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Does Happiness Adapt? A Longitudinal Study of Disability with Implications for Economists and Judges

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ABSTRACT

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Economics ignores the possibility of hedonic adaptation (the idea that people bounce back from utility shocks). This paper argues that economists are wrong to do so. It provides longitudinal evidence that individuals who become disabled go on to exhibit recovery in mental wellbeing. Adaptation to severe disability, however, is shown to be incomplete. The paper suggests ways to calculate the level of compensatory damages for the pain and suffering from disablement. Courts all over the world currently use *ad hoc* methods.

JEL Classification: D1, I3, I31, K0

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1. Introduction

Although new research is expanding our view of how economic policies might be designed (Easterlin 2003, Frey and Stutzer 2000, Helliwell 2006), economists continue to have a simple view of the nature of a person's wellbeing. This paper explores one way to extend the standard conception of utility. It argues that human beings exhibit hedonic adaptation. As usual in empirical research, a central issue is that of statistical identification. Using data on a life event that could be thought of as exogenous -- becoming disabled -- the paper studies adaptation.

Much work in psychology journals asserts that happiness bounces back after a bad life shock. The economics literature, however, assumes a given utility function, u(x). When deciding on compensatory damages, the courts in western countries do as well. While it is not clear why there is such a divide between economists and psychologists, there are perhaps two reasons. First, the quality of the evidence is currently viewed by economists as poor. One of the most famous papers is Brickman *et al* (1978). This work is widely cited but often misquoted. It is sometimes claimed in the literature that these authors demonstrate that lottery winners are no happier than non-winners and paraplegics are as happy as able-bodied individuals. In fact, the paper, which uses tiny cross-sections, does not say either of these things. Brickman *et al* report data in which disabled people do have lower life-satisfaction scores than the able-bodied, and this difference, when compared to a control group, is statistically significant at conventional levels. Moreover, lottery winners do have higher life-satisfaction scores than the controls, although the null hypothesis of no difference cannot be rejected at the 5% level. Second, one part of the psychology literature proposes the so-called 'set point hypothesis', which is the idea that people adapt completely to life shocks. Rightly or wrongly, economists view this position -- that utility effectively cannot be altered by outside events -- as so implausible that it is not worth considering. These attitudes have kept economists and psychologists apart.

In this paper we use British data to study whether happiness levels adapt (a phenomenon sometimes described as 'habituation'). Frederick and Loewenstein

(1999) call this hedonic adaptation. Another term is affective adaptation, which is the process, to quote Wilson and Gilbert's (2005) definition, whereby affective responses weaken after one or more exposures to a stimulus. A valuable discussion, with examples, is given in Lucas *et al* (2003). Earlier evidence is discussed in Argyle (1989) and Diener *et al* (1999).

Easterlin (2001, 2003, 2005) argues that adaptation is generally incomplete, namely, that people do not merely automatically bounce back to a baseline level of happiness. Clark and Oswald (1994) discuss partial adaptation by the long-term unemployed. Easterlin (2005) examines the idea of different rates of habituation across different domains of life. Becker and Rayo (2004) and Wilson and Gilbert (2005) are conceptual papers. The first, by two economists, likens hedonic adaptation to the ability of the human eye to adjust quickly -- for sound reasons of self-preservation -- to changes in the amount of light. Becker and Rayo set out a mathematical model of how Nature might optimally have designed human beings' emotional responses to behave a similar way. The second paper, by two psychologists, is rather different. It views humans as learning to change what they attend to and how they react. Wilson and Gilbert suggest that hedonic adaptation is not reducible to the type of adaptation found in the sensory or motor systems. The authors argue that affective habituation stems instead from the internal human need, and ability, to explain and make sense of stimuli. They advocate what they describe as an AREA model: attend; react; explain; adapt.

Riis *et al* (2005) also discuss the phenomenon of adaptation. Using an ecological momentary-assessment measure of mood, the authors find little evidence that hemodialysis patients are less happy than healthy people. The authors hence suggest that patients in the sample have largely adapted to their condition; they show that, in a forecasting task, healthy people fail to anticipate this bounce-back in wellbeing. Affective forecasting is known to be imperfect (Gilbert *et al* 1998, 2002; Ubel *et al* 2005). Other investigators, such as Clark (1999), Clark *et al* (2004), Stutzer (2004) Layard (2005, 2006) and Di Tella, Haisken and MacCulloch (2005), have begun to consider the economic implications of how people adapt. Kahneman and Sugden (2005) discuss the policy implications of allowing for adaptation in experienced utility. Di Tella, MacCulloch and Oswald (2001, 2003) study adaptation of national happiness to movements in real income. By estimating dynamic equations, they find evidence that the wellbeing consequences of shocks to gross domestic product eventually wear off. Their 2003 paper seems to be the first in the

wellbeing research literature to suggest a practical way to use difference equations to solve out for a steady-state level of habituation. In principle, the adaptation literature is also related to work on habit formation, such as Carroll *et al* (2000) and Carroll and Weil (1994), and potentially to work on broader conceptions of preferences such as Frey and Meier (2004); but potential links have not, to our knowledge, been explored. Currently, the economics literature on adaptation is small, and the extent of any hedonic adaptation in the world is imperfectly understood.

As well as being of theoretical interest, adaptation has practical implications. Consider a judge who, in a world where people adapt, is trying to decide on the necessary level of compensation to award someone who has negligently suffered a bad life event, L. Initially, the judge must estimate the immediate drop in happiness caused by L upon the person's life. Then the judge must make an adjustment for the way the person's utility may automatically rebound.

Legal scholars have written little on this issue, and judges use mechanical rules of thumb with conceptual foundations that are, at best, *ad hoc* (see, for example, pages 345-347 of Elliott and Quinn, 2005). However, in a somewhat related spirit, Posner (2000) argues persuasively for a better understanding of the emotions. Posner and Sunstein (2005) discuss similar ideas.

2. Concepts

For clarity of exposition, let an individual's utility or happiness be given by a simple separable function

$$V = v(y) + h \qquad (1)$$

where v(.) is increasing and concave in the person's income, y, and h is some measure of overall health. After a disabling shock at time T, which makes work impossible, wellbeing drops to

$$V = v(z) + h - D \qquad (2)$$

where D is to be thought of as being in disutility units and z is some external (possibly government benefit) financial support. Assume y strictly greater than z.

Because of the assumption of adaptation, define a habituation function D = D(t – T), where t is the current time period, T was the original date of disability, and the first derivative of the function D(.) is negative.

Consider the simplest approach. If a judge's aim is, *ex post*, to redress the individual's fortunes and restore his or her original utility level, the optimal compensation is a monetary payment c* that provides equality of utility levels in the two states.

At the general level, therefore, there exists an implicit function tying together income, compensation, external support, time, and time of the disability shock:

$$J(y,c,z,t,T) = 0. \qquad (3)$$

Solving J = 0 more explicitly under the simple assumptions given above, movements in compensation c* are governed locally by the equation

$$0 = v'(y)dy - v'(c^* + z)dc^* - v'(c^* + z)dz + D'(t - T)dt \qquad (4)$$

and the key signs of the partial derivatives of the optimal payment function with respect to time since disability, t, income, y, and outside support, z, are then respectively negative, positive, and minus unity.

First, as time t lengthens from the onset of disability, the compensation level c* falls. This is because psychological adaptation gradually reduces the unhappiness caused by the disability. Second, the higher is the person's pre-disability income, the greater is c*. This says simply that high-wage workers should be compensated more generously for disability. Third, a larger amount of external support z leads to a reduction in compensation c* by an exactly offsetting amount. This is because court settlements can be less generous where other funds become open to disabled individuals. A reasonable question to ask is why insurance is not included in the analytical framework. We deliberately leave this to one side. Except in a world with full insurance markets, it does not alter the underlying principle that judges will need to prescribe, or implicitly bear in mind the case for, time-contingent compensation.

Although these functional forms are deliberately elementary, the principles go through with non-separable wellbeing equations and more complex forms of income pre- and post-disability. Time-varying consumption payments will be a typical, not special, outcome in a world with hedonic adaptation (although judges might choose formally to make an award as a single lump-sum).

3. Implementing a Test

Do people bounce back from a bad life event? A longitudinal test is required. To be persuasive, it should have a number of features:

(i) the individuals in the sample must be followed over a reasonably long period, so that information on them is available before a bad life event and afterwards;

(ii) the bad life event must be exogenous;

(iii) there needs to be a comparison group of individuals who do not suffer the event;

(iv) the sample should be at least moderately representative of the adult population;

(v) a set of controls, particularly income, has to be available in the data set, so that confounding influences can be differenced out.

No study of this type has been published (some, including Clark *et al* 2004 and Riis *et al* 2005, and the seminal panel-data paper on unemployment by Winkelmann and Winkelmann 1998, satisfy a number of these requirements).

One example of a life event is disability. Although tragic for the individual, for scientific investigators this phenomenon has valuable features. First, it might be viewed -- like the heart conditions studied by Wu (2001) -- as an approximately exogenous event. Hence it contrasts with the (interesting) phenomena of, say, income changes and divorce, which have been studied longitudinally. Second, going back at least to Brickman *et al* (1978), there has been an inconclusive psychological research literature on whether people's wellbeing recovers fully from disability. In a large cross-section, Ville and Lavaud (2001) show that more severely impaired people have lower wellbeing, although age and time-since-the-disability are not statistically significant predictors. In a small cross-section, Chase, Cornille and English (2000) also find that the extent of disability is negatively correlated with life satisfaction. Yet, as explained earlier, Riis *et al* (2005) do conclude in favour of extreme adaptation to hemodialysis. Third, the courts routinely consider damage-

claims for disability, but currently appear to have no rigorous way to assess mental damages or pain-and-suffering, so the issue is of practical significance.

This paper proposes a test. The source used in the paper is the British Household Panel Survey (BHPS). This is a nationally representative sample of British households, which contains over 10,000 adult individuals, conducted between September and Christmas of each year from 1991 (see Taylor *et al*, 2002). Respondents are interviewed in successive waves; households who move to a new residence are interviewed at their new location; if an individual splits off from the original household, the adult members of their new household are also interviewed. Children are interviewed once they reach 11 years old. The sample has remained representative of the British population since the early 1990s.

For 1996 to 2002, psychological wellbeing scores on each person are available. Respondents also provide information on physical disability, which is available from 1991 onwards. To try to obtain clear results, we focus on quite serious levels of impairment, and therefore look at people who say that they are sufficiently disabled that they are unable to work. In the entire data set of seven years, there are approximately 60,000 person-year observations. Within this, there are approximately 2500 person-year observations of disability.

The paper draws on two survey questions. These are: (i) *What describes your current situation … long term sick or disabled?* (ii) *Does your health in any way limit your daily activities compared to most people your age?*

One empirical category that we employ is 'disabled but able to do day-to-day activities including housework, climbing stairs, dressing oneself, and walking for at least 10 minutes'. We sometimes denote this Disabled, with an uppercase letter. The other, even more fundamentally impaired, category is 'disabled and unable to do at least one of the above day-to-day activities.' We term this group the Seriously Disabled. There are 315 observations (ie. person-years) in the first category. There are 2204 observations in the second category. It might seem surprising that the Seriously Disabled outnumber the less severely disabled, but that is because all these individuals are sufficiently incapacitated that they cannot work, and this is more commonly accompanied by a severe physical handicap.

4. Simple Longitudinal Plots

When trying to understand the consequences of an event like disability, it is necessary to go beyond the pecuniary. Mental distress itself must somehow be empirically captured. The analysis uses reported life-satisfaction scores as psychological wellbeing, or proxy-utility, measures. These life satisfaction levels run from 1 to 7. A natural way to think about people's answers is as being true 'utility levels' measured with some reporting error. Watson and Clark (1991) defend the use of such data. Oswald (1997) and Frey and Stutzer (2002a,b) summarize the ways in which reported wellbeing numbers' validity has been checked. Blanchflower and Oswald (2004) show that, where data on both are available, happiness equations and life-satisfaction equations have almost identical structures.

In these data, disabled people are less happy than the able-bodied. On a 1 to 7 scale, the mean life-satisfaction score of Not Disabled individuals in our data set is 5.28. It has a standard deviation of 1.27. The 315 people who are disabled but able to do day-to-day activities are less happy than average. Their mean life-satisfaction score is 4.69, with a standard deviation of 1.67. The 2204 severely disabled individuals, who cannot do those activities, are worse off still. Their mean wellbeing score is 4.05, with a standard deviation of 1.78. The Appendix gives more details on the data.

As would be expected, there are some people (129 to be exact) who report disability in every year of the panel. These observations are not the most helpful scientifically, because they provide no information about transitions into disability. Nevertheless, they contribute a cross-sectional dimension to the measurement of happiness and disability. The gap in reported life satisfaction scores between these 'always disabled' individuals and the 'always able-bodied' can be calculated. It is depicted -- in a raw sense without control variables -- in Figure 1. The 13,776 people who never report disability have a mean wellbeing score of approximately 5.3 on a 1 to 7 scale. Those who are constantly disabled, marked in the Figure by the lighter line below the heavy line, have a mean score of approximately 4.3. Hence the raw difference caused by disability is approximately 1 life-satisfaction point. This can be thought of as fairly large, because it is a little less than one standard deviation of mean wellbeing. Although Figure 1 should not be thought of as an accurate estimate -- it does not factor out other differences in people's lives -- this is a first attempt at a quantitative illustration of the happiness cost of disability.

In this data set, it is possible to follow people longitudinally in the years before and after they become disabled. There are some hundreds of observations on entry into disability. In principle, information on these 'switchers' is particularly valuable.

Figure 2 is a longitudinal plot of mental wellbeing for those who go on to be disabled. Here the disability category includes both kinds in the data set ('able' and 'unable' to do day-to-day things). Time T is the year of entry into disability. In effect, this plot averages across those who are newly disabled in each of the different calendar years within the data set. There are 200 people on whom there are at least three consecutive years of wellbeing data. Figure 2 reveals that life-satisfaction slightly exceeds 4.2 in year T-1. It falls abruptly, to approximately 3.9, in the actual year that the person reports being disabled. But then life-satisfaction in Table 2 rises back somewhat, to nearly 4.1 in T+1. In Figure 3, there is evidence consistent with an even more dramatic bounce-back in mental wellbeing. Nevertheless, a word of caution is necessary. There is much inherent variation in wellbeing scores. As explained below them, the points in the Figures have large standard errors attached.

Figure 4 plots the mean life-satisfaction scores, again annually, of those in the sample who became severely disabled at time T. The graph also records the mean level in the year prior to disability and the mean level in the year after disability. Here the usable sample is 165 people. Before disability strikes, the individuals have an average wellbeing level of 4.2. Once they become disabled, life satisfaction falls to a little below 3.9. One year later, wellbeing has recovered fractionally, to almost 4.0.

The recovery in reported life satisfaction is starker in Figure 5. Here the sample is small, at only 52 people. Nevertheless, Figure 2's general idea remains visible (though in Figure 3, the first year, to T+1, sees no recovery, which is perhaps because the individuals here are even more seriously impaired that those in Figure 4). By T+2, nevertheless, life satisfaction of the Seriously Disabled group is half-way back to the level at which it began.

One notable fact about the Figures is that the pre-disability levels of life satisfaction in Figures 2-5 are low. The T-1 values, which are officially when the people were still able-bodied, are similar to those in the lower line in Figure 1, which plots the values of life satisfaction of those continuously disabled throughout the sample period. If disability struck randomly, and in a way that is independent of other personal characteristics, then what might be expected is that the gap between the two lines in

Figure 1 (of about one wellbeing point) would be similar to the gap between the high and low points in a graph like Figure 2 (of only about one third of a wellbeing point). This is not a fatal difficulty for the study, and is inescapable in real-world data sets, but it is a reminder that disability is probably often preceded by a slow worsening of health or functioning.

It might be thought that a low level of measured wellbeing prior to entering disability at time T inevitably compromises disability's claim to be seen as an exogenous variable. But such an argument is incorrect. Consider a person who gradually becomes ill through the years -- eventually recording themselves as disabled in time period T. The person's move from equation 1 to 2 is still exogenous. Nevertheless, the existence of such individuals in the data set will contribute a downward bias to the parameter estimate on disability in a wellbeing equation.

Finally, as an additional check on the issue of exogeneity, although the sample size is now necessarily tiny, and standard errors are poorly determined, Figure 6 provides the equivalent plot for the case of disability through an accident.

5. Other Influences

Although intriguing and stark, the patterns in Figures 2 to 5 do not control for other factors and, as explained below the graphs, often have quite large standard errors attached to them. Table 1 therefore moves to more formal econometric evidence. It presents simple ordinary least squares estimates. The dependent variable is life satisfaction measured cardinally (again, on the 1 to 7 scale). All the paper's results can be replicated with ordered estimators, but, as in the important paper by Luttmer (2005), for clarity of exposition we stick to elementary methods. Disability -- measured in two ways -- is the key independent variable. In columns 1 and 3, only exogenous regressors are included. These are gender and age. For the sake of generality, age is entered as a third-order polynomial; it has close to the literature's U-shape, minimising in the early 40s, although then runs fairly flat into later old age. Throughout this paper, we use a robust estimator of variance because random disturbances are potentially correlated within groups of the same individual in the panel.

The coefficient on the milder of the two disability variables, in column I, is -0.527. Its standard error is 0.111, so the null of zero is rejected at all usual confidence levels.

Being Disabled here (where the person is able to do day-to-day activities) is thus associated with a mental wellbeing penalty of approximately 0.5 life satisfaction points. An equivalent calculation is given in column III. In this case, in line with what intuition would expect, the Seriously Disabled (where the person is unable to do day-to-day activities) are much worse off and report 1.247 fewer life-satisfaction points.

In columns II and IV of Table 1, dummy variables are included for people's qualifications. Educational level in many circumstances will be an approximately predetermined variable (though this will not be true of those who were disabled in childhood). Perhaps surprisingly, the coefficients on disability in Table 1's life satisfaction equations are left effectively unchanged by the educational controls. Although an exact comparison is not possible, an interesting result of Smith *et al* (2005), on a sample of adults approaching retirement age, runs somewhat counter to this. The authors argue that assets -- on which we do not have data -- can psychologically cushion people who encounter a period of disability. Assets and educational level are likely to be systematically positively correlated. Smith *et al* (2005) also provide evidence that disability lowers psychological wellbeing, although an exact comparison with our results is not possible because the authors do not distinguish between one period of disability and continuing disability.

A longer set of controls is introduced in the life satisfaction equations of Table 2. In column I, it can be seen that, when compared to the numbers in Table 1, the estimates of disability's effect upon wellbeing are reduced only very fractionally by the allowance for extra regressors. The coefficients on the two kinds of disability are now, respectively, -0.464 and -1.144.

6. Monetary Compensation and Disability: A Time Path

In Table 2, and in almost all remaining tables, a variable is included for real income. It enters positively; richer people report higher levels of life satisfaction. The income coefficient is approximately 0.008, with a standard error of 0.001. This suggests a simple calculation.

Like Clark and Oswald (2002), Van Praag and Ferrer-I-Carbonell (2004) and Powdthavee (2005), we can ask the conceptual question: how much extra real income would be required to exactly compensate someone for a change in another of the influences upon wellbeing (in this particular case, for disability)? With a

coefficient of 0.008, and bearing in mind that the units of income are in thousands of pounds sterling, it follows that approximately £125,000 pounds (which is approximately $220,000 US dollars) extra per annum would buy one extra point of life satisfaction. Hence to compensate for being Disabled would here require an extra £58,000 per year. To compensate people in the Seriously Disabled category would require £143,000 per year. Interestingly, these sums are many multiples of the judicial rule-of-thumb amounts in, for instance, Elliott and Quinn (2005), p. 345.

These figures, however, make no allowance for emotional habituation or, put more simply, the idea that the intensity of feelings may wear off. How can such adaptation be studied in a regression framework? The paper does this in the following way. It defines in Table 2 a variable for the amount of time people have previously spent disabled. That fraction of time is then included in wellbeing equations to see if, in the current period, ceteris paribus, past experience softens the psychological blow of current disability.

The paper creates a variable "Past disability from t-3 to t-1" and an equivalent one "Past disability from t-6 to t-1". Each is constructed to take values between zero and unity. A person who has been disabled for one previous year in the last three years, for example, will have the value 1/3 for his or her past disability from t-3 to t-1.

More fully:
"Past disability from t-3 to t-1"
= 0 if no previous years of disability
= 1/3 if one previous year of disability
= 2/3 if two previous years of disability
= 1 if all three previous years were of disability.

Equivalently,
"Past disability from t-6 to t-1"
= 0 if no previous years of disability
= 1/6 if one previous year of disability
= 2/6 if two previous years of disability
…
= 1 if all six previous years were of disability

As part of the empirical strategy, these variables are entered separately and interacted with measures of current disability.

Table 2 explores what happens when the history-of-disability variables are incorporated into wellbeing equations. In column II, having past disability as a variable makes only a small difference. The long-run effects of each of the two forms of disability are now respectively (-0.281 + -0.369) and (-0.902 + -0.369), so they imply respective life-satisfaction penalties of approximately 0.6 points for Disabled and 1.3 points for Seriously Disabled.

In columns III and IV of Table 2, interaction terms are now included in the equations. These are statistically well-determined. They allow crude measures of adaptation rates to be inferred from the regression equations. For example, consider column III of Table 2. A Disabled person who had been disabled for zero previous years would have a life satisfaction penalty = -0.598. A person who been Disabled for one previous year out of the last three would have a combined life satisfaction penalty of (-0.598) plus (1/3)(-0.827) plus 1/3(1.106) = -0.505. Someone who had been Disabled for two previous years out of the last three would have a combined life satisfaction penalty of (-0.598) plus (2/3)(-0.827) plus (2/3)(1.106) = -0.412. A person who had been Disabled for all three previous years out of the last three would have a combined life satisfaction penalty of (-0.598) plus (-0.827) plus (1.106) = -0.319. In short, the longer the experience of disability, the less emotionally painful current disability appears to be. Loosely, the life satisfaction points lost are 0.6 in the first year of this form of disability, 0.5 in the second, 0.4 in the third, and 0.3 in the fourth. This is a particularly simple attempt to estimate dynamics from Table 2, of course, and a later part of the paper examines an alternative using fixed-effect estimates.

When the most severe kind of disability is examined (that is, Seriously Disabled, which is the ‘unable to do day-to-day activities’ category of disability), the effects on wellbeing persist more strongly. The unhappiness from such disability does not wear off quickly. Using the earlier methodology, it can be checked from column III of Table 2 that zero past Serious Disability corresponds to a psychological effect of -1.228. One year of past severe disability makes little difference to this; the current unhappiness effect drops to -1.184. Two years leads to -1.140. Even three full years of this type of disability produces only mild attenuation. The effect upon wellbeing declines marginally to -1.095. Table 2 also includes, for completeness, some

estimates with a six-year measure of past disability. A bottom-line number can be calculated. To compensate someone in the short run for being seriously disabled, then, would require a large enough flow of income to overcome a life-satisfaction penalty of more than 1.2 points. In terms of monetary payment, this equates to approximately £150,000 pounds a year.

These broad patterns are robust across sub-samples. Table 3 shows that the same equation structure holds, with well-defined coefficients, for men and women, the young and the old, and graduates and non-graduates.

To this point in the estimation, income has been assumed to enter linearly in the equations. Table 4 demonstrates that concave effects can be found – in quadratic form and in logarithmic form. These imply, because the marginal utility of income is then declining, that much larger monetary amounts would be required to compensate for disability. Depending on specification, disability compensation might here have to approach enormous annual sums -- up to ten times as high as the earlier figures based on linear specifications. Oswald (2005) points out that, when it moves from the study of first derivatives to the study of second derivatives, happiness research has to make more stringent assumptions about human beings' implicit reporting-function from actual to reported happiness. Future analytical work may have to return to this issue. It is perhaps not impossible, at some point in the future, that large amounts of money will turn on expert witnesses' ability to convince judges of the need for a particular set of non-linear income terms in a subjective wellbeing regression equation.

These regressions are cross-sectional. In order to difference out people's unobservable dispositions, a fixed effects estimator is used in Tables 5 and 6. Both provide within-groups equations.

Table 5 has no controls and can be thought of as measuring the reduced-form consequences of 'switching' into disability. Interestingly, the life satisfaction penalty associated with the milder form of disability is now statistically insignificantly different from zero. It has a coefficient of -0.024 with a standard error of 0.075. Severe disability, by contrast, continues to have a well-determined negative effect upon people's lives, though it is smaller than in previous tables. The coefficient is -0.449 with a standard error of 0.041. Again, it would be straightforward to work out the income-equivalent value of the wellbeing fall.

Table 6 examines the time path of attenuation in the unhappiness from disability. For those in the milder category, who are Disabled (able), zero past disability is associated with -0.408 points of life satisfaction. Working through the numbers in column III of Table 6, one past year of disability corresponds to a net wellbeing effect from disability of -0.292. Two years translates to -0.0177. Three past years produces -0.0062 points. In conclusion, there is essentially no long run effect upon wellbeing from disability of this type. Adaptation is estimated to be approximately complete.

Nevertheless, for Seriously Disabled individuals, Table 6's fixed-effects estimates demonstrate that there is less than 100% adaptation. Zero past disability is associated with -0.596 fewer life satisfaction points. One year of past disability leads to the number -0.521; two years implies -0.447; three years implies -0.372.

Interestingly, the compensation numbers implied by fixed-effects estimation are considerably larger than earlier in the paper. Figures 7 and 8 illustrate the difference in one illustrative case. Table 7 re-does the estimated equation form for the interesting case of disability through accident. The same general pattern is maintained. However, the tiny sample size here makes us caution against any literal reading of this or the graph in Figure 7 (such as putting weight on the fact that wellbeing appears to end at a greater level). It is included here simply as a check on biases from endogeneity.

The paper's calculations should be viewed, of course, as being illustrative or pedagogical rather than substantive. After three years, adaptation is often far from complete. If we re-estimate with the t-6 variable, then we find after 6 years it is again incomplete, and that the implied payment trajectory is somewhat different from the t-3 case. Longer panels (than available to us) would be valuable. This would also allow surveyed individuals' actual compensation figures awarded by courts to figure in the regression calculations; our data set does not record these amounts in a sufficiently reliable way to make that possible.

7. Issues

A number of issues arise. One objection is that physical health automatically rebounds, so wellbeing also will, and that is not evidence of adaptation. This is a

strong argument. To try to get around it as effectively as possible, the paper's focus is upon individuals who continue to report themselves in the disabled category. Yet some people who suffer a permanent bad event like disabling illness may gradually recover psychologically as their physical health itself returns -- and the blind might, say, learn to read Braille and then mark themselves as happier in the next survey. Whether this is a compelling objection to the paper's key results is open to doubt. The reason is that within our disabled sample the reverse tendency will also be at work. There will be some individuals whose health, for reasons of an increasingly debilitating condition, is worsening rather than recovering. Ideally we would control for the severity of disability but in this data set our judgment is that it is not feasible to do so beyond the 2-category distinction (Disabled-able; Disabled-unable) currently used in the estimation.

The use of life-satisfaction scores is open to objection. Some proxy-utility measure, however, is required. The literature currently does not strongly favour one over another. Life satisfaction numbers may carry with them -- it could be argued -- the possibility that human beings 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 about what counts as being satisfied (one could imagine: 'I guess I am a happy 7, bearing in mind that I am disabled'). This is a point about the language of expressed satisfaction. There is probably no way to reject such concerns definitively, but one objection to it is that in Figure 1, and many tables, there is a continuing negative effect from longstanding disability; this seems inconsistent with the claim that disabled people fundamentally rescale their use of language. Moreover, as a variant to life-satisfaction data, the Appendix shows that the paper's general point goes through in an equation where the dependent variable is the number of times people say they are happy, which might be thought less vulnerable to this changed-use-of-language objection. The happiness dependent variable, although interesting, is available only for a single year in the British Household Panel, so cannot be analyzed longitudinally.

Finally, as a variant, re-doing the paper's equations and figures using a so-called GHQ mental wellbeing score taken from the same data set also shows evidence of a bounce-back in wellbeing. These results are available upon request.

A further concern is the possibility that people may change their reference groups. A newly disabled person might consciously or unconsciously alter whom they choose

as a comparator. However, to assume in the extreme that this makes the reported life-satisfaction numbers of only illusory value or that it implies any evidence of hedonic adaptation false is scientifically unattractive; it comes close to having a view of non-adapting utility functions that is unfalsifiable. Nevertheless, this is a potential area of weakness. It may be that future research on larger data sets can make progress by formulating econometric checks on comparator effects.

The paper's equations, it might be objected, implicitly assume cardinality and use linear econometric methods. Our aim here is partly pedagogical; it is to lay out a methodology in the simplest way. These estimates can be redone, without affecting the main point of the paper (though with loss of transparency in the ease of reading life-satisfaction scales), by using conventional ordered estimators.

Disability, it might be argued, is endogenous, and unhappy people may be intrinsically pessimistic and thus over-report ill-health and disability. The first point is difficult to rule out categorically. The reason this paper focuses on disability is that it seems closer to being truly exogenous -- and thus less susceptible to such an argument -- than most other life events. It is not correct, however, to suggest that the paper's correlations are due to any simple version of such an argument. The fixed-effects estimates imply that there is more going on in the data than an omitted personality variable for pessimism. The paper's Figure 6, moreover, might be seen as useful evidence in the case of accident-induced disability, which would seem to have a moderately strong claim to exogeneity.

Attrition from the panel may be a problem. As usual, this is both a sensible point in longitudinal work and one difficult to correct comprehensively. It might be argued that some of the most severely disabled individuals die disproportionately often, or move into hospital, and that this would give the mere appearance of adaptation because of a composition effect among those who remain in the sample. However, we estimated a logit -- with fixed effects -- on the chance of dropping out of our sample, and found that becoming disabled does not lead to a statistically significantly higher probability of dropping out next period. Moreover, an attrition argument cannot easily explain the recovery pattern among those tracked in Figures 2 to 5. Finally, the level of life satisfaction itself also turns out in the data not to be a significant predictor of who goes on to disappear from the panel in the next period.

Adaptation itself may use up psychological resources, so is costly and should be compensated, it could be suggested. To an economist, this point seems persuasive. We have been unable to think, however, how it could be implemented empirically in a way that would allow the financial compensation figures to be adjusted. Future research may have to return to this.

It might be asserted, perhaps, that the idea of using wellbeing data is unworkable in the courts because judges, lawyers and juries cannot be expected to understand the details of happiness regression equations. Yet a similar argument would have been made, back in the 1950s and 60s, against those economists who suggested that econometric methods should be employed by judges in legal cases. Today that is common in, for example, sex-discrimination trials.

A related objection is that mental-wellbeing data might be thought to be an inappropriate basis for compensation calculations. Physical incapacity and an inability to earn an income, might go this traditional argument, should be the only issue for the courts: pecuniary disadvantage alone ought to be counterbalanced by legal compensation. That view, however, does not appear to be overwhelmingly convincing. Emotional damage seems as important to human beings as physical damage or loss of earnings. In that case, happiness equations may be a useful tool for the courts. The background to this is that, in tort cases around the world, courts currently have to rely upon *ad hoc* methods to decide on emotional costs (so-called pain-and-suffering estimates).

Another potential objection is that income is not exogenous and wellbeing gain from money may itself wear off. Short of having randomly assigned income, as in lottery windfalls, there is little that can be definitively done about the endogeneity of incomes in standard data sets. However, if instruments could be found, it might be possible to adjust the estimated income parameters in a conventional econometric way. If there is habituation-to-income, as DiTella, Haisken and MacCulloch (2005) argue, then that can be incorporated both into the general method set and into actual financial compensation settlements. This point may be an important one and is likely to stimulate future work in the area. Nevertheless, when the life satisfaction equations in tables like Table 2 are re-estimated with lagged levels of income as extra regressors, which we have done as a check on the calculations, a positive steady-state effect of income (of approximately the same size as in Table 2) is found. Moreover, when Table 6 is re-estimated with a set of lagged income levels, only the

current level of income enters with a statistically significant coefficient. In this data set, we do not find strong evidence of habituation to income. Hence, such monetary adaptation has not been built in to the compensatory figures.

There are, some will argue, practical difficulties, and courts often award lump-sums rather flows of compensation. The first part of this objection is a fair one, but it misses the point of the paper. The purpose here is not to write a handbook for lawyers to carry in their back-pockets. It is to describe a tentative way of thinking about adaptation and a generic method for calculating the time path of payments that would be required to compensate individuals for bad life-events. Details -- and there will be many, including the issue of how to adjust for life events like divorce that have an endogenous component -- must be left for the future.

The courts can, of course, continue to award lump-sums for emotional damage. They need not in a literal sense award people a downward-sloping time-path of payments. The underlying point of the paper continues to go through, because adaptive speed affects the required compensation, and the analysis can be used to assess the appropriate discounted value of a single lump-sum payment to a disabled person.

The ethics of allowing for adaptation are potentially complicated. Menzel et al (2002) provides a review of the moral issues; it discusses the ethics of allowing for, or not allowing for, adaptation in individuals' valuations of health. At present, our judgment is that, although this is admittedly a sensitive area of human behaviour, a reasonably defensible case can be made for treating adaptation as a phenomenon that the courts should consider.

More broadly, this paper began by noting a divide between the psychology and economics journals. The existence of such a divide seems intellectually and practically unattractive – for both literatures.

The above results point to a middle ground between the traditional economist's model of zero adaptation and the extreme set-point model advocated by some authors in the psychology literature. In this sense, it appears to be compatible with a small number of emerging papers such as Lucas et al (2004) and Fujita and Diener (2005). It may be that the two social-science disciplines can converge in their thinking.

8. Conclusions

Our findings suggest that economists are wrong to ignore habituation. This paper provides longitudinal evidence for the existence of hedonic adaptation to disability. Disablement is of interest for at least three reasons -- as an example of a major negative utility shock, as a life event that can be thought of as exogenous rather than chosen, and because the highly-cited work of Brickman et al (1978) has played an influential role in social science.

We track individuals' levels of life-satisfaction in the years leading up to, and after, disability. There is evidence of recovery in human wellbeing. In some cases, that recovery is strong. Our data do not, however, support the idea that there is always a return to the old happiness level.

We suggest methods for the study of this adaptation phenomenon and report a variety of specifications. One piece of evidence for the credibility of the estimates is that they are not sensitive to the inclusion of a list of controls or to disaggregation by demographic group. This means that observable characteristics do not explain a large proportion of the correlation between life satisfaction and disability, which in turn somewhat reduces, although cannot entirely banish, concerns about unobservable characteristics biasing upwards the relationship. Because of the existence of adaptation, a person's emotional disutility from disability seems to decline through the years. If true, this shapes how economists and the legal profession ought to think about financial redress.

Like all empirical work, this study is imperfect. Legitimate concerns are that the key independent variables may not be truly exogenous; attrition from the panel may create problems in estimation; attempts to put monetary values on emotional damage are in their intellectual infancy; there may be adaptation to income; and wellbeing data need to be treated cautiously by economists. These concerns do not mean that the paper's conclusions are incorrect. They do mean that our work cannot be the last word on hedonic adaptation.

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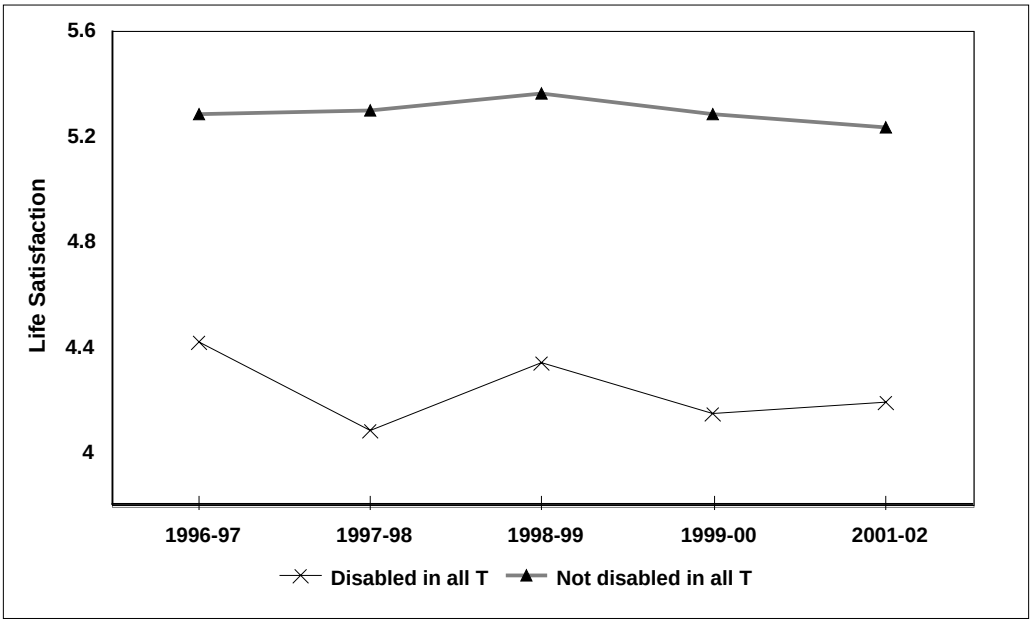
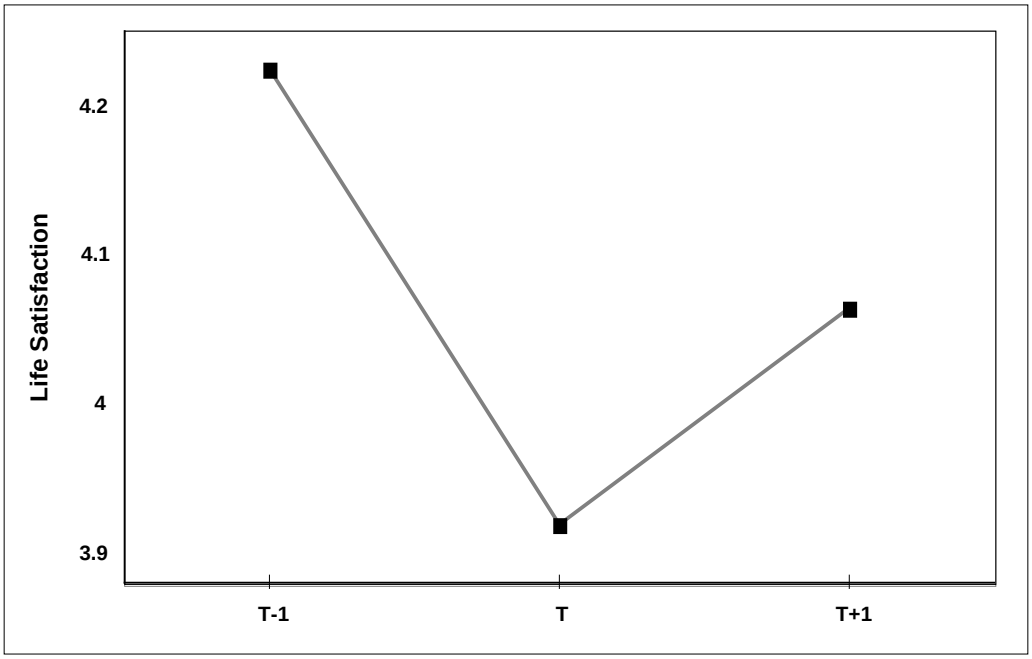
Figure 1: Life Satisfaction of the Never Disabled and the Always Disabled, BHPS 1996-2002



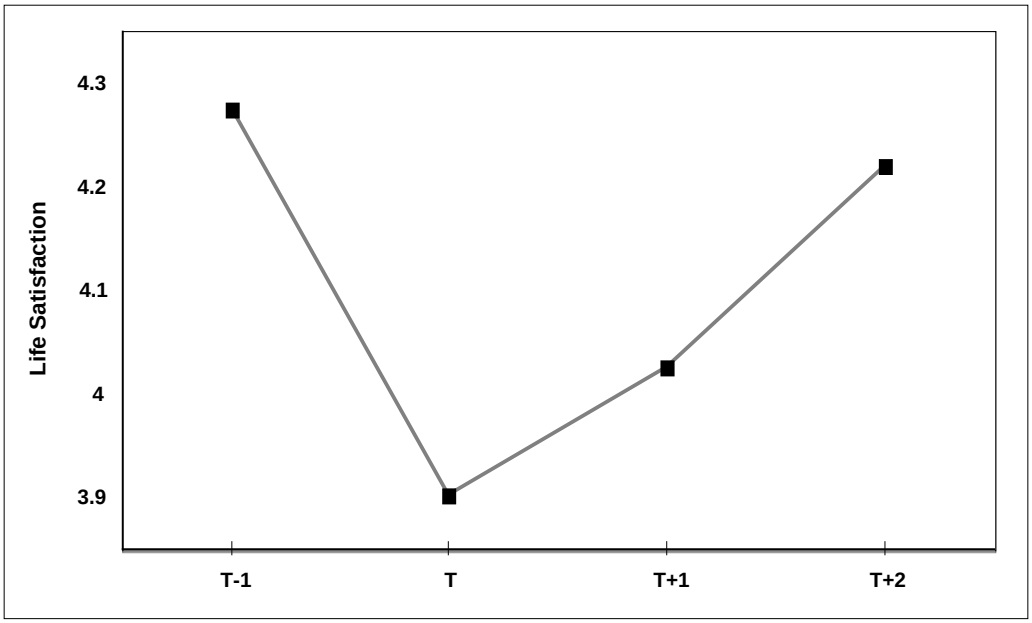
Note: There were 129 (13,776) individuals who were always disabled (never disabled).

Figure 2: Life Satisfaction of Those Who Entered Disability at Time *T* and Remained Disabled at *T+1*, BHPS 1996-2002



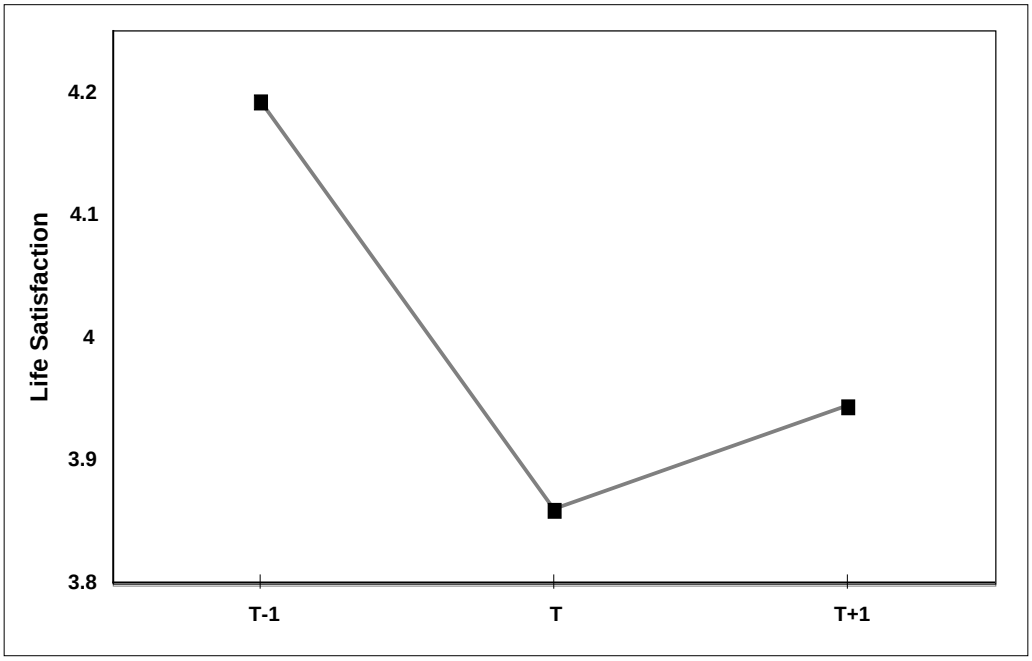
Note: There were 200 individuals who became disabled at time *T* and remained disabled in *T+1*. The mean life satisfaction of these individuals at *T-2* is 4.57. The *t*-test statistics [p-value] of whether the mean life satisfaction of the individual is equal are 1.761 [0.079] (between *T-1* and *T*) and -0.855 [0.393] (between *T* and *T+1*).

Figure 3: Life Satisfaction of Those Who Entered Disability at Time *T* and Remained Disabled in *T+1* and *T+2*, BHPS 1996-2002



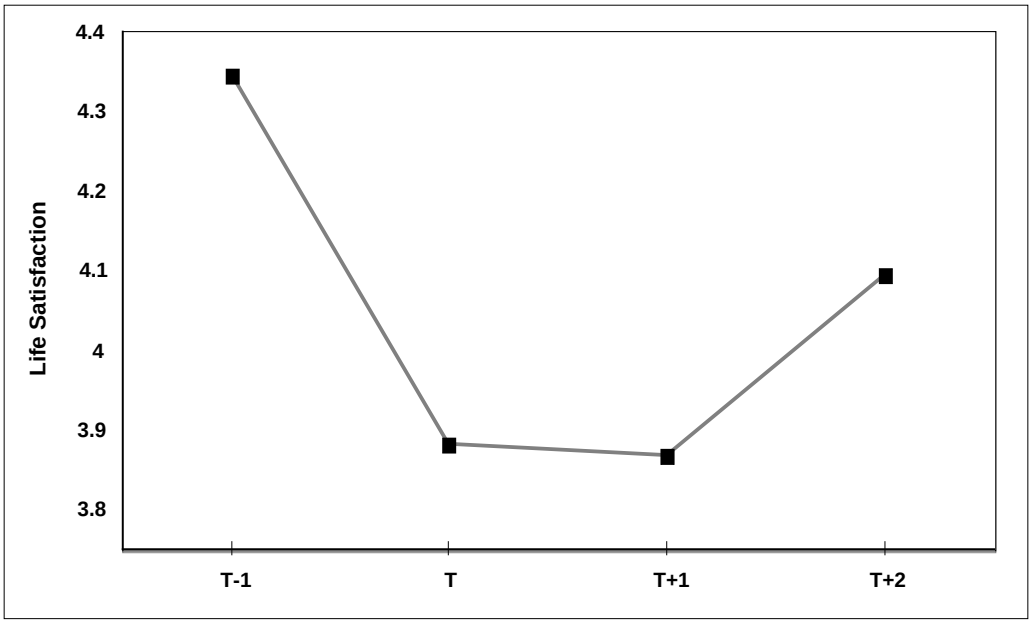
Note: There were 72 individuals who became disabled at time *T* and remained disabled in *T+1* and *T+2*. The mean life satisfaction of these individuals at *T-2* is 4.53. The *t*-test statistics [p-value] of whether the mean life satisfaction of the individual is equal are 1.374 [0.172] (between *T-1* and *T*), -0.466 [0.642] (between *T* and *T+1*) and -0.738 [0.461] (between *T+1* and *T+2*).

Figure 4: Life Satisfaction of Those Who Entered Serious Disability at Time *T* and Remained Seriously Disabled at *T+1*, BHPS 1996-2002



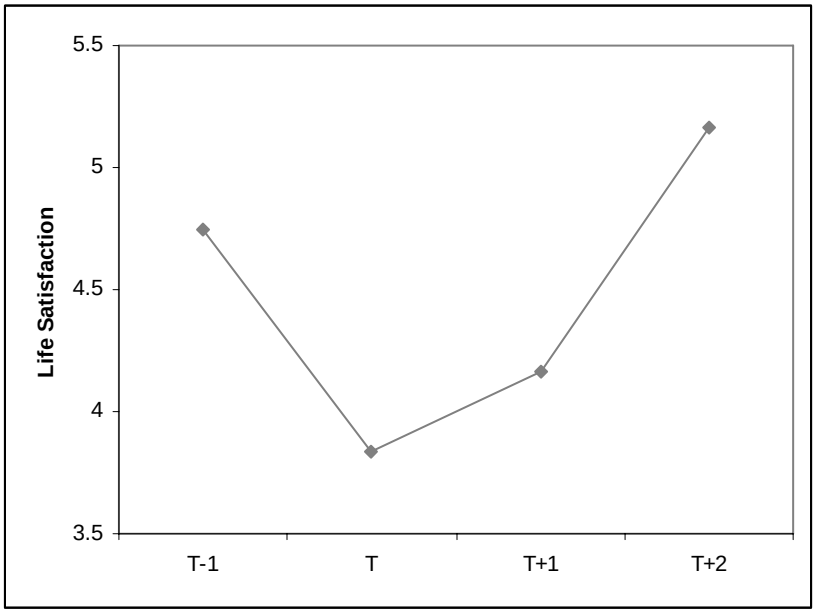
Note: There were 165 individuals who became seriously disabled at time *T* and remained seriously disabled in *T+1*. Serious disability includes those people who are not able to do at least one of the listed day-to-day activities. These include doing the housework, climbing the stairs, getting dressed, and walking for more than 10 minutes. The mean life satisfaction of these individuals at *T-2* is 4.52. The *t*-test statistics [p-value] of whether the mean life satisfaction of the individual is equal are 1.776 [0.076] (between *T-1* and *T*) and -0.459 [0.646] (between *T* and *T+1*).

Figure 5: Life Satisfaction of Those Who Entered Serious Disability at Time *T* and Remained Seriously Disabled in *T+1* and *T+2*, BHPS 1996-2002



Note: there were 52 individuals who became seriously disabled at time *T* and remained seriously disabled in *T+1* and *T+2*. The mean life satisfaction of these individuals at *T-2* is 4.63. The *t*-test statistics [p-value] of whether the mean life satisfaction of the individual is equal are 1.598 [0.113] (between *T-1* and *T*), 0.065 [0.949] (between *T* and *T+1*) and -0.748 [0.456] (between *T+1* and *T+2*).

Figure 6: Life Satisfaction of Those Who Became Disabled from an Accident At Time *T* and Remained Disabled in *T+1* and *T+2*, BHPS 1996-2002



Note: there were 12 individuals who became disabled from an accident at time *T* and remained disabled in *T+1* and *T+2*. The mean life satisfaction of these individuals at *T-2* is 4.8. The *t*-test statistics [p-value] of whether the mean life satisfaction of the individual is equal are 1.225 [0.233] (between *T-1* and *T*), -0.473 [0.640] (between *T* and *T+1*) and -1.517 [0.143] (between *T+1* and *T+2*).

Table 1: OLS Life Satisfaction Equations with Exogenous Variables, BHPS 1996-2002

	I		II		III		IV	
Disabled; able to do day-to-day activities	-0.527	(0.111)	-0.515	(0.111)	-	-	-	-
Disabled; unable to do day-to-day activities	-	-	-	-	-1.247	(0.051)	-1.243	(0.051)
Male	0.007	(0.016)	0.003	(0.016)	0.016	(0.016)	0.015	(0.016)
Age	-0.112	(0.007)	-0.116	(0.007)	-0.110	(0.007)	-0.110	(0.007)
Age^2/100	0.228	(0.016)	0.237	(0.016)	0.234	(0.016)	0.235	(0.016)
Age^3/100	-0.001	(0.000)	-0.001	(0.000)	-0.001	(0.000)	-0.001	(0.000)
Education: O-Level, A-Level	-	-	0.047	(0.022)	-	-	0.009	(0.022)
Education: Higher	-	-	0.083	(0.023)	-	-	0.015	(0.022)
Constant	6.801	(0.125)	6.801	(0.127)	6.753	(0.122)	6.754	(0.124)
Round dummies	Yes		Yes		Yes		Yes	
Region dummies	Yes		Yes		Yes		Yes	
N	59,709		59,709		59,709		59,709	
R-squared	0.0265		0.0270		0.0575		0.0575	

Note: Life satisfaction is recorded on a 7-point scale, ranging from 1 "very dissatisfied" to 7 "very satisfied". Disabled, but able to do day-to-day activities, include those who are disabled but are able to do all of the following: i) housework, ii) climb stairs, iii) dress oneself, and iv) walk for at least 10 minutes. There are 315 observations of people who are disabled but able to do day-to-day activies as opposed to 2,204 observations of seriously disabled individuals who are not able to do at least one of the listed day-to-day activities. Reference variables are: non-disable, female, and no formal education. Round dummies are for the years interviewed in the panel. Standard errors are in parentheses.

Table 2: OLS Life Satisfaction Equations with Past Disability Variables

	I		II		III		IV	
Disabled; able to do day-to-day activities	-0.464	(0.112)	-0.281	(0.125)	-0.598	(0.169)	-0.473	(0.157)
Disabled; unable to do day-to-day activities	-1.144	(0.052)	-0.902	(0.062)	-1.228	(0.081)	-1.265	(0.084)
Past disability from t-3 to t-1 (3 yrs)	-	-	-0.369	(0.073)	-0.827	(0.095)	-	-
Disabled; able*past disability (3 yrs)	-	-	-	-	1.106	(0.277)	-	-
Disabled; unable*past disability (3 yrs)	-	-	-	-	0.960	(0.149)	-	-
Past disability from t-6 to t-1 (6 yrs)	-	-	-	-	-	-	-0.824	(0.103)
Disabled; able*past disability (6 yrs)	-	-	-	-	-	-	0.876	(0.295)
Disabled; able*past disability (6 yrs)	-	-	-	-	-	-	0.957	(0.159)
Unemployed	-0.544	(0.039)	-0.541	(0.043)	-0.524	(0.043)	-0.528	(0.046)
Self-employed	0.017	(0.028)	0.019	(0.029)	0.021	(0.029)	0.025	(0.030)
Look after home	-0.153	(0.031)	-0.141	(0.034)	-0.132	(0.034)	-0.128	(0.034)
Retired	0.011	(0.032)	0.047	(0.034)	0.071	(0.034)	0.070	(0.035)
Student	0.011	(0.030)	-0.004	(0.033)	-0.001	(0.033)	-0.017	(0.035)
Real household income per capita (*1,000)	0.008	(0.001)	0.008	(0.001)	0.008	(0.001)	0.007	(0.001)
Male	-0.026	(0.016)	-0.012	(0.017)	-0.012	(0.017)	-0.016	(0.017)
Age	-0.123	(0.010)	-0.125	(0.011)	-0.124	(0.011)	-0.126	(0.011)
Age^2/100	0.234	(0.021)	0.237	(0.022)	0.235	(0.022)	0.241	(0.023)
Age^3/100	-0.001	(0.000)	-0.001	(0.000)	-0.001	(0.000)	-0.001	(0.000)
Married	0.382	(0.027)	0.384	(0.030)	0.384	(0.030)	0.399	(0.030)
Living as a couple	0.302	(0.027)	0.283	(0.030)	0.286	(0.030)	0.315	(0.031)
Separated	-0.419	(0.057)	-0.420	(0.064)	-0.419	(0.063)	-0.386	(0.066)
Divorced	-0.144	(0.045)	-0.119	(0.048)	-0.116	(0.048)	-0.111	(0.049)
Widowed	0.061	(0.046)	0.082	(0.049)	0.082	(0.049)	0.106	(0.050)
Education: O-Level, A-Level	-0.048	(0.021)	-0.049	(0.023)	-0.049	(0.023)	-0.047	(0.023)
Education: Higher	-0.081	(0.022)	-0.076	(0.024)	-0.077	(0.024)	-0.072	(0.024)
Household size	0.006	(0.008)	0.009	(0.008)	0.009	(0.008)	0.005	(0.009)
Own home outright?	0.135	(0.020)	0.128	(0.021)	0.127	(0.021)	0.120	(0.022)
Days spent in hospital last year	-0.012	(0.001)	-0.012	(0.001)	-0.012	(0.001)	-0.013	(0.001)
Number of children	-0.030	(0.012)	-0.035	(0.013)	-0.037	(0.013)	-0.037	(0.013)
Constant	6.934	(0.156)	6.946	(0.168)	6.927	(0.168)	6.990	(0.171)
Round dummies	Yes		Yes		Yes		Yes	
Region dummies	Yes		Yes		Yes		Yes	
N	52,973		52,973		52,973		44,405	
R-squared	0.0952		0.0947		0.0967		0.1002	

Note: Past disability measures the proportion of time the respondent spent being disabled prior to the inview date. Hence, past disability (3 years) takes the values of 0, 0.33, 0.66, and 1, whilst past disability (6 years) takes the values of 0, 0.17, 0.33, 0.5, 0.66, 0.83, and 1. Reference variables are: employed, female, never married, no formal education, and do not own home outright. Real household income per capita is income per annum, deflated by CPI. Standard errors are in parentheses.

Table 3: OLS Life Satisfaction Equations with Disability as Independent Variable for Sub-Samples

	Male		Female		Age<40		Age>=40		Non-graduates		Graduates	
Disabled; able to do day-to-day activities	-0.415	(0.247)	-0.814	(0.222)	-0.411	(0.283)	-0.686	(0.207)	-0.562	(0.202)	-0.747	(0.291)
Disabled; unable to do day-to-day activities	-1.365	(0.125)	-1.125	(0.106)	-1.615	(0.144)	-1.095	(0.096)	-1.197	(0.092)	-1.394	(0.169)
Past disability from t-3 to t-1 (3 yrs)	-0.813	(0.134)	-0.811	(0.134)	-0.701	(0.188)	-0.864	(0.108)	-0.868	(0.103)	-0.662	(0.251)
Disabled; able*past disability (3 yrs)	0.894	(0.379)	1.287	(0.403)	0.989	(0.525)	1.185	(0.323)	1.014	(0.316)	1.415	(0.573)
Disabled; unable*past disability (3 yrs)	1.007	(0.211)	0.908	(0.212)	1.181	(0.286)	0.849	(0.171)	0.957	(0.161)	0.871	(0.405)
Unemployed	-0.531	(0.056)	-0.545	(0.065)	-0.494	(0.051)	-0.521	(0.075)	-0.496	(0.050)	-0.612	(0.080)
Self-employed	0.046	(0.034)	-0.040	(0.056)	0.113	(0.041)	-0.027	(0.039)	0.023	(0.038)	0.017	(0.044)
Look after home	-0.396	(0.164)	-0.115	(0.036)	-0.170	(0.044)	-0.098	(0.049)	-0.162	(0.038)	0.008	(0.067)
Retired	-0.005	(0.052)	0.129	(0.046)	-1.033	(0.366)	0.029	(0.038)	0.024	(0.041)	0.182	(0.061)
Student	-0.017	(0.050)	0.018	(0.045)	0.042	(0.036)	-0.036	(0.212)	0.027	(0.039)	-0.026	(0.067)
Real household income per capita (*1,000)	0.008	(0.002)	0.007	(0.002)	0.012	(0.002)	0.006	(0.001)	0.008	(0.001)	0.007	(0.002)
Male	-	-	-	-	-0.021	(0.022)	-0.001	(0.024)	0.007	(0.021)	-0.046	(0.027)
Age	-0.144	(0.015)	-0.106	(0.015)	-0.232	(0.079)	-0.135	(0.055)	-0.113	(0.012)	-0.158	(0.021)
Age^2/100	0.277	(0.032)	0.200	(0.031)	0.742	(0.291)	0.273	(0.089)	0.223	(0.026)	0.287	(0.045)
Age^3/100	-0.002	(0.000)	-0.001	(0.000)	-0.008	(0.003)	-0.002	(0.000)	-0.001	(0.000)	-0.002	(0.000)

Table 3 (*continued*).

	Male		Female		Age<40		Age>=40		Non-graduates		Graduates	
Married	0.338	(0.044)	0.422	(0.041)	0.385	(0.035)	0.355	(0.056)	0.317	(0.039)	0.490	(0.044)
Living as a couple	0.288	(0.044)	0.286	(0.042)	0.257	(0.033)	0.304	(0.070)	0.234	(0.040)	0.360	(0.045)
Separated	-0.405	(0.095)	-0.424	(0.084)	-0.390	(0.080)	-0.449	(0.099)	-0.551	(0.079)	-0.164	(0.102)
Divorced	-0.002	(0.078)	-0.169	(0.061)	-0.178	(0.071)	-0.104	(0.069)	-0.187	(0.061)	0.009	(0.073)
Widowed	0.170	(0.089)	0.064	(0.060)	-0.250	(0.228)	0.063	(0.063)	0.068	(0.057)	-0.057	(0.110)
Education: O-Level, A-Level	-0.055	(0.033)	-0.045	(0.032)	0.073	(0.037)	-0.087	(0.029)	-0.037	(0.024)	-	-
Education: Higher	-0.108	(0.033)	-0.039	(0.034)	0.058	(0.038)	-0.138	(0.030)	-	-	-	-
Household size	0.011	(0.011)	0.007	(0.012)	0.039	(0.011)	0.008	(0.014)	0.016	(0.010)	-0.006	(0.015)
Own home outright?	0.094	(0.031)	0.151	(0.030)	0.063	(0.037)	0.146	(0.026)	0.138	(0.026)	0.097	(0.037)
Days spent in hospital last year	-0.011	(0.002)	-0.012	(0.002)	-0.010	(0.002)	-0.012	(0.002)	-0.013	(0.002)	-0.009	(0.002)
Number of children	-0.024	(0.018)	-0.042	(0.019)	-0.055	(0.018)	-0.026	(0.021)	-0.040	(0.016)	-0.016	(0.022)
Constant	7.221	(0.239)	6.684	(0.234)	7.382	(0.695)	6.834	(1.092)	6.641	(0.202)	7.526	(0.323)
Round dummies	Yes		Yes		Yes		Yes		Yes		Yes	
Region dummies	Yes		Yes		Yes		Yes		Yes		Yes	
N	24,254		28,719		23,067		29,906		36,486		16,487	
R-squared	0.1072		0.0933		0.0802		0.1092		0.1010		0.0958	

Note: See Table 2. Graduates are those who have completed a university degree.

Table 4: OLS Life Satisfaction Equations Allowing for Non-Linearity in Income

	I		II	
Disabled; able to do day-to-day activities	-0.585	(0.169)	-0.576	(0.170)
Disabled; unable to do day-to-day activities	-1.215	(0.081)	-1.204	(0.081)
Past disability from t-3 to t-1 (3 yrs)	-0.820	(0.096)	-0.823	(0.096)
Disabled; able*past disability (3 yrs)	1.110	(0.276)	1.118	(0.279)
Disabled; unable*past disability (3 yrs)	0.952	(0.149)	0.949	(0.150)
Unemployed	-0.512	(0.043)	-0.496	(0.043)
Self-employed	0.025	(0.029)	0.035	(0.029)
Look after home	-0.124	(0.034)	-0.107	(0.034)
Retired	0.081	(0.034)	0.085	(0.034)
Student	0.004	(0.033)	0.019	(0.034)
Real household income per capita (*1,000)	0.012	(0.002)	-	-
Real household income^2/100	-0.005	(0.002)	-	-
Log of real household income per capita	-	-	0.109	(0.012)
Male	-0.014	(0.017)	-0.013	(0.017)
Age	-0.126	(0.011)	-0.126	(0.011)
Age^2/100	0.239	(0.022)	0.239	(0.022)
Age^3/100	-0.001	(0.000)	-0.001	(0.000)
Married	0.380	(0.030)	0.377	(0.030)
Living as a couple	0.282	(0.030)	0.282	(0.030)
Separated	-0.417	(0.064)	-0.403	(0.064)
Divorced	-0.114	(0.048)	-0.109	(0.048)
Widowed	0.078	(0.049)	0.073	(0.049)
Education: O-Level, A-Level	-0.052	(0.023)	-0.055	(0.023)
Education: Higher	-0.086	(0.024)	-0.088	(0.024)
Household size	0.011	(0.008)	0.009	(0.008)
Own home outright?	0.127	(0.021)	0.127	(0.021)
Days spent in hospital last year	-0.012	(0.001)	-0.012	(0.001)
Number of children	-0.030	(0.013)	-0.023	(0.013)
Constant	6.918	(0.168)	6.077	(0.193)
Round dummies	Yes		Yes	
Region dummies	Yes		Yes	
N	52,973		52,864	
R-squared	0.0973		0.0975	

Note: See Table 2. Standard errors are in parentheses.

Table 5: Fixed-Effect Life Satisfaction Equations with only Disability Variable, Round and Regional Dummies, BHPS 1996-2002

	I		II	
Disabled; able to do day-to-day activities	-0.024	(0.075)	-	-
Disabled; unable to do day-to-day activities	-	-	-0.449	(0.041)
Constant	5.279	(0.066)	5.300	(0.066)
Round dummies	Yes		Yes	
Region dummies	Yes		Yes	
N	59,709		59,709	
Group	21,517		21,517	
R-squared	0.0063		0.0093	

Note: Standard errors are in parentheses.

Table 6: Fixed-Effect Life Satisfaction Equations with Past Disability Variable

	I		II		III	
Disabled; able to do day-to-day activities	-0.278	(0.077)	-0.268	(0.080)	-0.408	(0.111)
Disabled; unable to do day-to-day activities	-0.536	(0.044)	-0.503	(0.046)	-0.596	(0.060)
Past disability from t-3 to t-1 (3 yrs)	-	-	0.068	(0.072)	-0.076	(0.086)
Disabled; able*past disability (3 yrs)	-	-	-	-	0.422	(0.188)
Disabled; unable*past disability (3 yrs)	-	-	-	-	0.300	(0.108)
Unemployed	-0.345	(0.031)	-0.336	(0.032)	-0.334	(0.032)
Self-employed	0.004	(0.032)	0.005	(0.033)	0.006	(0.033)
Look after home	-0.127	(0.028)	-0.111	(0.029)	-0.108	(0.029)
Retired	-0.046	(0.031)	-0.037	(0.032)	-0.025	(0.032)
Student	0.068	(0.036)	0.064	(0.036)	0.064	(0.036)
Real household income per capita (*1,000)	0.002	(0.001)	0.002	(0.001)	0.002	(0.001)
Age	-0.117	(0.025)	-0.121	(0.026)	-0.120	(0.026)
Age^2/100	0.253	(0.035)	0.269	(0.036)	0.268	(0.036)
Age^3/100	-0.002	(0.000)	-0.002	(0.000)	-0.002	(0.000)
Married	0.050	(0.042)	0.033	(0.043)	0.032	(0.043)
Living as a couple	0.163	(0.034)	0.157	(0.035)	0.156	(0.035)
Separated	-0.345	(0.061)	-0.348	(0.062)	-0.348	(0.062)
Divorced	-0.103	(0.056)	-0.116	(0.057)	-0.116	(0.057)
Widowed	-0.172	(0.066)	-0.178	(0.067)	-0.180	(0.067)
Education: O-Level, A-Level	-0.004	(0.049)	-0.010	(0.050)	-0.010	(0.050)
Education: Higher	0.045	(0.049)	0.053	(0.050)	0.053	(0.050)
Household size	-0.019	(0.009)	-0.017	(0.009)	-0.017	(0.009)
Own home outright?	0.043	(0.025)	0.035	(0.025)	0.034	(0.025)
Days spent in hospital last year	-0.006	(0.001)	-0.006	(0.001)	-0.006	(0.001)
Number of children	0.015	(0.015)	0.023	(0.015)	0.023	(0.015)
Constant	7.046	(0.927)	6.972	(0.989)	6.968	(0.989)
Round dummies	Yes		Yes		Yes	
Region dummies	Yes		Yes		Yes	
N	59,709		52,973		52,973	
Group	21,517		17,311		17,311	
R-squared (within)	0.0199		0.0196		0.0198	

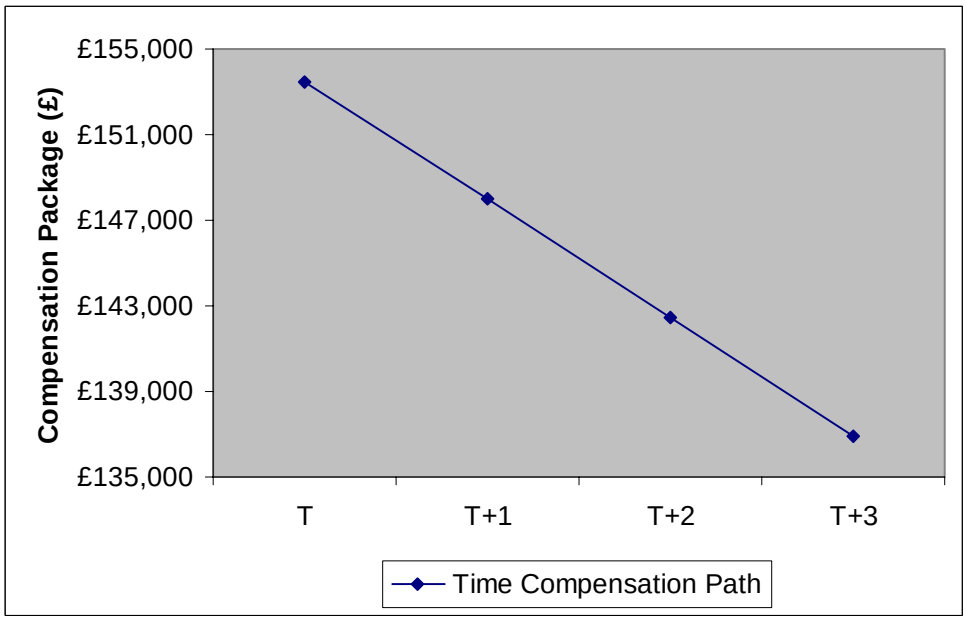
Note: Standard errors are in parentheses.

Table 7: Fixed-Effect Life Satisfaction Equations with Past Disability from Accident

	(1)		(2)	
Disabled at t	-0.466	(0.045)	-0.511	(0.046)
Became disabled at t-3; no accident	0.251	(0.123)	-0.024	(0.172)
Became disabled at t-3; had accident	-0.035	(0.053)	-0.222	(0.074)
Disabled at t*disabled at t-3; no accident	-	-	0.567	(0.245)
Disabled at t*disabled at t-3; had accident	-	-	0.374	(0.105)
Unemployed	-0.332	(0.033)	-0.331	(0.033)
Self-employed	-0.013	(0.033)	-0.012	(0.033)
Look after home	-0.100	(0.029)	-0.099	(0.029)
Retired	-0.031	(0.031)	-0.030	(0.031)
Student	0.078	(0.035)	0.078	(0.035)
Real household income per capita (*1,000)	0.002	(0.001)	0.002	(0.001)
Age	-0.117	(0.028)	-0.117	(0.028)
Age^2/100	0.289	(0.037)	0.290	(0.037)
Age^3/100	-0.002	(0.000)	-0.002	(0.000)
Married	0.016	(0.043)	0.016	(0.043)
Living as a couple	0.147	(0.034)	0.147	(0.034)
Separated	-0.388	(0.061)	-0.389	(0.061)
Divorced	-0.149	(0.057)	-0.149	(0.057)
Widowed	-0.253	(0.067)	-0.253	(0.067)
Education: O-Level, A-Level	0.035	(0.049)	0.035	(0.049)
Education: Higher	0.091	(0.050)	0.091	(0.050)
Household size	-0.027	(0.009)	-0.027	(0.009)
Own home outright?	0.027	(0.025)	0.027	(0.025)
Days spent in hospital last year	-0.005	(0.001)	-0.005	(0.001)
Number of children	0.026	(0.016)	0.026	(0.016)
Constant	6.557	(0.978)	6.583	(0.978)
Round dummies	Yes		Yes	
Region dummies	Yes		Yes	
N	47,244		47,244	
Within R-squared	0.0191		0.0195	

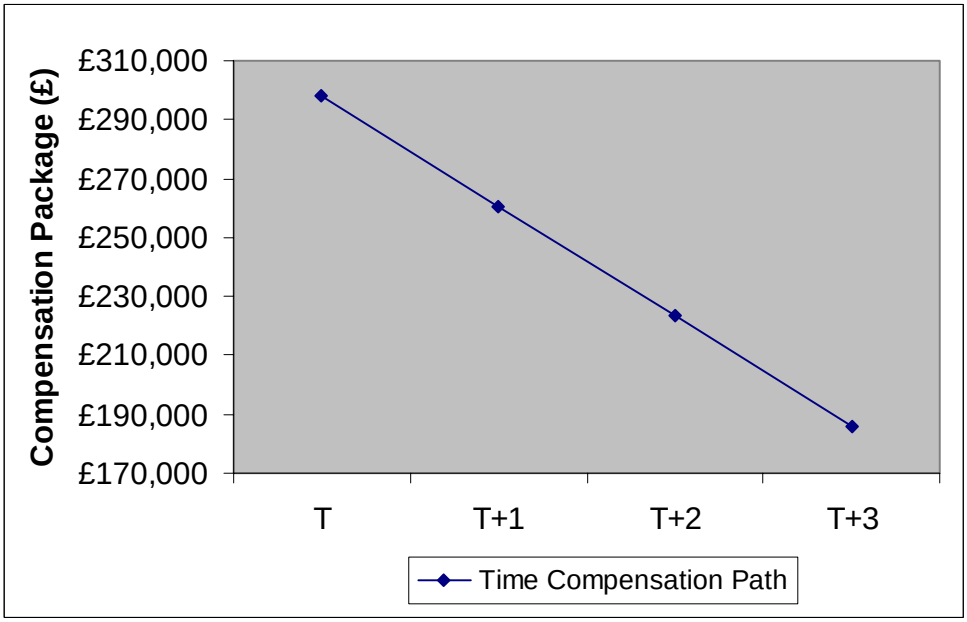
Note: Standard errors are in parentheses. The 'Became disabled at t-3; no accident' dummy represents those who were not disabled at t-4 but then became disabled at t-3, though had no experience of a serious accident one year prior to disability. The 'Became disabled at t-3; had accident' dummy represents those who were not disabled at t-4 but then became disabled at t-3 and had reported of having a serious accident one year prior to becoming disabled. There are 638 observations of those who became disabled at t-3; no accident, and there are 112 observations of those who became disabled at t-3; had accident.

Figure 7: Time Compensation Path (Cross-section)



Note: The estimated time compensation packages are based on pooled OLS regression taken from Column III of Table 2.

Figure 8: Time Compensation Path (Fixed-Effects)



Note: The estimated time compensation packages are based on fixed-effects regression taken from Column III of Table 6

Table A1: Data Description and Summary Statistics

Varibles	Descriptions	Not Disabled		Disabled Able		Disabled Unable	
		Mean	Std.Dev.	Mean	Std.Dev.	Mean	Std.Dev.
Life satisfaction	satisfaction with life score, coded so that 1 = very dissatisfied, 7 = very satisfied	5.28	(1.27)	4.69	(1.67)	4.05	(1.78)
Past disability (3 years)	the proportion of time spent being disabled from t-3 to t-1	0.01	(0.09)	0.48	(0.43)	0.64	(0.41)
Number of time being happy in a day	number of time being happy in a day score, coded so that 1 = none, 6 = all the time	4.60	(1.07)	-	-	-	-
Unemployed	employment status, unemployed = 1	0.04	(0.19)	-	-	-	-
Self-employed	employment status, self-employed = 1	0.07	(0.25)	-	-	-	-
Family-cared	employment status, family-cared = 1	0.08	(0.27)	-	-	-	-
Student	employment status, student = 1	0.21	(0.41)	-	-	-	-
Retired	employment status, retired = 1	0.06	(0.24)	-	-	-	-
Real household income per capita (*1000)	annual household income per capita, adjusted to CPI index	9.52	(7.93)	6.82	(10.91)	6.55	(4.06)
Male	gender (male = 1)	0.45	(0.50)	0.56	(0.50)	0.51	(0.50)
Age	age	44.60	(18.68)	48.34	(12.85)	49.85	(11.58)
Age^2/100	age-sqauared/100	23.38	(18.42)	25.02	(11.67)	26.19	(11.63)
Age^3/100	age-cubed/100	1380.26	(1542.34)	1356.49	(872.23)	1437.66	(959.44)
Married	marital status, married = 1	0.54	(0.50)	0.41	(0.49)	0.57	(0.50)
Living as a couple	marital status, living with a partner = 1	0.11	(0.31)	0.11	(0.32)	0.07	(0.25)
Separated	marital status, separated = 1	0.02	(0.13)	0.02	(0.13)	0.03	(0.16)
Divorced	marital status, divorced = 1	0.05	(0.22)	0.19	(0.39)	0.14	(0.35)
Widowed	marital status, widowed = 1	0.08	(0.27)	0.04	(0.19)	0.05	(0.21)
Education: A-levels, O-levels	tertiary education, i.e. A-levels, O-levels	0.42	(0.49)	0.36	(0.48)	0.36	(0.48)
Education: High	higher education, i.e. university level	0.31	(0.46)	0.19	(0.39)	0.13	(0.33)
Household size	number of people living in the household	2.86	(1.37)	2.26	(1.15)	2.62	(1.45)
Own home outright	whether the respondent owns home outright (yes = 1)	0.24	(0.43)	0.16	(0.36)	0.19	(0.39)
Number of days in hospital last year	the number of days spent in hospital last year for the respondent	0.82	(5.61)	3.42	(18.46)	4.20	(15.57)
Number of children	number of children who are under 16 in the household	0.53	(0.95)	0.30	(0.67)	0.42	(0.91)
Total number of observations		71,032		315		2,204	

Note: Standard deviations are in parentheses. Disabled type Able: disabled, but able to do day-to-day activities include those who are disabled but are able to do all of the followings: i) housework, ii) climb stairs, iii) dress oneself, and iv) walk for at least 10 minutes. Disabled type Unable: disabled, and unable to do day-to-day activities.

Table A2: OLS Number of Times Being Happy in a Day Equations, BHPS 1999

	I		II		III	
Disabled	-0.926	(0.058)	-0.813	(0.105)	-1.046	(0.133)
Past disability from t-3 to t-1 (3 yrs)	-	-	-0.144	(0.120)	-0.446	(0.161)
Disabled*past disability (3 yrs)	-	-	-	-	0.656	(0.238)
Unemployed	-0.402	(0.056)	-0.321	(0.073)	-0.310	(0.072)
Self-employed	0.051	(0.034)	0.046	(0.040)	0.048	(0.040)
Look after home	-0.131	(0.040)	-0.100	(0.046)	-0.095	(0.047)
Retired	-0.074	(0.041)	-0.092	(0.050)	-0.075	(0.050)
Student	0.017	(0.040)	0.013	(0.050)	0.013	(0.050)
Real household income per capita (*1,000)	0.004	(0.001)	0.003	(0.001)	0.003	(0.001)
Male	0.109	(0.018)	0.121	(0.022)	0.120	(0.022)
Age	-0.078	(0.012)	-0.087	(0.014)	-0.087	(0.014)
Age^2/100	0.148	(0.025)	0.165	(0.030)	0.165	(0.030)
Age^3/100	-0.001	(0.000)	-0.001	(0.000)	-0.001	(0.000)
Married	0.188	(0.033)	0.180	(0.039)	0.179	(0.039)
Living as a couple	0.138	(0.036)	0.110	(0.043)	0.113	(0.043)
Separated	-0.271	(0.079)	-0.386	(0.104)	-0.386	(0.105)
Divorced	-0.037	(0.053)	-0.052	(0.065)	-0.052	(0.065)
Widowed	-0.073	(0.055)	-0.083	(0.065)	-0.085	(0.065)
Education: O-Level, A-Level	0.077	(0.024)	0.036	(0.029)	0.035	(0.029)
Education: Higher	0.085	(0.025)	0.052	(0.031)	0.050	(0.031)
Household size	0.001	(0.009)	-0.010	(0.012)	-0.010	(0.012)
Own home outright?	0.075	(0.024)	0.060	(0.029)	0.059	(0.029)
Days spent in hospital last year	-0.006	(0.002)	-0.007	(0.002)	-0.007	(0.002)
Number of children	-0.022	(0.014)	-0.013	(0.018)	-0.015	(0.018)
Constant	5.407	(0.433)	5.857	(0.435)	5.852	(0.435)
Round dummies	Yes		Yes		Yes	
Region dummies	Yes		Yes		Yes	
N	15,168		10,046		10,046	
R-squared (within)	0.0664		0.0641		0.0653	

Note: Standard errors are in parentheses. The happiness question is "How much time during the past month... Have you been a happy person? 1. None of the time, 2. A little of the time, 3. Some of the time, 4. A good bit of the time, 5. Most of the time, 6. All the time." Disability variable is pooled from serious disability and those who are disabled but still able to do day-to-day activities.