact on life satisfaction (Lucas, 2007; Oswald & Powdthavee, 2008). In other words, previous studies assumed that life satisfaction function would not have, say, health satisfaction as an argument but the underlying variables which determine health, e.g. the disability variables. One major draw back of this model is that disability may have a different effect on different life domains, which implies that the balance effect on overall life satisfaction may be difficult to measure and interpret. As a result, the last part of this paper adopts a two-layer model outlined in Ferrer-i-Carbonell and van Praag (2002) and van Praag van Praag et al (2003) to account for the weighted averages of the impacts of domain satisfactions on the overall life satisfaction.

2. Implementing a test

2.1. Data

The data in this study comes from Waves 6-10 and Waves 12-15 of the British Household Panel Survey (BHPS). Wave 11 is omitted from the analysis as it does not contain a set of questions on domain-specific and overall life satisfactions. This is nationally representative of British households, contains over 10,000 adult individuals, and has been conducted between September and Christmas of each year from 1991. This paper draws on two survey questions in the BHPS. These are:

(i) *What describes your current situation … long term sick or disabled?*

(ii) *Does your health in any way limit your daily activities – i.e. including housework, climbing stairs, dressing oneself, and walking for at least 10 minutes – compared to most people your age?*

One empirical category derived from interacting the two variables in the estimation process is 'disabled but able to do day-to-day activities'. I denote this Moderately Disabled. The other, even more fundamentally impaired, category generated from the interaction between the disability variables and the unable to do day-to-day activities variable is 'disabled and unable to do at least one of the above day-to-day activities.' I term this group the Severely Disabled. Those who answered 'No' to (i) but 'Yes' to (ii) fall within the 'no disabled' category.

Participants are also asked to indicate how satisfied they were with their health, income, housing, partner, job, social life, amount of leisure time, and use of leisure time, using a scale that ranged from 1 (least satisfied) to 7 (most satisfied). Participants are then asked on a separate page of the questionnaire to indicate, immediately after the domain satisfaction questions**,** how satisfied they are with their life overall. Only those who answered the domain

satisfaction questions, including the overall life satisfaction, are used in the analysis. This includes all unmarried individuals who reported some values when prompted to answer the partner satisfaction question, e.g. those living with a partner or who are unmarried but not single. This yields an unbalanced panel with 61,398 observations (12,986 individuals). Note that only 9% of those who are disabled report some values for job satisfaction. As a result, the final sample is not conditioned on whether the person also reports a level for job satisfaction. There are 4,546 observations (1,768 individuals) of the Severely Disabled, and 489 observations (354 individuals) of the Mildly Disabled. It might seem surprising that the Severely Disabled outnumber the less seriously disabled, but that is because all these individuals are sufficiently incapacitated that they cannot work, and this is more commonly accompanied by some extreme physical handicap.A summary of leads and lags and the descriptive statistics of overall life satisfaction and domain satisfactions are presented in Table 1.

2.2. Empirical strategy

2.2.1. Domain satisfaction equations

Assume that *LS* is a function of different domain satisfactions, *DS*:

$$LS_{it} = f(DS_{1it}, DS_{2it}, ..., DS_{jit}), \quad (1)$$

and that *DS* is a function of past, present, and future disability status,

$$DS_{jit} = (\sum_{n}^{N} D_{it-n}, \sum_{k}^{K} D_{it+k}, ...), \quad (2)$$

Where *D* represents the disability status, and *j* = 1…*J*. The empirical counterpart to (2), which is analogous to the lead and lagged life satisfaction equations estimated in Frijters et al (2008), can be written as followed:

$$DS_{jit} = \alpha_j + X'_{jit}\delta + \beta_{-5j}D_{-5,jit} + \beta_{-4j}D_{-4,jit} + \beta_{-3j}D_{-3,jit} + \beta_{-2j}D_{-2,jit} + \beta_{-1j}D_{-1,jit} + \beta_{0j}D_{0,jit} + \beta_{1j}D_{1,jit} + \beta_{2j}D_{2,jit} + \beta_{3j}D_{3,jit} + \beta_{4j}D_{4,jit} + \varepsilon_{jit}, \quad (3)$$

The dependent variable, DS_{jit}, is recorded on the 1 to 7 scale. There are seven *DS* variables of interest, namely satisfactions with health, income, housing, partner, social life, amount of leisure time, and use of leisure time, i.e. $J = 7$. The variable X_{jit} denotes a vector of standard personal and household controls, including age dummies, income, marital status, employment status, education, household size, the number of dependent children (age<16), and year dummies (see, e.g., Ferrer-i-Carbonell & Frijters, 2004). Here, $D_{-5,jit}$ represents a dummy variable that takes a value of 1 if the individual will report to be disabled in the following 4 to 5 years. The other leading *D* dummies are defined similarly. If there is a lead effect to becoming disabled, then we would expect to see the lead coefficients to be negative, and to be more negative the closer the periods of long-term disability become.

The adaptation effects to being disabled are captured by four dummy variables: Disabled 1-2 years, Disabled 2-3 years, Disabled 3-4 years, Disabled 4 years or more. Disability of less than one year's duration is identified by being disabled today ($D_t = 1$) but not in the previous interview ($D_{t-1} = 0$). Disability of one to two years' duration is identified by $D_t = 1, D_{t-1} = 1, \text{and } D_{t-2} = 0.$ Longer lags are defined analogously. If there is no adaptation to

disability, then we would expect all of the later values β to be negative, statistically significant, and all of the same size. However, if there is adaptation then the later values of β to be less negative – we will observe individuals "bounce back" from severe disability. Finally, if adaptation is complete then later values of β will be statistically insignificant, i.e. being disabled for a long time is the same as not being disabled at all.

To distinguish between mild and severe disability in the *DS* equations, the lead and lag disability variables described in Eq.3, denoted here as D'_{jit}, can be interacted with a dummy representing whether the individual is unable to do day-to-day activities, $UNABLE_{jit}$, as followed:

$$DS_{jit} = \alpha_j + X'_{jit}\delta + D'_{jit}\beta + \theta UNABLE_{jit} + (D'_{jit} \times UNABLE_{jit})\phi + \varepsilon_{jit}. \quad (4)$$

With the above interaction terms, β will now represent the lead and lag effects of becoming and being mildly disabled, and $\beta + \theta + \phi$ the corresponding rates for the severely disabled.

Each *DS* equation is estimated separately using fixed effects (FE) estimator, which allows us to compare, for example, the satisfaction of those who have been disabled for 1-2 years to the satisfaction scores reported by the same individuals who have been disabled for one year. One advantage of the FE approach over the hierarchical linear (HL) approach often used in the analysis of adaptation by psychologists (Lucas et al., 2004; Lucas, 2007) is that it completely removes the stable personality factors from biasing the welfare impact of disability. By contrast, the HL approach is essentially a special case of random effects model, which assumes zero correlations between the explanatory variables and the individual fixed effects.

Given that some people are born with persistent personality traits that make them happy, these predispositions, noted by Headey (2006), are also likely to determine the type of life events the person will be experiencing in her life time. For example, satisfaction scores tend to be higher among extroverts. However, they are also more likely to engage in risky behaviours and, as a result, are more prone to accidents than less extravert individuals. The positive correlations between (a) personality traits and self-rated satisfaction scores and (b) between personality traits and the likelihood of becoming disabled mean that failure to allow for such heterogeneity will lead to an overestimation of the true impact of disability on subjective well-being. It could also lead to a potential overestimation of the speed of adaptation to disability, i.e. more optimistic people may adapt faster to changes in life events than their less optimistic counterpart. This explains why results obtained from FE and HL models are not always the same (see the contrasts between Oswald & Powdthavee, 2008, which used FE models and Lucas, 2007, which used HL models to estimate adaptation to disability using the same data sets).

Disability may also have an indirect effect on well-being through its effects on income: disability lowers earnings capacity. In order to account for both the direct and indirect effects of disability on *DS*, I follow the instrumental variables method outlined in Powdthavee (2009a) and use information on the proportion of people showing payslips in the household to instrument for income in all of the *DS* equations.

Finally, given nine waves of panel data, it is possible to follow individuals for up to eight years before or after becoming severely disabled. However, the vast majority of individuals can be tracked for far shorter periods. In this paper, I particularly concentrate on the five years

preceding serious disability with respect to the lead effects, and the four years or more following serious disability to identify adaptation.

2.2.2. Two-layer life satisfaction model

In an attempt to incorporate the dynamic effects of disability on *DS* to determine the life satisfaction path before and after becoming disabled, I follow van Praag et al's (2003) description of a two-layer model (see Figure 1), and estimate a life satisfaction, *LS*, equation using a fixed effects estimator. To allow for the possibility that the weights that individuals put on different aspects of their life may change with the severity and the duration of disability, I incorporate a three-way interaction between *DS*, the lead and lag disability variables, and the inability to do day-to-day activities as followed:

$$\begin{aligned} LS_{it} &= DS'_{jit}\sigma + D'_{jit}\pi + \gamma\, UNABLE_{jit} + (DS'_{jit} \times D'_{jit})\eta + (D'_{jit} \times UNABLE_{jit})\nu \\ &+ (DS'_{jit} \times UNABLE_{jit})\tau + (DS'_{jit} \times D'_{jit} \times UNABLE_{jit})\rho + \zeta_{it}, \end{aligned} \tag{6}$$

which allows the weight attached to each *DS* to vary according to the severity and the duration of disability. Here, the main effects of *DS* on *LS* are captured by the coefficients σ. The coefficients π and γ represent the main effects of the disability and the inability to do day-to-day activities variables on *LS* which are over and above that of *DS*, whilst the subsequent coefficients moderate these effects by the severity and the duration of disability. Like the *DS* variables, the dependent variable *LS* is also measured on the 1 to 7 scale, ranging from 1 "very dissatisfied" to 7 "very satisfied". Using the estimates obtained from Eq.5, we can calculate how leads and lags in different *DS* determine overall dynamics of *LS*. For instance, imagine that there is no adaptation to serious disability in the health domain even after 3 years

of being disabled (i.e. change in health satisfaction<0), but there is a continuing increase in the satisfaction with amount of leisure time during that duration (i.e. change in satisfaction with amount of leisure time>0). The shape of the overall adaptation will therefore depend on the relative weight between health satisfaction and satisfaction with amount of leisure time in the *LS* equation. Eq.5 thus gives a more complete picture of the complex phenomenon of overall lead and lag effects to disability.

Finally, as a pedagogical device and for ease of reading, I will treat both *DS* and *LS* as a cardinal construct in all of the regressions: the fixed effects analysis (i.e. Eq.4 and 5) is carried out via 'within' regressions.

3. Results

3.1. Lead and lags in domain satisfactions

Results from the lead and lag *DS* equations are reported in Table 2. Given that Table 2 has a large number of coefficients, for ease of interpretation I have also produced graphs in Figures 2a-2g displaying the dynamics of *DS* before and after becoming either mildly or seriously disabled. For comparative purposes, the last column of Table 2 presents the estimates obtained from a reduced form *LS* equation with lead and lag disability variables as independent variables. The dynamics of predicted *LS* is illustrated in Figure 2h. The horizontal line represents the average satisfaction for those who remained able-bodied throughout the sampled periods.

An examination of the effects of both mild and severe disability upon health satisfaction in both the first column of Table 2 and Figure 2a shows predictable results: becoming disabled is

associated in the first year with generally lower health satisfaction, regardless of its severity. What is perhaps more surprising is that there are, on average, strong future effects to becoming disabled in terms of health: individuals report a statistically significant and monotonic decline in health satisfaction which started at least four years before the year of disability at *T*. This is robust even after controlling for the individual's inability to do day-to-day activities in the periods prior to becoming disabled. Thus, this result implies that health satisfaction regressions based on the effect of severe disability in the year of occurrence would grossly underestimate the importance of severe disability on subjective health. Moreover, whilst adaptation to mild disability seems to be complete within three years of being disabled, there is little evidence of quick adaptation to serious disability: adaptation to serious disability in terms of health satisfaction is in the order of 13% after 4 or more years of being disabled.

The results also reveal some lead effects to becoming disabled in income, housing, partner, social life, and use of leisure time domains. However, the patterns of these lead effects are not as clear cut as the one observed in the health domain, i.e. there is little evidence of a monotonic decline in the levels of satisfaction in these life domains prior to becoming disabled at *T*.

Consistent with previous cross-sectional studies, both mild and serious disability have a negative and statistically significant effect on the levels of satisfactions with income and social life. In terms of severe disability, the ranking of the negative welfare impacts of disability at *T* is in the following order: health satisfaction (a drop of 29% from *T*-1), income satisfaction (-11%), use of leisure time (-6%), and social life (-5%). The current impact of both mild and severe disability on amount of leisure time is positive and statistically

significant at the 1% level. Importantly, however, we can see that adaptation to severe disability is not only incomplete in the health domain but in all of the affected life domains; satisfactions with income, amount of leisure time, use of leisure time, and social life remain negative and statistically significant even after 4 or more years of being seriously disabled. Thus, the results imply that seriously disabled patients continue to think negatively about their health, income, social life, and what they could do with their free time, and positively about amount of leisure time whenever they are prompted to think about these aspects of their life, whatever the duration of their disability status. By contrast, adaptation seems to be complete in all of the affected life domains for people with mild disability.

3.2. Implied lead and lag effects in life satisfaction

How do we use the above information to help construct a more complete and explainable statistical model of *LS* before and after disability? To do so, Table 3 adopts van Praag et al's (2003) two-layer model and estimates a within regression of *LS* with *DS* as the explanatory variables (Eq.5). Here, we assume that disability enters the life satisfaction function indirectly via its effects on the seven *DS* variables.

Consistent with van Praag et al (2003), *LS* is indeed an amalgam of various *DS*. Allowing the weights of *DS* on *LS* to vary by the severity and the duration of disability, I find all of the main effects of *DS* coefficients to be positive, statistically significant at the 1% level, and are in this order: partner satisfaction (0.188), social life satisfaction (0.144), use of leisure time satisfaction (0.126), health satisfaction (0.113), income satisfaction (0.094), amount of leisure time satisfaction (0.056), and housing satisfaction (0.056). Apart from (i) satisfactions with housing and amount of leisure time and (ii) social life and use of leisure time, we can

comfortably reject the hypothesis that any pair of coefficients is equal at the 1% level. Though not shown in the table, the main effects of lead and lag disability variables and the inability to do day-to-day activities variable are not statistically significantly different from zero. However, some of the coefficients on the interactions between *DS* and longer term disability are statistically significant at conventional levels. For example, the interaction between income satisfaction and being severely disabled for 4 or more years is negative and significant at the 1% level: income means less to *LS* the longer we spent in disability. This implies that people's view on what matters to life varies according to the severity and the duration of disability, and is therefore consistent to the idea that explains why the able-bodied often mispredict – or rather, underestimate – the speed and extent of adaptation to disability.

Figures 3a & 3b plot the predicted *LS* path before and after mild and severe disability, taking into account all of the indirect effects of disability (disability $\rightarrow DS \rightarrow LS$) taken from Table 2 and the flexible weights of *DS* in the *LS* equation in Table 3. For comparative purposes, the raw *LS* scores before and after mild and severe disability are also superimposed into both figures.

We can see that there is a negative and monotonic lead effect to becoming disabled between *T*-4 and *T*-2, which can perhaps be explained by the drops in the levels of satisfaction with health, income, partner, and use of leisure time. There is a slight increase in satisfactions with housing and use of leisure time at *T-1*, which "bumps" up *LS* at *T*-1. Whilst there is a noticeable drop in *LS* for both mild and severe disability at *T*, there is little evidence of any improvements in *LS* for the severely disabled until *T*+4. Part of the reason for this is that there is a combination of declines amongst different aspects of life, including health, income, social life, and use of leisure time during that period. By contrast, overall hedonic adaptation to mild

disability is complete within two years, even though domain adaptation in terms of health and income takes three years to complete. This is primarily because adaptation to mild disability in terms of satisfactions with housing, partner, social life, and use of leisure time is complete within the first two years of being disabled, thus offsetting the negative effects disability has on both health and income. For the severely disabled, the predicted *LS* shares a similar trend as that of the raw *LS*: there is a general decline in raw *LS* in the periods before disability at *t*. This implies that severe disability may not have a significant influence on any other missing *DS* that varies over time before and after disability.

There is little evidence of a statistical significant difference, in terms of the average satisfaction scores, between the predicted *LS* obtained from the two-layer model (Figure 3) and the predicted *LS* obtained from the reduced form model (Figure 2h). What this implies is that it makes virtually no difference to the final *LS* estimates whether a direct or an indirect effect of disability is assumed in the model. Finally, it should be noted that while the estimation of Eq.5 allows the *DS* weights to vary according to the severity and the duration of disability, a set of almost identical figures to Figures 3a & 3b can nevertheless still be obtained in a model where constant *DS* weights is assumed.

4. Discussions

One concern is that the satisfaction variables are recorded ordinally rather than cardinally, i.e. a unit increase in the satisfaction scale from 1 to 2 may not be the same as a unit increase from 2 to 3. However, rerunning Eqs.4 and 5 using a conditional fixed-effects logit estimator produce results that are qualitatively similar to those obtained using within estimator. This is

consistent with the conclusion made by Ferrer-i-Carbonell and Frijters (2004) that it makes virtually no difference whether one assumes cardinality or ordinality in well-being data.

Second, attrition from the panel could be problematic (Contoyannis et al, 2004). It might be argued that some of the most severely disabled individuals die disproportionately often, or move into hospital, and the results on adaptation would be merely reflecting those who remain in the sample. To be sure that the results are not being driven by individuals who are in the panel briefly, I re-estimate Eq.5 on a smaller balanced sample (Wave 6-15). Despite some notable increases in the standard errors, there is little change in the size and the significance of the estimated lead and lag disability coefficients.

Another criticism is that the lead and lag equations were estimated separately for each *DS* rather than simultaneously for all *DS* variables. Because the responses to the *DS* questions are drawn from the same data set, failure to take into account the correlation of residuals across different *DS* equations could potentially confound the correlation of residuals with the effects of independent variables. However, re-estimating the *DS* equations simultaneously in a single 'within' seemingly unrelated regression equation yield estimates that are virtually similar – in terms of coefficient size and statistical significance – to those obtained from regressing the *DS* equations separately. Thus, consistent with van Praag et al. (2003), it makes quantitatively little difference whether the lead and lag equations are estimated separately for each *DS* or simultaneously for all *DS*.

Another argument may be that, despite our ability to control for unobserved heterogeneity in the fixed effects estimation, there may still be a time-varying element which influences both *DS* and *LS*. For example, a random shock in life events such as death of a loved one may

affect both *DS* and *LS* simultaneously. In other words, the two-layer model may be biased due to the underlying correlations between *DS* and *LS*. To correct for this bias, I follow a method outlined in van Praag et al (2003) and include an error-correction variable, i.e. the first principal component of the (7×7) error covariance matrix obtained from estimating separately the seven *DS* equations into the estimation of Eq.6. By adding this variable as an additional explanatory variable to the two-layer model, we may assume that the remaining *LS*-error is no longer correlated with the *DS*-errors and that the estimators of the coefficients in Eq.5 do not suffer from endogeneity bias. This approach is similar to the error-correction model proposed by Heckman (1976). However, I find that the estimated error-correction variable is not statistically significant in the *LS* equation, thus suggesting that there is no significant time-varying element which influences both *DS* and *LS* and that our FE estimates obtained from Eq.5 are consistent.

Finally, it could be argued that individuals alter their reported satisfaction score, artificially, merely because their reference level alters. For example, a disabled person might, ex post, begin to compare herself subconsciously to a different standard – such as those who are in a similar physical situation – about what counts as being satisfied (one could imagine: 'I guess I am a happy 7, bearing in mind that I am still healthier compared to other people who are more disabled than I am'). There is probably no way to reject such concerns definitively, but one objection to it comes in the form of a study by Powdthavee (2009b) who finds using the BHPS that, although there is some evidence of a statistically significant positive externality from other people's long-standing health problems on self-assessed health of those who are chronically ill themselves, the economic significance of such relative health effect is in fact negligibly small. In addition to this, it is worth noting that the results are robust to control for the proportion of (other) disabled people in the household. Thus, there seems to be little

evidence to suggest that individuals fundamentally shift their scale of reference completely – or at least in a significant way – following disability.

5. Conclusions

To imagine what life must be like to be disabled is an extremely difficult thing to do if we have never experienced disability (or known anybody who is disabled) before. One reason for this is because we tend to focus our attention on what it must be like to *become* disabled rather than *being* disabled, and, as a result, we fail to anticipate the shift of attention for a disabled person when the event of disability becomes a state of disability (Schkade & Kahneman, 1998). Are these observations made by outsiders completely wrong? Do we miss a large part of what disabled people are thinking about when they are asked to assess how happy they are with their life? Currently little is known about the impact of disability on different domain satisfactions and, in turn, overall judgment of life satisfaction.

The current study used a nationally representative longitudinal sample of British people to study the dynamic effects of disability on different domains of life. Consistent with the attention theory, current disability, regardless of its severity, was found to have the most detrimental impact on health satisfaction, followed by less salient aspects which are income, social life, use of leisure time, housing and partner. Becoming disabled had a positive impact on satisfaction with amount of leisure time. There was also a significant lead effect to becoming disabled in health satisfaction, which was less apparent in other domains of life. Adaptation to severe disability was incomplete in both health and income domains, suggesting that the severely disabled continued to think about their health, income, social life, and use of leisure time in a negative light after spending up to four or more years in disability.

Adaptation was complete, however, in all of the affected life domains for those with mild disability.

Finally, this paper offers a new way to think about hedonic anticipation and adaptation to life events. By allowing different domain satisfactions to explain overall life satisfaction, we have, perhaps for the first time, a statistical model that taps into the underlying processes of both hedonic anticipation and adaptation to changes in the life events. Future research should use the same approach to investigate the underlying mechanisms of anticipation and adaptation in life events other than health shocks such as marriage and unemployment.

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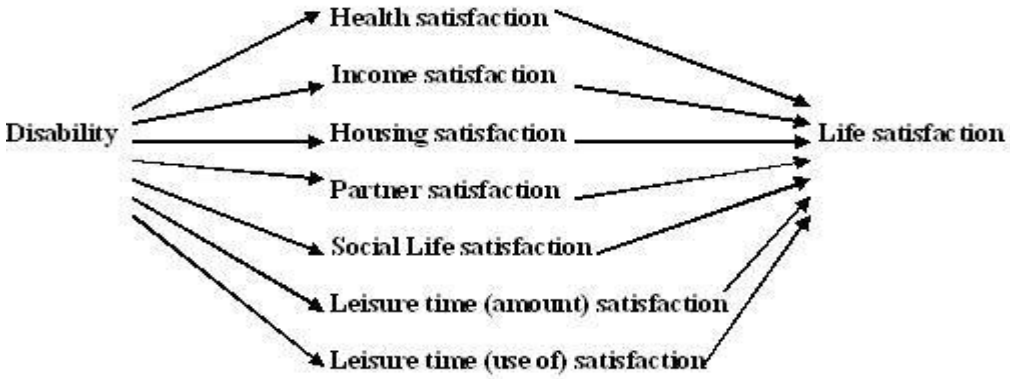
Table 1: Number of leads and lags to mild and serious disability and average life satisfaction and domain satisfactions, BHPS 1996-2005

	N	Domain satisfactions							Overall life satisfaction
		Health satisfaction	Income satisfaction	Housing satisfaction	Partner satisfaction	Social life satisfaction	Satisfaction with amount of leisure	Satisfaction with use of leisure	
Leads									
Disabled 4-5 years hence	151	4.23	4.17	5.15	6.12	4.69	4.60	4.60	4.94
		(1.87)	(1.70)	(1.68)	(1.29)	(1.68)	(1.69)	(1.73)	(1.45)
Disabled 3-4 years hence	184	4.25	4.11	5.17	6.27	4.86	4.55	4.85	5.04
		(1.70)	(1.73)	(1.69)	(1.16)	(1.63)	(1.79)	(1.68)	(1.40)
Disabled 2-3 years hence	269	3.90	3.78	5.08	6.04	4.44	4.38	4.36	4.73
		(1.80)	(1.69)	(1.60)	(1.57)	(1.67)	(1.79)	(1.74)	(1.41)
Disabled 1-2 years hence	437	3.73	3.93	5.05	5.95	4.44	4.45	4.42	4.69
		(1.85)	(1.71)	(1.74)	(1.57)	(1.63)	(1.71)	(1.73)	(1.53)
Disabled within next year	748	3.16	3.60	5.12	6.05	4.37	4.45	4.36	4.52
		(1.76)	(1.71)	(1.69)	(1.50)	(1.76)	(1.79)	(1.79)	(1.66)
Lags of being mildly disabled									
Mild disabled	131	4.09	3.49	4.97	5.90	4.80	5.06	4.80	4.80
		(1.63)	(1.55)	(1.58)	(1.55)	(1.57)	(1.61)	(1.65)	(1.42)
Mild disabled for 1-2 year	50	4.48	3.94	5.58	5.82	4.56	5.08	4.78	4.84
		(1.77)	(1.82)	(1.47)	(1.82)	(1.71)	(1.66)	(1.61)	(1.58)
Mild disabled for 2-3 years	21	3.33	3.52	5.00	5.80	4.85	5.57	5.66	4.71
		(2.03)	(2.06)	(1.81)	(2.11)	(1.82)	(1.74)	(1.79)	(1.76)
Mild disabled for 3-4 years	17	4.17	3.76	5.29	5.70	4.76	5.23	4.88	5.23
		(1.77)	(2.07)	(1.89)	(1.75)	(1.78)	(1.75)	(1.69)	(1.52)
Mild disabled for 4 years or more	51	4.13	3.72	5.52	6.19	4.74	5.47	5.01	4.66
		(1.69)	(1.60)	(1.47)	(1.52)	(1.61)	(1.61)	(1.60)	(1.68)
Lags of being seriously disabled									
Seriously disabled	894	2.57	3.39	5.06	6.10	4.11	4.67	4.15	4.23
		(1.65)	(1.80)	(1.81)	(1.55)	(1.85)	(1.90)	(1.92)	(1.80)
Seriously disabled for 1-2 year	487	2.51	3.35	5.16	6.04	3.97	4.53	4.06	4.24
		(1.56)	(1.68)	(1.74)	(1.62)	(1.80)	(1.87)	(1.87)	(1.66)
Seriously disabled for 2-3 years	262	2.38	3.28	5.06	6.05	3.85	4.46	3.99	4.03
		(1.49)	(1.63)	(1.80)	(1.41)	(1.78)	(1.87)	(1.84)	(1.63)
Seriously disabled for 3-4 years	225	2.36	3.42	4.91	6.18	3.72	4.04	3.73	3.81
		(1.57)	(1.76)	(1.86)	(1.41)	(1.84)	(2.00)	(1.85)	(1.76)
Seriously disabled for 4 years or more	940	2.39	3.43	5.24	6.31	4.01	4.75	4.18	4.16
		(1.44)	(1.67)	(1.74)	(1.31)	(1.77)	(1.82)	(1.85)	(1.68)

Note: Life and domain satisfactions are on a 7-point scale, 1 = very dissatisfied, …, 7 = very satisfied. Standard errors are in parentheses

Figure 1: The two-layer model



Source: van Praag et al (2003)

Table 2: Fixed effects domain satisfaction regressions, BHPS 1996-2005

	Domain satisfactions							Life overall
	Health	**Income**	**Housing**	**Partner**	**Social**	**Amt. leisure**	**Use leisure**	
Disabled 4-5 years hence	0.389	0.071	-0.011	0.152	0.390	0.297	0.445	0.322
	[0.132]**	[0.132]	[0.128]	[0.101]	[0.124]**	[0.138]*	[0.131]**	[0.106]**
Disabled 3-4 years hence	0.242	0.112	0.177	0.169	0.280	0.278	0.345	0.268
	[0.126]+	[0.126]	[0.122]	[0.096]+	[0.118]*	[0.132]*	[0.125]**	[0.101]**
Disabled 2-3 years hence	0.281	-0.003	0.076	-0.008	-0.011	-0.108	0.012	0.092
	[0.112]*	[0.113]	[0.109]	[0.086]	[0.106]	[0.118]	[0.112]	[0.090]
Disabled 1-2 years hence	0.043	-0.153	-0.113	-0.155	-0.043	-0.085	-0.110	-0.071
	[0.094]	[0.094]	[0.091]	[0.072]*	[0.088]	[0.098]	[0.093]	[0.075]
Disabled within next year	-0.118	-0.137	0.097	-0.141	-0.065	-0.132	0.025	0.093
	[0.098]	[0.098]	[0.095]	[0.075]+	[0.092]	[0.103]	[0.097]	[0.079]
Year became disabled	-0.705	-0.772	-0.146	-0.170	-0.233	0.442	-0.079	-0.268
	[0.127]**	[0.128]**	[0.124]	[0.097]+	[0.120]+	[0.134]**	[0.127]	[0.102]**
Disabled for 1-2 year	-0.474	-0.252	0.393	-0.102	-0.321	0.522	0.091	-0.169
	[0.201]*	[0.203]	[0.195]*	[0.154]	[0.189]+	[0.211]*	[0.200]	[0.162]
Disabled for 2-3 years	-1.190	-0.972	-0.042	-0.045	-0.379	0.521	0.591	-0.403
	[0.263]**	[0.265]**	[0.256]	[0.202]	[0.248]	[0.276]+	[0.262]*	[0.212]+
Disabled for 3-4 years	-0.329	-0.401	-0.340	-0.296	-0.507	0.611	0.130	-0.070
	[0.301]	[0.303]	[0.292]	[0.230]	[0.283]+	[0.316]+	[0.299]	[0.242]
Disabled for 4 years or more	0.049	-0.344	0.063	0.147	-0.141	0.521	0.379	0.040
	[0.226]	[0.227]	[0.219]	[0.173]	[0.212]	[0.237]*	[0.224]+	[0.181]
Unable to do day-to-day activities	-0.692	-0.089	-0.080	-0.031	-0.120	-0.018	-0.110	-0.165
	[0.020]**	[0.020]**	[0.019]**	[0.015]*	[0.018]**	[0.021]	[0.020]**	[0.016]**
Disabled 4-5 years hence × Unable to do day-to-day activities	-0.850	-0.235	-0.008	-0.230	-0.533	-0.198	-0.849	-0.472
	[0.206]**	[0.207]	[0.200]	[0.157]	[0.193]**	[0.216]	[0.204]**	[0.165]**
Disabled 3-4 years hence × Unable to do day-to-day activities	0.053	-0.243	-0.036	0.074	0.011	-0.233	-0.023	0.003
	[0.184]	[0.185]	[0.179]	[0.141]	[0.173]	[0.193]	[0.183]	[0.148]
Disabled 2-3 years hence × Unable to do day-to-day activities	-0.509	-0.474	-0.298	-0.161	0.127	0.253	-0.204	-0.103
	[0.153]**	[0.154]**	[0.149]*	[0.117]	[0.144]	[0.161]	[0.152]	[0.123]
Disabled 1-2 years hence × Unable to do day-to-day activities	-0.392	0.082	0.091	0.068	0.061	0.185	0.074	0.096
	[0.125]**	[0.126]	[0.121]	[0.096]	[0.117]	[0.131]	[0.124]	[0.100]
Disabled within next year × Unable to do day-to-day activities	-0.552	-0.220	-0.095	0.152	-0.014	0.088	-0.218	-0.304
	[0.109]**	[0.110]*	[0.106]	[0.084]+	[0.103]	[0.114]	[0.108]*	[0.088]**
Year became disabled × Unable to do day-to-day activities	-0.145	0.243	0.194	0.223	0.055	0.000	-0.065	-0.033

	[0.130]	[0.131]+	[0.126]	[0.099]*	[0.122]	[0.136]	[0.129]	[0.104]
Disabled for 1-2 year ✕ Unable to do day-to-day activities	-0.312	-0.368	-0.374	0.162	0.097	-0.171	-0.320	-0.153
	[0.206]	[0.207]+	[0.200]+	[0.158]	[0.194]	[0.216]	[0.205]	[0.166]
Disabled for 2-3 years ✕ Unable to do day-to-day activities	0.335	0.318	0.075	-0.120	0.061	-0.019	-0.654	0.006
	[0.273]	[0.275]	[0.265]	[0.209]	[0.256]	[0.286]	[0.271]*	[0.219]
Disabled for 3-4 years ✕ Unable to do day-to-day activities	-0.476	0.028	0.241	0.197	0.325	-0.517	-0.282	-0.369
	[0.309]	[0.311]	[0.300]	[0.237]	[0.290]	[0.324]	[0.307]	[0.248]
Disabled for 4 years or more ✕ Unable to do day-to-day activities	-0.755	-0.147	-0.059	-0.107	-0.120	-0.065	-0.459	-0.433
	[0.220]**	[0.222]	[0.214]	[0.169]	[0.207]	[0.231]	[0.219]*	[0.177]*
Log of real equivalent household income (IV)	0.103	0.723	0.310	0.214	0.332	-0.469	-0.008	0.327
	[0.147]	[0.148]**	[0.143]*	[0.113]+	[0.138]*	[0.154]**	[0.146]	[0.118]**
Age: 25-34	0.038	-0.071	-0.065	-0.047	-0.018	0.091	-0.033	-0.019
	[0.043]	[0.044]	[0.042]	[0.033]	[0.041]	[0.045]*	[0.043]	[0.035]
Age: 35-44	0.032	-0.088	-0.025	-0.117	0.077	0.215	0.018	-0.036
	[0.055]	[0.056]	[0.054]	[0.042]**	[0.052]	[0.058]**	[0.055]	[0.044]
Age: 45-54	-0.004	-0.116	-0.015	-0.154	0.078	0.161	0.025	-0.060
	[0.067]	[0.067]+	[0.065]	[0.051]**	[0.063]	[0.070]*	[0.066]	[0.054]
Age: 55-64	0.068	-0.077	-0.002	-0.109	0.195	0.212	0.134	0.043
	[0.074]	[0.074]	[0.072]	[0.056]+	[0.069]**	[0.077]**	[0.073]+	[0.059]
Age: 65+	0.114	-0.094	-0.046	-0.094	0.206	0.192	0.166	0.080
	[0.086]	[0.087]	[0.084]	[0.066]	[0.081]*	[0.091]*	[0.086]+	[0.069]
Living as a couple	-0.030	0.060	-0.048	0.012	0.116	0.089	0.063	0.029
	[0.030]	[0.030]*	[0.029]+	[0.023]	[0.028]**	[0.032]**	[0.030]*	[0.024]
Widowed	-0.402	-0.111	-0.303	0.302	0.231	-0.164	0.269	0.050
	[0.239]+	[0.241]	[0.232]	[0.183]+	[0.225]	[0.251]	[0.238]	[0.192]
Divorced	-0.148	-0.309	-0.199	-0.146	0.063	-0.003	-0.089	0.024
	[0.117]	[0.118]**	[0.114]+	[0.090]	[0.110]	[0.123]	[0.116]	[0.094]
Separated	-0.148	-0.159	-0.359	-1.674	0.233	-0.135	-0.050	-0.591
	[0.140]	[0.141]	[0.136]**	[0.107]**	[0.132]+	[0.147]	[0.139]	[0.113]**
Never married	-0.112	0.253	0.094	-0.350	0.414	0.297	0.369	0.054
	[0.057]+	[0.057]**	[0.055]+	[0.044]**	[0.054]**	[0.060]**	[0.057]**	[0.046]
Unemployed	-0.021	-0.694	0.030	0.026	-0.109	0.442	0.038	-0.141
	[0.045]	[0.045]**	[0.044]	[0.035]	[0.042]*	[0.047]**	[0.045]	[0.036]**
Self-employed	0.032	0.072	-0.009	0.010	-0.035	-0.084	-0.076	-0.001
	[0.035]	[0.035]*	[0.034]	[0.027]	[0.033]	[0.037]*	[0.035]*	[0.028]
Retired	-0.040	-0.091	0.130	0.085	0.036	0.553	0.131	0.094
	[0.048]	[0.048]+	[0.046]**	[0.037]*	[0.045]	[0.050]**	[0.047]**	[0.038]*
Not active in the labour market	-0.052	-0.181	0.071	0.052	-0.088	0.190	0.008	0.043
	[0.035]	[0.035]**	[0.034]*	[0.026]+	[0.032]**	[0.036]**	[0.034]	[0.028]

Completed first degree	0.000	-0.013	-0.095	0.026	-0.194	0.014	-0.175	-0.013
	[0.073]	[0.074]	[0.071]	[0.056]	[0.069]**	[0.077]	[0.073]*	[0.059]
Completed higher degree	0.078	-0.053	-0.125	0.180	-0.224	0.209	0.121	0.010
	[0.136]	[0.137]	[0.132]	[0.104]+	[0.128]+	[0.143]	[0.135]	[0.109]
Household size	-0.013	-0.076	-0.083	-0.081	-0.079	-0.065	-0.082	-0.074
	[0.018]	[0.018]**	[0.017]**	[0.013]**	[0.016]**	[0.018]**	[0.017]**	[0.014]**
Number of dependent children (age < 16)	0.021	0.100	0.076	0.037	-0.042	-0.189	-0.052	0.081
	[0.031]	[0.031]**	[0.030]*	[0.024]	[0.029]	[0.033]**	[0.031]+	[0.025]**
Overall R-squared	0.2130	0.0450	0.0299	0.0297	0.0656	0.1574	0.0839	0.0726

Note: N=61,398. All equations included year dummies and other household members' employment statuses. See also Table 2 for reference groups.
+<10%, *< 5%, ** < 1%. Standard errors are in parentheses.

Figure 2: The dynamic effects of disability on domain satisfactions

Fig 2a: Effects on satisfaction with health

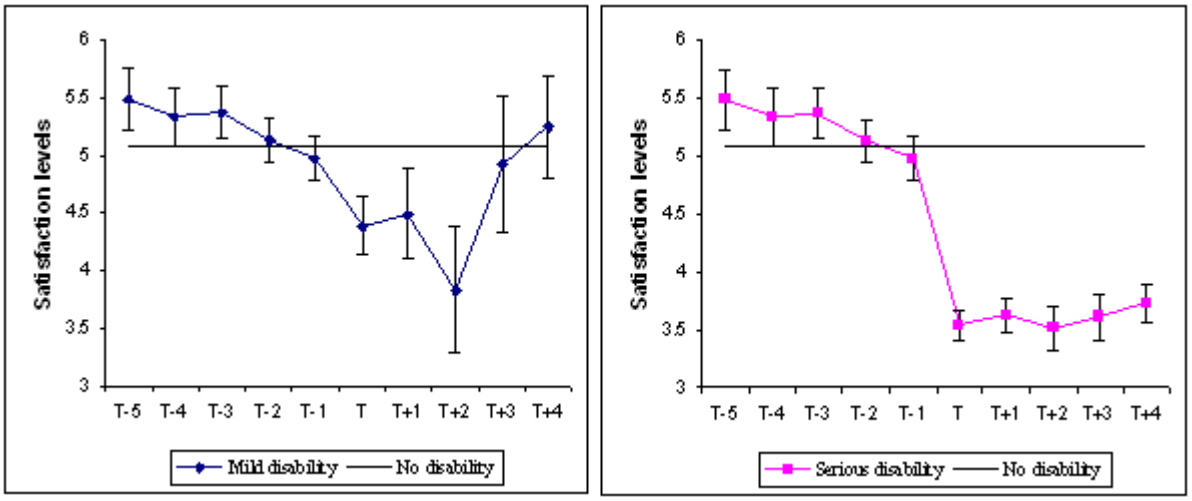


Fig 2b: Effects on satisfaction with income

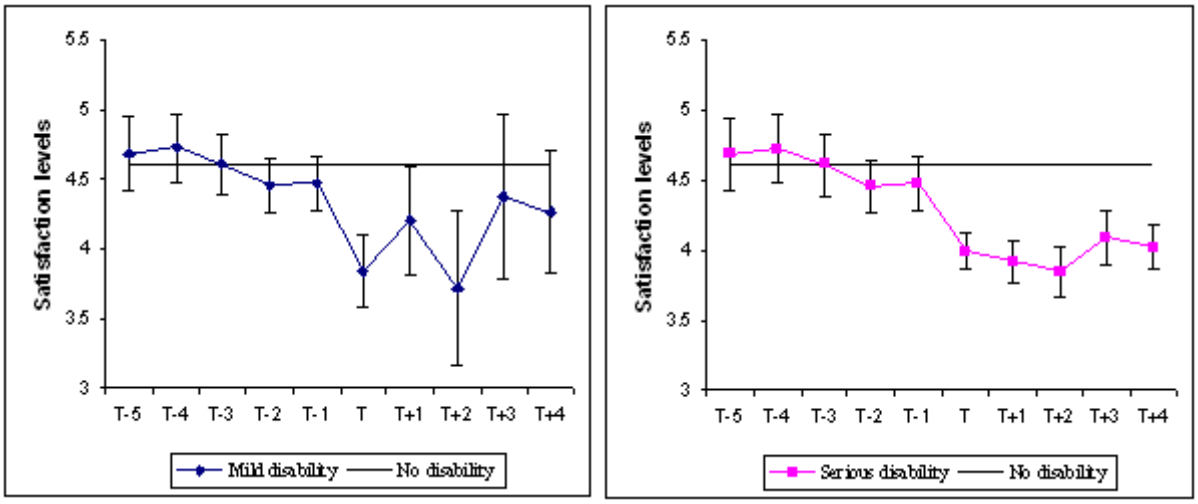


Fig 2c: Effects on satisfaction with housing

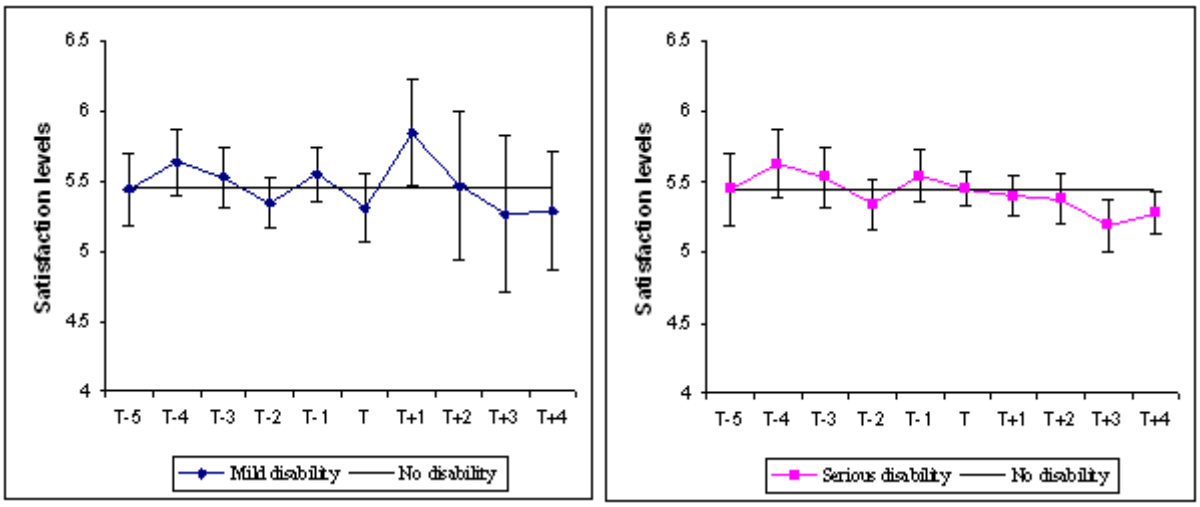


Fig 2d: Effects on satisfaction with partner

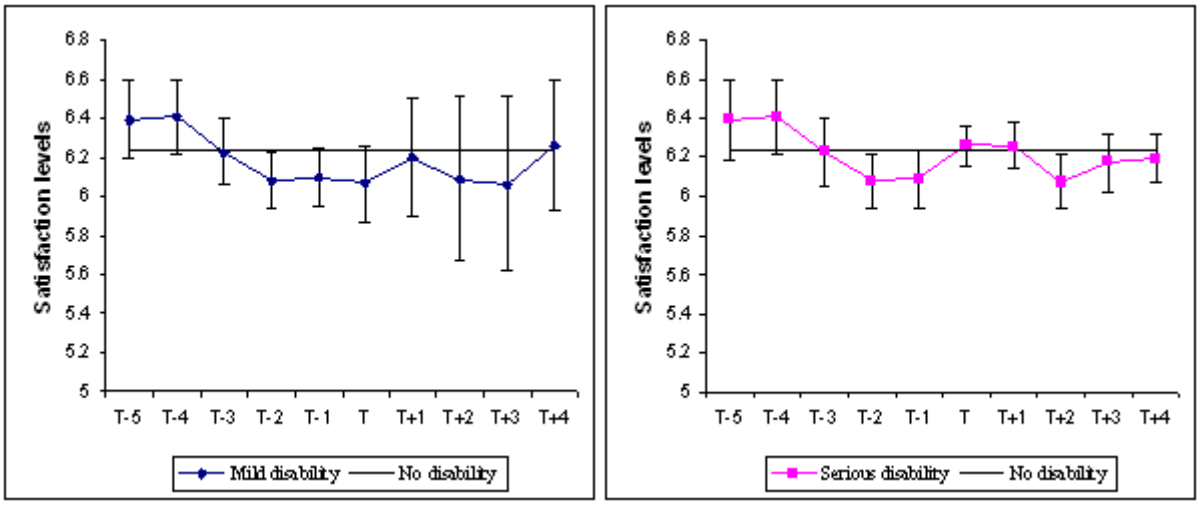


Fig 2e: Effects on satisfaction with social life

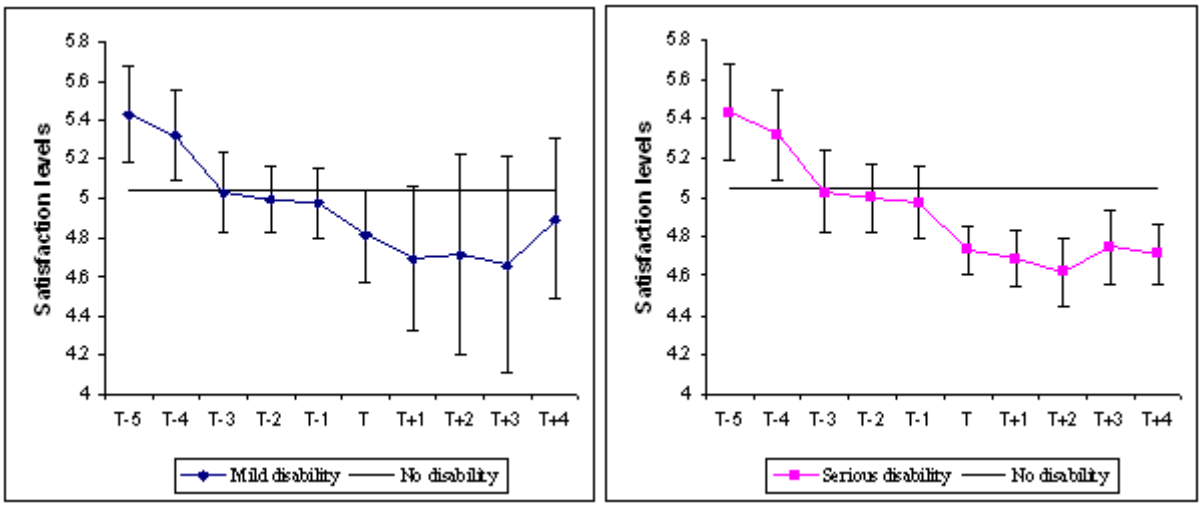


Fig 2f: Effects on satisfaction with amount of leisure time

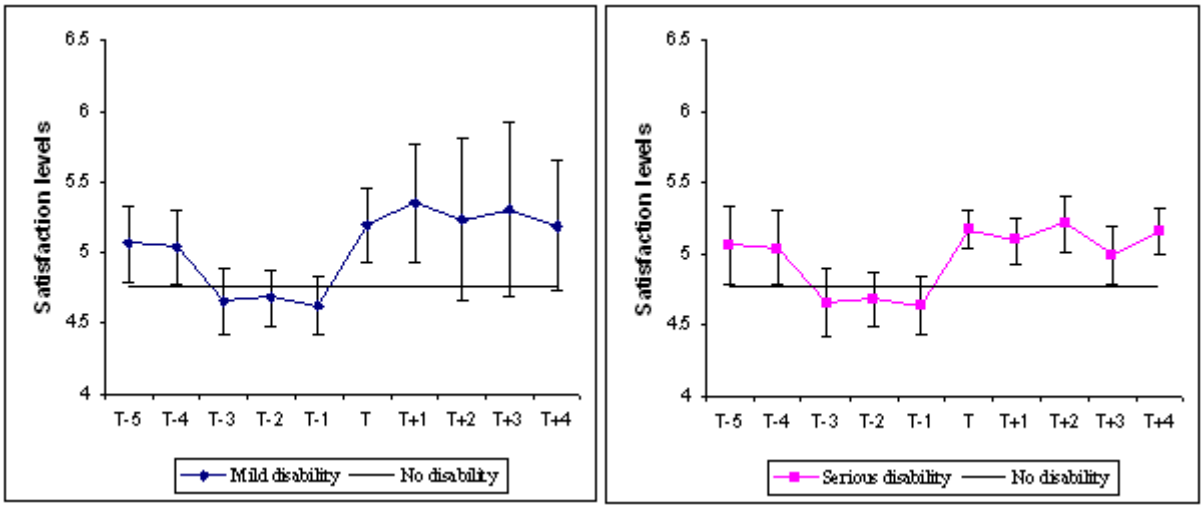


Fig 2g: Effects on satisfaction with use of leisure time

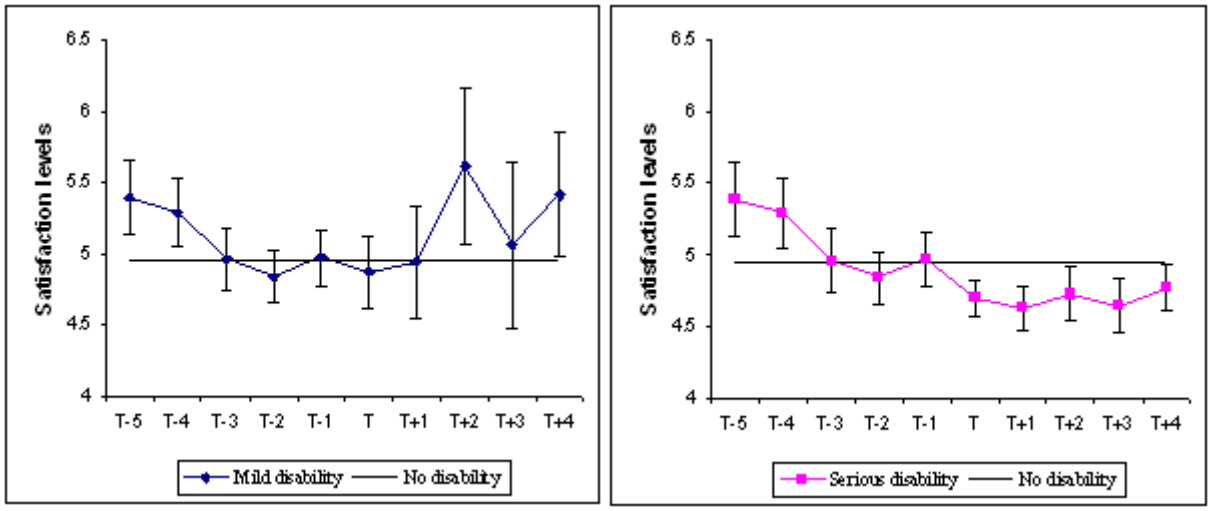
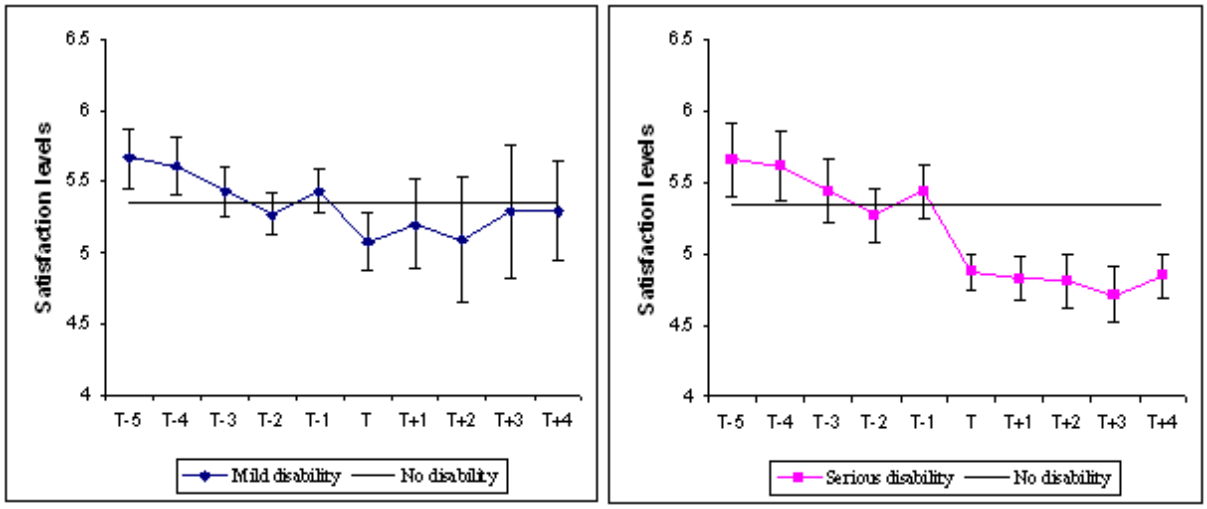


Fig 2h: Effects on life satisfaction



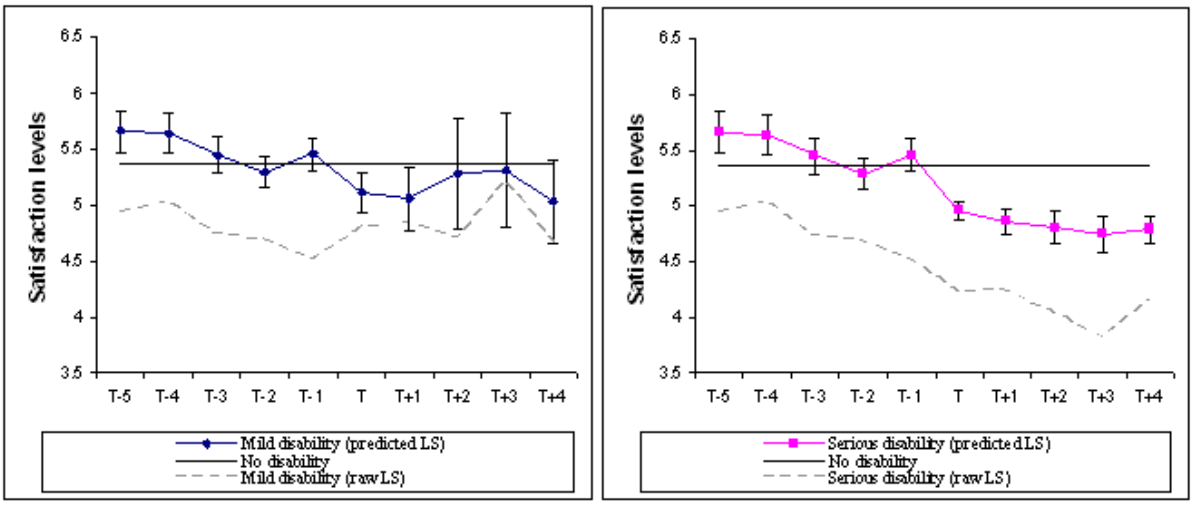
Note: Year T indicates the year of declaring disability. 4-standard-error bands (95% C.I.) are reported: two s.e. above and two below. The horizontal lines represent the average satisfaction levels for those who remained able-bodied throughout the panel.

Table 3: Fixed effects life satisfaction regression, BHPS 1996-2005

Dependent variable: Life satisfaction	Assuming flexible weights of DS on LS
Health satisfaction	0.113
	[0.005]**
Income satisfaction	0.094
	[0.005]**
Housing satisfaction	0.056
	[0.005]**
Partner satisfaction	0.188
	[0.006]**
Social life satisfaction	0.144
	[0.008]**
Leisure time (amount) satisfaction	0.056
	[0.007]**
Leisure time (use of) satisfaction	0.126
	[0.007]**
Constant	1.255
	[0.163]**
Observations	61398
Number of person	12986
Overall R-squared	0.5612

Note: ** < 1%. Standard errors are in parentheses. Other controls include the lead and lag disability variables, the inability to do day-to-day activities variable, and the three-way interaction between DS, lead and lag disability, and the inability to do day-to-day activities variables (157 coefficients).

Figure 3: Predicted life satisfaction before and after disability



Note: See Figure 2. The above predicted satisfaction levels are based on the estimates obtained from Tables 2 and 3. The broken lines represent the raw data on *LS*.