Longitudinal analysis of the domains of satisfaction before and after disability: Evidence from the German Socio-Economic Panel

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Abstract:

The aim of this paper is to analyse the effect of the onset of disability on life satisfaction and five different domains of satisfaction (health, household income, housing, job, leisure) for German individuals. Particular attention is paid to examining whether individuals can adapt to disability over time before and after its onset in terms of satisfaction. Using longitudinal data from the German Socio-Economic Panel (GSOEP) for the period 1984-2008, we estimate an innovative fixed-effects model on life satisfaction and each domain of satisfaction for working-age males (aged 21-58), which allows us to estimate lag and lead effects and thus to test the anticipation and adaptation hypotheses. Although individuals attain a complete adaptation to disability in terms of global life satisfaction (5 years after the onset), this adaptation is not complete in all domains of satisfaction. For example, despite the fact that the levels of health satisfaction drop as the individual becomes disabled, after the onset it increases but the levels are lower than those reached before the onset. In contrast, the adaptation is especially faster in the terms of leisure satisfaction (3 years after the onset), household income and housing satisfaction (5 years after the onset in both cases). Our results support the findings obtained in other psychological studies that conclude that the domain of disability extends far beyond health related concerns to encompass the person's well-being, definition of self and social position. Finally, these findings may help policy makers and government to promote social and economic measures and actions lead to increase the scores of global well-being and specific domains of satisfaction of this collective.

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Introduction

Becoming disabled as a result of a disease, injury, accident or a worsening medical condition can affect many areas of individual's life as, for example, health status, employment, education, free time, social relations, housing, etc. According to the World Health Organization (WHO), there are 750 million people in the world who are disabled (i.e. 10% of the total population), and around 80% of these disabled people live in developing countries. Despite these figures and the increasing interest of policy makers, governments and non-governmental organisations regarding the social and labour integration of people with disabilities, very little is known on the effects of disability on the levels of well-being attained by individuals. Psychologists and sociologists have analysed in depth the effects of some live events (e.g. divorce, widowhood, unemployment, marriage, birth of child and lottery winnings, etc.) on subjective well-being (SWB) of individuals (e.g. Brickman *et al.*, 1978; Frederick and Loewenstein, 1999; Deiner *et al.*, 1999; Lucas *et al.*, 2003; Lucas, 2005; Deiner *et al.*, 2006). One of the key questions within this abundant literature on SWB is whether individuals adapt to these life events or circumstances. According to the set-point theory, individuals return to baseline levels of happiness following painful or cheerful changes in life circumstances. In the last decade, some economists have started to study SWB as an important and relevant issue. The lack of previous economic studies on SWB is based on the reluctance to use a subjective variable that measures "what individuals say" instead of "what individuals do". With regards to adaptation, many economists assert finding no adaptation at all to these life events.

The aim of this article is to analyse the changes in the levels of life satisfaction and five different domains of satisfaction (health, household income, housing, job, leisure) before, during and after the onset of disability. Particular attention is paid to testing

three different hypotheses; a) the entry into disability at time "*t*" significantly reduces the levels of satisfaction with life and each domain of satisfaction at time "*t*". b) The longer one is disabled, the less reduction there are in current life satisfaction and domain of satisfaction (*adaptation*); and c) Satisfaction with life and the rest of domains decrease before the onset of disability (*anticipation*). They are very few longitudinal studies that have addressed the relationship between disability and life satisfaction in general (Lucas, 2007; Oswald and Powdthavee, 2008; Pagan, 2010), and disability and different domains of life in particular (Powdthavee, 2009). The results obtained in the works of Lucas (2007), Oswald and Powdthavee (2008) and Pagan (2010) on the effects of disability on life satisfaction are contradictory. For example, Lucas (2007) does not find adaptation at all to disability in terms of life satisfaction for British and German individuals, whereas Oswald and Powdthavee (2008) only find a partial adaptation to disability (around 30%-50% according to the grade of severity of disability) for the same European countries. In contrast, Pagan (2010) obtains a full adaptation to disability after six years from the onset for German males. Only the work of Powdthavee (2009) has analysed the effects of disability on life satisfaction and seven domains of satisfaction (health, income, housing, partner's satisfaction, social life, amount of leisure time and use of leisure time) for British individuals. His results show full adaptation to disability in almost all of the affected life domains, but it is often incomplete for the severely disabled.

The contribution of this study is three-fold. Firstly, it increases the empirical evidence on the changes of satisfaction with life and five different areas of life before, during and after the onset of disability, The lack of longitudinal studies on the effects of onset of disability on life satisfaction in general and different areas of life in particular, as well as the increasing social and economic interest of policy makers in the particular

situation of the disabled population lead to the necessity of carrying out this type of works. This necessity has also been pointed out in the previous studies due to the fact that the economics literature in this area is very limited and the extent of any hedonic adaptation is imperfectly understood. In this sense, our study contributes to increasing the literature and empirical evidence on the effects of disability on the well-being of German individuals. Secondly, although we use the same dataset as Lucas (2007) and Oswald and Powdthavee (2008), the German Socio-Economic Panel (GSOEP), we employ a different definition of disability and based on the work of Burkhauser and Schroeder (2007), who have created a work limitation-based measure of disability for all GSOEP years. As will be noted later, the use of this work limitation-based measure of disability allows identification of the disabled population in a better and more accurate way. In addition, we use an innovative fixed-effects model on life satisfaction proposed by Clark *et al.* (2008) that allows us to estimate lag and lead effects on current life satisfaction and domain of satisfaction and thus to test the anticipation and adaptation hypotheses. Thirdly, the results contribute to defining, promoting and carrying out specific social and economic measures and actions aimed at improving the levels of satisfaction of German individuals with disabilities.

The remainder of the paper is as follows. Section 2 reviews the existing literature on disability and well-being, with particular interest to those studies that use longitudinal data. Section 3 describes the dataset and the definitions used in this study, whereas section 4 introduces the econometric model. Section 5 shows and discusses the results obtained in the estimation process and section 6 summarizes the main conclusions and includes some public policy recommendations.

Literature review

There has been an abundant literature in the last years that has analysed and tested the existence of adaptation to different life events such as unemployment (Clark *et al.*, 2001; Lucas *et al.*, 2004; Clark, 2006), marriage and divorce (Lucas *et al.*, 2003; Lucas and Clark, 2006; Zimmerman and Easterlin, 2006; Oswald and Gardner, 2006) and income (Di Tella *et al.*, 2005; Kuhn *et al.*, 2008). In addition, Clark *et al.* (2008) examine the adaptation and anticipation hypotheses to unemployment, marriage, divorce, widowhood, birth of child and layoff. He found strong evidence of anticipation and adaptation effects for each life event on life satisfaction scores. Despite the existence of previous studies analysing the negative effects of some diseases on well-being (Wu, 2001; Ferrer-i-Carbonell and Van Praag, 2002; Groot *et al.*, 2004; Chase *et al.*, 2006), there are very few studies that have analysed the relationship between disability and life satisfaction from a dynamic point of view (Lucas, 2007; Oswald and Powdthavee, 2008; Pagan, 2010). All these studies are based on large-scale panel data that allow for the changes in the levels of satisfaction to be studied before, during and after the onset of disability. For example, Lucas (2007), using 19 waves of the GSOEP (1984-2002) and 12 of the British Household Panel Study (1991-2002), employs a measure of disability based on official certifications, wherein the disability scores range from 0% to 100%. He found that disability is associated with moderate to large drops in happiness, as well as the participants who became disabled show very little adaptation over time. Therefore, this last result contradicts the long-held belief among psychologists that adaptation is inevitable and occurs for even major life events.

Oswald and Powdthavee (2008) use the same datasets as Lucas (2007) to estimate only the adaptation effects to the onset of disability in the United Kingdom (and additionally in Germany). To do this, they create the variable "*ratio of time spent being disabled from t-3 to t-1*" that takes a value between zero and unity (= 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). This variable, together with a disability variable (=1 if the person is disabled at year *t* and 0 otherwise), is included in the life satisfaction model, among others. On the other hand, they use the degree of disability of individuals to identify the disabled population as they use the GSOEP. The result do not support the idea that after the onset of disability there is routinely a return to the old well-being level, conversely to the traditional economist's model of 0% adaptation and the extreme 100% adaptation model postulated by some psychologists. In this sense, they found a partial adaptation to disability around 50% and 30% for moderate and severe disability, respectively. Recently, Pagan (2010) also uses longitudinal data from the GSOEP for the period 1981-2006 to analyse the effect of the onset of disability on the levels of life satisfaction of individuals. He finds that the individuals who enter into disability suffer a significant decrease in their life satisfaction scores. However, they attain complete adaptation to disability in terms of life satisfaction after 6 year from the onset. The anticipation hypothesis is also hold. However, Pagan (2010) does not investigate the effect of the onset of disability on different domains of satisfaction as, for example, health, income, leisure or job, among others.

To our knowledge, the work of Powdthavee (2009) is the only one that addresses the question of when and what extent life satisfaction and seven different areas of an individual's life are affected by disability (health, income, housing, partner's satisfaction, social life, amount of leisure time and use of leisure time). This author uses data from waves 6-10 and waves 12-15 of the British Household Panel Survey (BHPS) and estimates separately fixed-effects models to measure lead and lag disability effects on overall life satisfaction and each domain satisfaction. In addition, Powdthavee (2009)

follows a two-layer model proposed by van Praag *et al.* (2003) to estimate a within regression of life satisfaction with each domain satisfaction as the explanatory variables and assuming that disability enters the life satisfaction function indirectly via its effects on the seven domain satisfaction variables. The results show that disability, regardless its severity, has the most detrimental impact on health satisfaction, followed by less salient aspects such as income, social life, use of leisure time, housing and partner's satisfaction. Adaptation is found in almost all of the affected life domains for disabled individuals, but it is often incomplete for the severity disabled. Also, he finds that all of the main effects of domain satisfaction coefficients are positive, statistically significant at the 1% level, and in the following 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).

Data and definitions

We use data taken from the 25 waves (covering the period 1984-2008) of the German Socio-Economic Panel (GSOEP), a representative longitudinal dataset of persons, households and families in Germany. This dataset started in 1984 with a sample of 5,921 households containing a total of 12,245 individual respondents. One of the main advantages of this dataset is the high degree of stability of the sample over time. However, several changes in sampling have occurred over time. In 1990 with the unification, more than 2,000 households of the former German Democratic Republic were included in the sample. In addition, an immigrant sample was added in 1994/1995 and additional new samples were also added in 1998, 2000, 2002 and 2006. In 2008, the

GSOEP contained data on 11,058 households and 19,945 adult respondents[1]. The GSOEP covers a broad range of topics, including information at an individual and household level on living conditions, household composition, employment status, income, health, education, satisfaction measures, among others. In our case, data are drawn from the English Public Use Version of the GSOEP (95% of the full sample, due to confidentiality reasons) provided by Cornell University (Department of Policy Analysis and Management).

All of the satisfaction measures used in this study are reported by the own individuals. With regards to the satisfaction with life, this is measured by participant responses to the following question and asked in each wave of the GSOEP: "*How satisfied are you with life, all things considered?*". The respondents of the GSOEP are also asked to report how satisfied they are today with their health, household income, place of dwelling, free time and job[2]. The possible responses to all these satisfaction questions range from 0 (completely dissatisfied) to 10 (completely satisfied). According to Veenhoven (1996), this single-item measure is generally as reliable and valid as multi-item measures. In addition, psychologists have usually considered these answers to satisfaction questions as cardinal (e.g. Schwartz, 1995; Ng, 1997), whereas some economists have assumed the ordinality of the answers (e.g. Van Praag, 1991; Ferrer-i-Carbonell and Frijters, 2004). Nevertheless, Ferrer-i-Carbonell and Frijters (2004) conclude that assuming cardinality or ordinality has little impact on estimation results. In our case, we will assume cardinality because the econometric results are rather similar and their interpretation is simpler.

[1] For more information on the GSOEP data, see, for example, Wagner, Frick and Schupp (2007).
[2] The GSOEP also includes data on how satisfied individuals are with their personal income, child care (if they have small children), family life, volunteer work (if they do) and insurance (for health care, unemployment, pension, and nursing care). However, these domains of satisfaction are only asked in a few waves. For example, satisfaction with personal income is only available in 2005 onwards, whereas satisfaction with family life is only asked in 2006, 2007 and 2008.

The results obtained in this study use a definition of disability based on whether the person reports a work-limiting health condition (e.g. Burkhauser and Daly, 1998; Burchardt, 2000; Hotchkiss, 2004; Jenkins and Rigg, 2004; Burkhauser, Houtenville and Rovba, 2006). Looking at the GSOEP questionnaire, we find that work limitation question has been changed over time and it has not been asked in all its waves (from 1988 to 1991 and in 1993 and 1994, or at all from 2002 onwards)[3]. One possible solution to bridge these gaps in the data is to employ a work limitation-based measure of disability created by Burkhauser and Schroeder (2007) which is available for all GSOEP years and comparable to that work limitation question included in the Current Population Survey (CPS) for United States. These authors combine information on satisfaction with health and degree of officially registered disability that have been asked each year to create this work limitation-based measure of disability[4]. They evaluate this measure in detail based on those years a work limitation question is available and also provide an example of the power of such a measure. They found that the best concordance of the combination definition with the severe limitation question is a combination of individuals with a health satisfaction level of *at most* 2 or a degree of disability of *at least* 53 percent. Namely, those individuals who fulfil at least one of these two conditions are considered disabled. In contrast, the previous studies on disability and life satisfaction carried out by Lucas (2007) and Oswald and Powdthavee (2008) only use the official registration measure to identify the disabled population. Burkhauser and Schroeder (2007) pointed out that if we only use the degree of disability

[3] In 2001, the work limitation question in the GSOEP was: *Aside from minor illnesses, does your health prevent you from completing everyday tasks like work around the house, paid work, studies, etc.? (Yes/No) To what extent?* (*Not at all/Slightly/Greatly*). This question is the closest one to that included in the CPS. In the CPS every working-age individual in the household is required to answer (in March of the survey year) the following question: "*Do you have a health problem or disability which prevents work or which limits the kind or amount of work you can do?*" (*Yes*/*No*). Those individuals who respond "*Yes*" are considered disabled.

[4] The variable "degree of disability" is obtained from the following question: *"Are you officially registered as having a reduced capacity to work or as being severely disabled? If Yes, what is the degree of your disability?"*. The degree of disability ranges from 0 (not disabled) to 100 (severely disabled).

measure to identify the disabled population we would miss individuals with a work limitation who were in the process of becoming registered and who had short-term limitations or had decided it was not worth registering. Following Pagan (2010), one may suppose that the variable "*satisfaction with health*" used in the definition of disability may be problematic in our analysis of the effects of the onset of disability on "*satisfaction with life*". However, it is important to point out that the variables disability and health are not strictly coincident. For example, a very important disability such as total blindness is not necessarily related to a very poor health status. Nevertheless, potentially some disabilities can be closely linked to lower levels of health status if they proceed from some illnesses causing, at the same time, not only limitations and disabilities but poor health too. We will go back to this issue in more detail in the result section.

We define disability onset to have occurred if an individual reports two consecutive periods of non-disability followed by two consecutive periods of disability. This is the same definition that Burkhauser and Daly (1998) employed and allows us to focus on long-term (non-transitory) disabilities (main focus of government disability policy) and reduce the impact of measurement error in reporting disability. In the same line that Jenkins and Riggs (2004), we are interested in the first onset of disability that a person may experience within our 25-year panel in order to avoid any issues arising from repeated disability episodes. The length of a disability spell is measured as the number of years during which the individual is observed as disabled, including the year of onset. Those whose disability spell begins before the panel are excluded from our analysis (left-censored[5]).

[5] This includes those individuals who remain disabled throughout all of the years and are observed within the panel. In this case, we cannot identify any transition between disability and non-disability status.

This study focuses on working-age population aged 21-58 years. This limited age group avoids confusing reductions in work or economic well-being associated with disability with reductions or declines associated with retirement at older ages or initial transitions into and out of the labour force related to job shopping at young ages (Burkhauser and Daly, 1998). Since the effects of the onset of disability on life satisfaction and domains of satisfaction may be different for males and females, the analysis is limited to males. From the 25 waves of the GSOEP (1984-2008), we obtain a full unbalanced panel available that contains 22,722 males aged 21-58, who are interviewed successfully at least in one year. Using the two-period definition, there are 504 males who are observed to experience the onset of disability during the panel[6]. By definition, these 504 individuals who experience the onset of disability remain disabled for at least two years. After two years of disability, around 64% of males are still disabled. This percentage decreases when the disability spell is longer. For example, 6 years after the onset more than 26% of males remain disabled. These percentages are similar to those obtained in other longitudinal studies of disability (e.g. Burchardt, 2000). The total number of males who are at risk of disability, but do not experience it during the panel, is 16,054 (117,736 person-years).

Method

We apply the methodology proposed by Clark *et al.* (2008) to evaluate the extent of anticipation and adaptation to onset of disability. These authors employ this methodology to analyse the degree of anticipation and adaptation of individuals to unemployment, marriage, divorce, widowhood, the birth of a child and layoff. We estimate fixed-effects models on life satisfaction and each domain of satisfaction

[6] This total number of males who experience the onset of disability within our panel (504) is greater than that observed in other longitudinal studies on disability. For example, there are 280 individuals (males + females) who experienced disability onset in the work of Jenkins and Rigg (2004).

(health, household income, place of dwelling, free time and job) that include an additional set of dummy variables measuring anticipation and adaptation to onset of disability. This allows us to control for unobserved heterogeneity and follow the variations in the satisfaction scores of a same individual throughout our 25-year panel. To test the adaptation hypothesis we estimate the following "*adaptation*" equation[7]:

$$DS_{it} = \alpha_i + \beta' X_{it} + \gamma_0 D_{0it} + \gamma_1 D_{1it} + \gamma_2 D_{2it} + \gamma_3 D_{3it} + \gamma_4 D_{4it} + \gamma_5 D_{5it} + \gamma_6 D_{6it} + \gamma_7 D_{7it+} + \varepsilon_{it} \qquad [1]$$

where DS_{it} is the specific domain satisfaction reported by individual "*i*" in the year "*t*", α_i is the individual fixed effect, X_{it} is a vector of explanatory variables, and ε_{it} is the error term. Following Pagan (2010), we split the disability variable up into 8 groups: those who have been disabled for 0-1 years (D_{0it}), 1-2 years (D_{1it}), 2-3 years (D_{2it}), and so on up until the last group, with those who have been disabled for seven years or more (D_{7it})[8]. The dummy variable D_{0it} takes the value 1 if the individual experiences the onset of disability, and all of the other "D" variables are equal to zero. If the individual is still disabled one year later then D_{1it}=1 and the rest of "D" variables are set to zero. If there is no adaptation to disability, then we would expect the estimated coefficients on all disability dummies to take roughly the same negative value. If there is adaptation, then the later values of γ will be less negative, i.e. individuals are recovering from disability. Complete adaptation is found when the later values of γ are not significant, i.e. the levels of life satisfaction of those individuals who are disabled for long enough are not statistically different from those reached by non-disabled individuals (our *control group*).

An analogous approach is followed for the analysis of anticipation effects. In this case, we replace the set of disability dummies in equation [1] by a series of dummies

[7] In contrast, the model used by Oswald and Powdthavee (2008) weights each previous year of disability (variable "Past disability from *t-1* to *t-3*") in the same way.
[8] Clark *et al.* (2008) include in this equation [1] dummy variables from D_{0it} to D_{5it}.

showing whether the individual will become disabled in the next 0-1 years (D_{-1it}), 1-2 years (D_{-2it}), 2-3 years (D_{-3it}) or 3-4 years (D_{-4it}). The "*anticipation*" equation is then as follows:

$$DS_{it} = \alpha_i + \beta' X_{it} + \gamma_{-4} D_{-4it} + \gamma_{-3} D_{-3it} + \gamma_{-2} D_{-2it} + \gamma_{-1} D_{-1it} + \varepsilon_{it} \quad [2]$$

where D_{-4it} takes the value 1 if the individual experiences the onset of disability in the following 3-4 years. The other dummy variables are defined in the same way. We expect zero or negative coefficients for these new disability dummies, and especially more negative ones where the onset of disability is closer. This equation [2] is estimated only for all non-disabled individuals who are at risk of disability onset. Following Clark *et al.* (2008), we can alternatively trace out the changes in the levels of satisfaction of all those individuals who enter into disability at time zero, without paying attention if they subsequently are not disabled (i.e. we create the D_{Xit} dummies solely as a function of lagged entry into disability without requiring that $D_{0it}=0$). Although this methodology is valid (and used in previous studies), it does confound adaptation to disability with the normal increase in the level of satisfaction when a person moves from disability to non-disability. In addition, Clark *et al.* (2008) points out that this methodology would produce more of a rebound than the method we adopt in this study.

The predicted values from the estimation of the equations [1] and [2] provide us with a baseline of life satisfaction and each domain of satisfaction, which uses information from both observable (the right-hand side variables) and unobservable variables, via the fixed effect (Clark *et al.*, 2008). As a result, the analysis of domain satisfactions relative to the baseline of those who at some stage become disabled controls for the "*selection effect*" that disability tends to have on individuals who are

already more disadvantaged (Jenkins and Riggs, 2004)[9]. The remainder of variables included in the X_{it} vector in equations [1] and [2] are those traditionally used in other previous studies on satisfaction (e.g. Clark *et al.*, 2001, Zimmermann and Easterlin, 2006; Oswald and Powdthavee, 2008; Clark *et al.*, 2008; Powdthavee, 2009; Pagan, 2010). We include age, marital status, educational level, employment status, if the individual is a home owner, the number of children (under age 18) in the household, total number of persons living in the household, the real household income per capita (in logarithms), region of residence and the year of the interview.

Results

To start with our analysis, Appendix Table A.1 presents the mean reported satisfaction scores and percentage of highly satisfied (i.e. satisfaction score equals or greater than 7 on the scale 1-10) by disability status for life satisfaction and all domains of satisfaction analysed. For all of the six satisfaction measures, non-disabled individuals enjoy greater levels of satisfaction as compared to their disabled counterparts, and the differential is easily significant at the 1% level. The differential is especially high for satisfaction with health (4.38 points), whereas for satisfaction with housing and leisure the differential is smaller (0.63 and 0.64 points, respectively). For the disabled sample, the highest satisfaction ratings are found in the domains of satisfaction with housing (6.85), leisure (5.89) and job (5.62), whereas for the non-disabled sample these are found in satisfaction with housing (7.48), health (7.25) and job (7.08). The overall life satisfaction is 7.12 and 5.50 (i.e. a gap of 1.62 points) for non-disabled and disabled individuals, respectively. Looking at the percentage of highly satisfied individuals in each domain of satisfaction, we found again that these percentages are higher for non-

[9] Jenkins and Rigg (2004) conclude that those individuals who become disabled, compared to those who do not became disabled, are older, have lower household income, are less likely to be employed and have lower educational levels.

disabled males as compared to disabled ones. In all cases, the differential observed between both groups is highly significant at the 1% level. The differential in terms of life satisfaction is 37.5 points in favour of non-disabled males. However, this differential is even higher whether we observe the percentages of highly satisfied individuals with health, 60.28 points. The differential for satisfaction with household income and job ranks in the middle (23.73 and 24.77, respectively). Once again, the gap between non-disabled and disabled males is lower for satisfaction with housing and leisure (12.89 and 6.72 points, respectively). In addition, we observe for these two domains of satisfaction (housing and leisure) the highest percentage of highly satisfied individuals with disabilities (60.39 and 51.72, respectively), whereas for non-disabled individuals they are found for satisfaction with housing and health (73.28 and 69.68, respectively).

As we noted earlier and following Pagan (2010), we have studied the relationship between disability and health in order to test that both variables do not correlate perfectly for our sample of reference (males aged 21-58 years)[10]. According to Appendix Table A.2, we observe that for those individuals with the highest levels of health satisfaction, almost all of them are people without disabilities (around 98 per cent). However, looking at the distribution by disability status, 93.3 per cent of the total sample corresponds to people without disabilities. Therefore, the huge percentages of non-disabled people in the highest levels of health satisfaction are very closely related to the sample distribution among disabled and non-disabled individuals. Looking at column percentages, we find that disabled males report lower levels of health satisfaction relative to non-disabled ones. Although disability and low health satisfaction are related, we believe that they do not share exactly the same information.

[10] Due to definition of our disability measure, all individuals with a satisfaction with health of at most 2 are considered as disabled. For this reason, Appendix Table A.2 shows zeros in the health satisfaction scores 0, 1 and 2 for non-disabled individuals.

Intuitively, we can take again the example of blindness. When it is generated by a chronic illness (such as diabetes) it is probably linked with low health satisfaction, but when blindness is related to a congenital problem of the eyes, this disability and the level of health satisfaction of the individual will probably be orthogonal (Pagan, 2010). For example, 24.29% of disabled individuals report a level of satisfaction with health equal to or over 5 points. Appendix Table A.2 also shows the mean life satisfaction considering health satisfaction and disability, and we find the expected result that life satisfaction increases with health satisfaction for non-disabled and disabled individuals. Within the literature in psychology, Grimby *et al.* (1988) conclude that the domain of disability extends far beyond health related concerns to encompass the person's well-being, definition of self and social position. As a result, life satisfaction goes beyond activities of daily living and disease categories because it directs attention to the more complete social, psychological and spiritual being.

Table 1 reports the regression results obtained from the estimation of adaptation and anticipation equations [1] and [2] on satisfaction with life and each domain of satisfaction. All regressions are estimated separately using a fixed-effects model. To ease the interpretation of all these results and similar to Clark *et al.* (2008), we present graphically in Figure 1 the estimated coefficients from the adaptation and anticipation equations [1] and [2] (i.e. D_{-4it}, D_{-3it}, …, D_{6it}, D_{7it}), rather than constantly referring to the regression table. The horizontal line is at zero and means no effect on life satisfaction or domain of satisfaction. The vertical line measures the impact of past, current and future disability on the levels of life satisfaction or domain of satisfaction with respect to the reference person. Therefore, we can easily observe the degree of anticipation and adaptation to disability in every year in terms of life satisfaction and each domain of

satisfaction (i.e. health, household income, housing, leisure and job). We use the symbol ▲ to denote those coefficients that are significant at the 5% level.

[Table 1]

According to Figure 1, the life satisfaction score of those individuals who suffer the onset of disability at time "*t*" significantly decreases by 1.368 points as compared to that reached for the reference person. The coefficients of the dummy variables that take into account the length of time a person has been disabled (from 1-2 years to 7 or more years) are less negative when the distance (in years) from the onset increases. In our case, the coefficients of the dummy variables D_{5it}, D_{6it} and D_{7it} are no significant at conventional levels. This means that full adaptation to disability is reached after 5 years of the onset of disability and thus the adaptation hypothesis is supported by the data. This results is very similar to that obtained by Pagan (2010) for the period 1984-2006, who concludes that being disabled for 6 or more years is the same in terms of life satisfaction as not being disabled at all (the *control group*). With regards to satisfaction with health, we observe that becoming disabled has a strong negative effect on the levels of satisfaction with health reported by German males. The year of entry into disability the health satisfaction falls 3.475 points as compared to that of the reference person. After the onset the levels of health satisfaction increases but they are lower than those reached before the onset (around 2.2 points). This result implies that there is no full adaptation to disability in terms of health satisfaction. Loosely speaking, we only detect a partial adaptation to disability (around 40%) with respect to the baseline level. This finding supports again the question pointed out above that disability and health do not reflect always the same reality and the domain of disability extends far beyond health related concerns to encompass the person's well-being, definition of self and

social position. Therefore, it is critical in studying disability not to restrict the notion of quality of life and life satisfaction to health related issues.

[Figure 1]

The entry into disability has a negative and statistically significant effect on the levels of satisfaction with household income[11]. The income satisfaction scores at time "*t*" decrease by 0.751 points and reach the same levels reported by the reference person after 5 years from the onset. Therefore, data support the existence of a complete adaptation to disability in this domain of satisfaction. Burkhauser and Daly (1998), using longitudinal data, conclude that the labour earnings of German males with disabilities are much closer to those of German males without disabilities than is the case in the United States, due to the Germany's strong commitment to promote and protect the employment for people with disabilities. In addition, these authors point out that large differences in wage earnings and household income found in cross-sectional studies may exaggerate the influence that disability has on income levels in the United States. Concerning housing satisfaction, there is a slightly drop in the levels of satisfaction during the year of onset (-0.498 points) and they almost remain in the same level, except 5 years after the onset wherein the coefficient estimated is no significant relative to the reference person. Once again, after 5 years from the onset of disability the individuals return to the levels registered by those who have not become disabled. We found a very quick adaptation to disability in terms of leisure. The adaptation is reached after only three years from the onset. Oi (1991) points out that disability steals time from individuals (e.g. hours of work or free time) and these people may look for other types of jobs (e.g. part-time work and self-employment) as a means of accommodating working life and disability status, especially for those who are easily tired or have

[11] We have to remember that the GSOEP contains information on the levels of satisfaction of individuals with their personal income but it is only available for only 4 years (from 2005 onwards).

considerable health limitations. Finally, the levels of satisfaction with job also decrease by 0.906 points in the year of onset as compared to the reference person. All remaining coefficients are negative and statistically significant at conventional level. The levels of job satisfaction increases smoothly in the following years but do not reach the levels reported by those who have not become disabled. We only identify a partial adaptation to disability of approximately 50%. Overall, the ranking of negative impacts of disability on each domain of satisfaction at time "*t*" is the following: health (-3.475), job (-0.906), household income (-0.751), leisure (-0.588) and finally housing (-0.498). This ranking is in line with that obtained by Powdthavee (2009). Complete adaptation to disability is found in satisfaction with life, household income and housing (after 5 years in all cases), as well as in satisfaction with leisure (after 3 years). In contrast, partial adaptation to disability are detected in the domains of satisfaction with health and job (approximately 40 and 50%, respectively).

Turning to the anticipation hypothesis, the results show strong anticipation effects to disability but not in all of the domains of satisfaction. We have to bear in mind that all anticipation equations has been estimated only for those who are currently without disability. Becoming disabled within the next year or 1-2 years has a significant negative effect on the levels of life satisfaction reported by males as compared to those males who are non-disabled (-0.155 points). The drop is even sharper if the individual enters into disability within the next year (−0.353 points). In contrast, the coefficients of the other two lead dummy variables (i.e. disabled 3-4 years hence and 2-3 years hence) are less negative and not significant at 5% level as compared to the reference person. This means that the individual's life satisfaction score starts falling significantly and progressively 1-2 years before the onset of disability. With regards to health satisfaction, there are substantial lead effects for males aged 21-58, with disability up to

four years in the future significantly reducing current health satisfaction. The magnitude of the coefficients of the lead dummy variables is especially higher within the 1-2 years and the next year (-0.594 and -0.985 points, respectively) as compared to non-disabled males. On the contrary, no anticipation to disability is found for satisfaction with household income and leisure. None of the coefficients of the lead dummy variables in both cases are significant at 1%. Two-year effect is found for satisfaction with housing. If the individual becomes disabled within the next year or 1-2 years, the levels of satisfaction with housing decrease by 0.51 and 0.235 points, respectively, in comparison to non-disabled individuals. Finally, future disability reduces the current levels of job satisfaction reported by individuals. According to Figure 1, this reduction is soft and monotonic each year before the onset. The size of the coefficients of lead dummy variables moves from -0.347 (disabled 3-4 years hence) to -0.752 (disabled within the next year)[12]. The Table 2 summarizes all results obtained to test the anticipation and adaptation hypotheses for life satisfaction and all domains of satisfaction analysed. These findings corroborate *in part* the hypothesis formulated by the set-point model that people initially react to events, but later they return to baseline levels of well-being. However, this hypothesis is not valid whether we analyse the adaptation to disability in terms of health and job satisfaction, wherein only partial adaptation is supported by the data. In addition, anticipation effects are not found for satisfaction with household income and leisure.

[Table 2]

[12] Similar to Clark *et al.*, (2008) and Pagan (2010), we have tested the robustness of the estimation results shown in Table 1. Firstly, we have re-estimated all anticipation and adaptation equation without including the household income variable in order to check the existence of a possible problem of endogeneity. The results obtained in all cases are very similar to those shown in Table 1. Secondly, we have considered each measure of satisfaction as ordinal variables and have estimated conditional fixed-effects logits (using a binary dependent variable that take the value 1 if the level of satisfaction ranges between 0 and 7, and zero if it is between 8 and 10). Once again, the results are very similar and do not change the conclusions obtained in our study.

With regards to the remainder of the variables included in the equations [1] and [2], we found strong significant effects of age on life satisfaction scores and almost all of the domains of satisfaction. Although the dummy variables measuring the individual's marital status have a significant effects on life satisfaction in both equations (except for the coefficient on being single), they are less or no significant in other domains of satisfaction as, for example, for satisfaction with health or job. The variable "*years of education*" is negative and statistically significant for satisfaction with life and housing. The coefficient on this variable is also significant but positive for satisfaction with job in both equations. We found significant effects of the variable "*household income per capital* (in logarithms)" for all satisfaction measures except for satisfaction with leisure and job as compared to the reference person. The presence of children in the household has negative effects on household income (except if there is 1 child living in the household) and leisure time (especially if there are 3 or more children), whereas it has positive effects on satisfaction with housing. Household sizes greater than 1 have a positive effect on the levels of satisfaction with life and household income. Those males who are part-time workers or are not working report lower levels of satisfaction in all of the domains of satisfaction, expect for satisfaction with leisure wherein we found the opposite result as compared to those working full-time (reference category). The magnitude of its effect on life satisfaction and domain of satisfaction is stronger and significant for those males who are not working. Finally, being a home-owner has a positive and significant effect on the level of satisfaction with life, housing and leisure reported by the individuals. We have to remember that the estimation of the equations [1] and [2] include fixed effects, so the results do not represent selection of unhappy types into disability (Clark *et al.*, 2008).

Conclusions

Using data from the first 25 waves of the German Socio-Economic Panel (covering the period 1984-2008), we have analysed from a dynamic perspective the effects of onset of disability on the levels of life satisfaction and five different domains of life for German males aged 21-58. After estimating fixed-effects models on each satisfaction measure, the results show that those people who experience onset suffer a significant reduction in their life satisfaction scores at time "*t*", but they return to the reference baseline satisfaction after 5 years. In addition, there is strong evidence that life satisfaction anticipates future disability onset occurring at time "*t*" (two years before). As a result, the anticipation and adaptation hypotheses postulated by the set-point model are supported in terms of life satisfaction by our data. However, complete adaptation to disability is not found in all domains of satisfaction. For example, partial adaptation is found for satisfaction with health and job, approximately 40 and 50% after seven years from the onset of disability, respectively. It is worth noting the significant negative effect of onset of disability on the levels of health satisfaction reported by individuals at time "*t*". Furthermore, the anticipation hypothesis is not supported for satisfaction with household income and leisure. All our findings contribute to increasing the debate among economists, psychologists and sociologists on the effect of onset of disability on well-being of individuals and providing an adequate framework for further research in this area. An important limitation in all existing studies on disability and well-being (including this one) is that there is no information on the type of disability that the person has. The GSOEP does not contain this information and does not allow us to carry out a more disaggregated analysis. There is no doubt that the anticipation and adaptation to disability vary depending on the type of disability. For example, the existing literature have concluded that people with mental and psychological problems suffer the most negative social attitudes and have the lowest probability of employment.

For these people the grade of anticipation and/or adaptation to disability may be very small or even null as compared to other disabled individuals.

From a public policy perspective, the detection and recognition of disability as soon as possible become a very important question in order to facilitate a faster individually-tailored intervention process (OECD, 2003). Policy makers must take into account the high heterogeneity of the disabled population and design different actions and measures according the type of disability that the individuals suffer. Disabled individuals vary in their abilities, education, work experiences, and demographic characteristics, and jobs vary in their skill and knowledge requirements. The provision of health devices or technical facilities such us hearing aids, medications, or wheelchairs, or by a social support network of friends or relatives are crucial to increase the adaptation to disability in all domains of life. The risk of discrimination tends to be greater when the time span with the disability is longer and/or when the onset of the disability occurred at an early age. The timing of the disability onset strongly influences human capital development. An individual who experiences onset as a child likely will make different types of human capital investments throughout his or her life than an individual who experiences onset as an adult (Livermore *et al.*, 2000). In addition, the more obvious the disability is, the greater the risk of exposure to discrimination and stigmatisation. Discrimination, and in particular stigmatisation, can seriously damage different areas of the lives of people with disabilities, namely their life satisfaction, their self-esteem, their subjective evaluation of their health, their psychological well-being as well as their consumption of health care services. The absence or low level of social or cultural resources among the disabled (the fact of living alone, unemployment and/or lack of educational qualifications) tends to exacerbate the risk of discrimination and, in particular, of stigmatisation. The disabled population frequently experience higher levels of

discrimination in the world of employment and education. Vocational training and rehabilitation programs must be promoted to increase the likelihood of maintaining or returning to work after becoming disabled. However, in many cases these kinds of interventions are used too little and often initiated too late. In many cases, public policies targeted at people who are at risk of becoming disabled are difficult to design and implement due to the difficulty in ascertaining *ex ante* who is or is not going to be disabled (Jenkins and Rigg, 2004). Nevertheless, it is necessary to help employers to manage risk and create healthy workplaces, and to protect and promote the health and well-being of individuals. Finally and according other studies in the psychology area, two elements positively contribute to greater life satisfaction among the disabled: the presence of a social support network and the feeling of integration, i.e. being able to lead a "*normal*" life in spite of or with their disability. These factors attenuate the negative impact of discrimination and stigmatisation and contribute to increasing their psychological and economic well-being.

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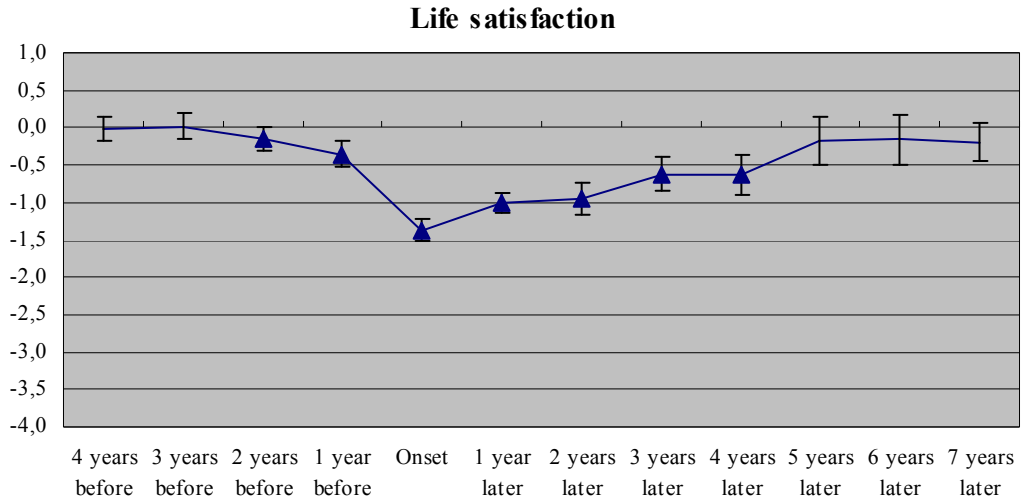
Table 1: Fixed-effects satisfaction regressions to test anticipation and adaptation to disability onset.

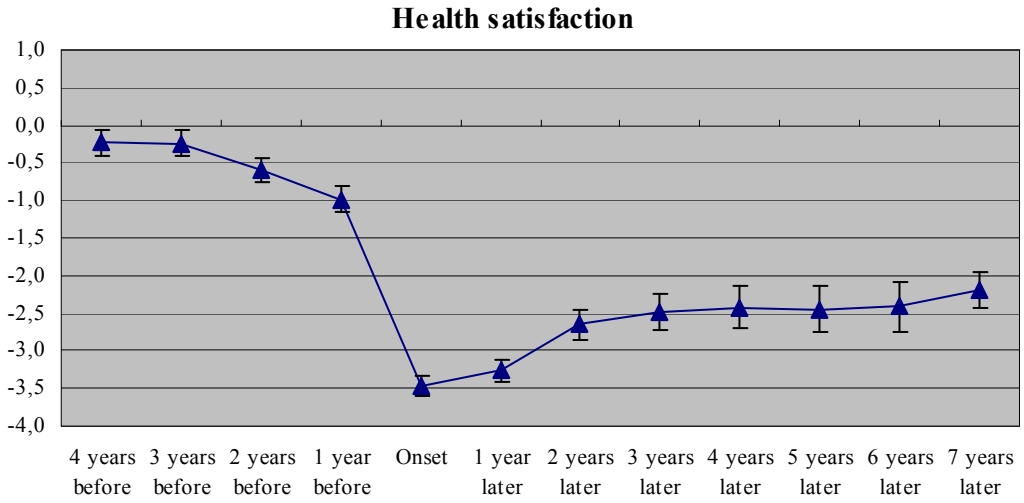
	Adaptation equation						Anticipation equation					
	Life Overall	Health	Income	Housing	Leisure	Job	Life Overall	Health	Income	Housing	Leisure	Job
Variables	*Coef.*	*Coef.*	*Coef.*	*Coef.*	*Coef.*	*Coef.*	*Coef.*	*Coef.*	*Coef.*	*Coef.*	*Coef.*	*Coef.*
Lags:												
Disabled 0-1 years	-1.368***	-3.475***	-0.751***	-0.498***	-0.588***	-0.906***	-	-	-	-	-	-
Disabled 1-2 years	-1.009***	-3.266***	-0.663***	-0.325***	-0.285***	-0.866***	-	-	-	-	-	-
Disabled 2-3 years	-0.954***	-2.650***	-0.392***	-0.487***	-0.453***	-0.909***	-	-	-	-	-	-
Disabled 3-4 years	-0.622***	-2.487***	-0.334**	-0.391***	-0.116	-1.126***	-	-	-	-	-	-
Disabled 4-5 years	-0.638***	-2.418***	-0.430**	-0.687***	-0.053	-0.825***	-	-	-	-	-	-
Disabled 5-6 years	-0.177	-2.448***	-0.205	-0.201	-0.117	-0.749**	-	-	-	-	-	-
Disabled 6-7 years	-0.158	-2.410***	0.214	-0.642***	0.053	-0.683**	-	-	-	-	-	-
Disabled 7 or more years	-0.192	-2.194***	-0.010	-0.450***	-0.251	-0.537**	-	-	-	-	-	-
Leads:												
Disabled 3-4 years hence	-	-	-	-	-	-	-0.019	-0.232***	-0.044	-0.064	0.167	-0.347***
Disabled 2-3 years hence	-	-	-	-	-	-	0.020	-0.240***	0.057	-0.065	0.087	-0.450***
Disabled 1-2 years hence	-	-	-	-	-	-	-0.155**	-0.594***	-0.156	-0.235**	0.010	-0.591***
Disabled within the next year	-	-	-	-	-	-	-0.353***	-0.985***	-0.007	-0.510***	-0.124	-0.752***
Age:												
21-34	0.126***	0.062***	0.302***	0.333***	0.184***	0.074	0.122***	0.050***	0.315***	0.338***	0.178***	0.087*
35-44	0.036*	0.024***	0.141***	0.083***	-0.070**	0.044	0.025	0.008***	0.133***	0.088***	-0.075***	0.039
Marital status:												
Single	-0.019	-0.022	-0.036	-0.117***	0.098**	-0.008	-0.048*	-0.045	-0.038	-0.134***	0.089**	-0.018
Widowed	-0.267**	-0.137	0.237	0.180	0.119	0.221	-0.316	-0.137	0.179	0.173	-0.035	0.119
Divorced	-0.104***	0.001	-0.240***	-0.041	0.150***	0.068	-0.127***	-0.027	-0.235***	-0.098**	0.152***	0.049
Separated	-0.532***	0.032	-0.467***	-0.190***	-0.062	0.066	-0.579***	-0.032	-0.472***	-0.241***	-0.094	0.038
Years of education	-0.042***	-0.004	-0.010	-0.021**	-0.012	0.022**	-0.045***	0.001	-0.013	-0.020**	-0.011	0.023**

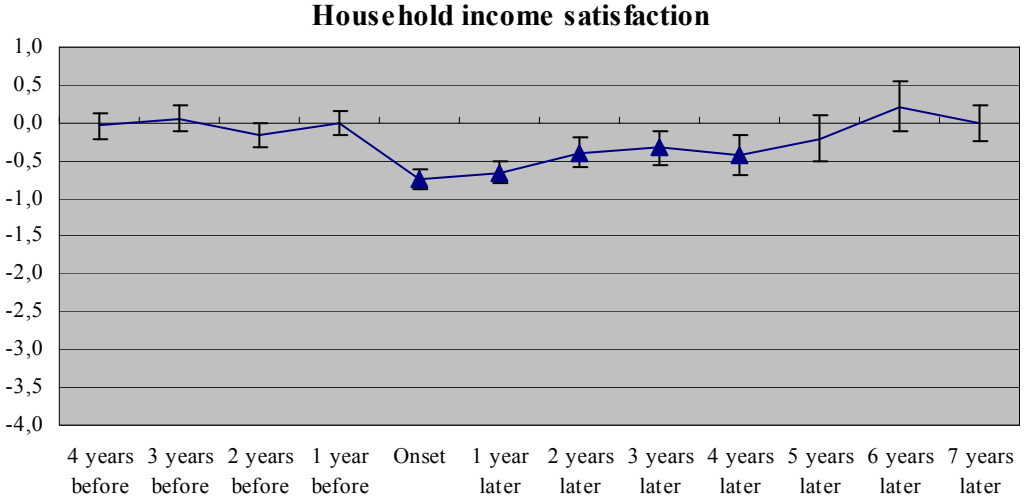
Log (real household income per capita)	0.055***	-0.023**	0.223***	0.067***	-0.003	0.014	0.052***	-0.039***	0.224***	0.063***	0.004	0.014
Number of children:												
1	0.034*	0.005	-0.032	0.071***	-0.092***	0.037	0.027	0.004	-0.016	0.070***	-0.101***	0.031
2	0.006	-0.014	-0.105***	0.094***	-0.222***	0.037	-0.011	-0.010	-0.102***	0.099***	-0.224***	0.027
3+	0.037	0.009	-0.096**	0.031	-0.412***	0.105**	0.007	-0.025	-0.099**	0.000	-0.384***	0.103***
Household size:												
2	0.195***	0.014	0.308***	0.181***	-0.016	0.014	0.178***	-0.005	0.307***	0.184***	0.010	0.008
3	0.142***	0.031	0.217***	0.017	-0.022	0.002	0.120***	0.004	0.201***	0.007	-0.002	-0.019
4+	0.146***	0.011	0.367***	-0.027	-0.004	0.025	0.134***	-0.016	0.362***	-0.042	0.008	0.008
Employment status:												
Part-time	-0.373***	-0.178***	-0.906***	-0.083**	0.399***	-0.431***	-0.342***	-0.141***	-0.881***	-0.046	0.406***	-0.408***
Not working	-0.779***	-0.206***	-1.476***	-0.051***	0.768***	-	-0.748***	-0.126***	-1.476***	-0.016	0.765***	-
Home owner	0.044***	-0.019	0.026	0.886***	0.093***	0.019	0.048***	-0.008	0.038*	0.901***	0.086***	0.011
Constant	6.992***	6.294***	5.048***	7.318***	6.965***	6.095***	7.199***	6.628***	5.155***	7.427***	7.041***	6.113***
Number of observations	95,057	95,115	94,306	94,217	94,438	81,570	90,832	90,876	90,104	90,010	90,241	78,960
Number of individuals	15,194	15,208	15,153	15,193	15,064	13,956	14,987	15,001	14,944	14,982	14,866	13,797
R^2 (within)	0.0541	0.0939	0.0701	0.0380	0.0237	0.0204	0.0434	0.0547	0.0660	0.0327	0.0238	0.0175

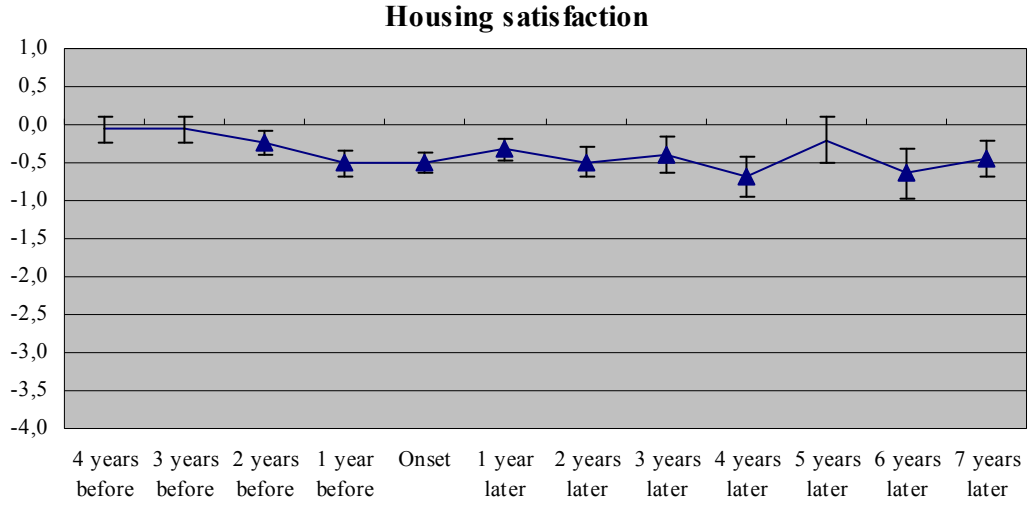
Note: All equations include regional and year dummies. The reference person is non-disabled, married, aged 45-58, full-time worker, no children in the household, one person in the household, no home-owner, living in Berlin and interviewed in 2008. * Significant at 10%, ** significant at 5% and *** significant at 1%.
Source: Author's calculations using the German Socio-Economic Panel (GSOEP) for the period 1984-2008.

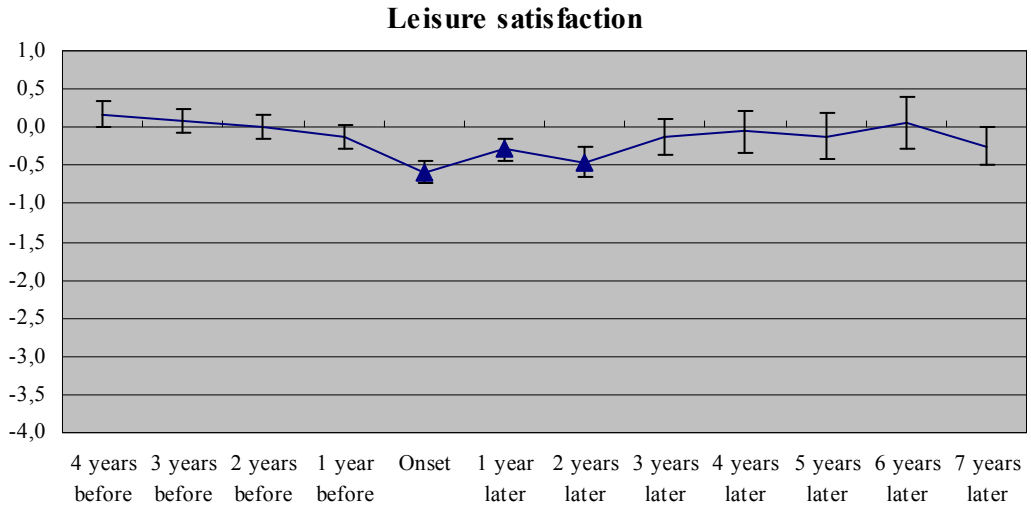
Figure 1: Dynamic effect of the onset of disability on life satisfaction and the domains of satisfaction for males (aged 21-58).

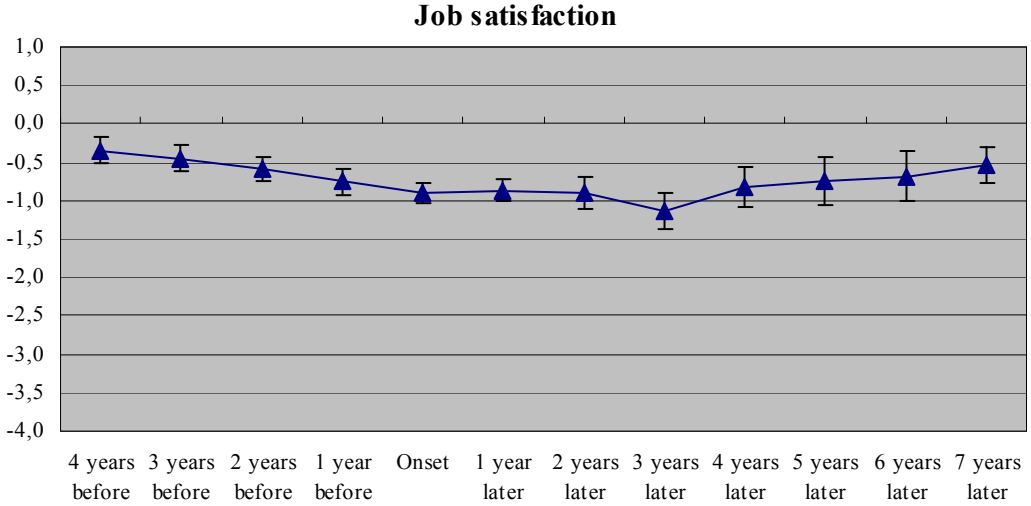












Note: (▲) Coefficient is significant at 5%. Confidence intervals (95%) are reported for each mean satisfaction score.
Source: Estimated coefficients shown in Table 1.

Table 2: Summary of anticipation and adaptation effects of disability on life satisfaction and each domain of satisfaction for males aged 21-58 during the period 1984-2008.

Type of satisfaction	Anticipation	Adaptation
Life overall	2 years	Complete after 5 years
Health	4 years	Partial after 7 years (40%)
Household income	0 years	Complete after 5 years
Housing	2 years	Complete after 5 years
Leisure	0 years	Complete after 3 years
Job	4 years	Partial after 7 years (50%)

Source: Estimated coefficients shown in Table 1 and Figure 1.

APPENDIX

Table A.1: Mean reported satisfaction scores and percentage of highly satisfied (satisfaction score equals or greater than 7 on the scale 1-10) by disability status for males aged 21-58 during the period 1984-2008.

Type of satisfaction	Non-disabled	Disabled
Mean scores:		
Life overall	7.12	5.50***
Health	7.25	2.88***
Household income	6.42	5.05***
Housing	7.48	6.85***
Leisure	6.52	5.89***
Job	7.08	5.62***
% highly satisfied:		
Life overall	69.42	31.92***
Health	69.68	9.40***
Household income	51.66	27.93***
Housing	73.28	60.39***
Leisure	58.44	51.72***
Job	68.91	44.14***

Note: *** Difference significant at 1%. Weighted data.
Source: The German Socio-Economic Panel (GSOEP) for the period 1984-2008.

Table A.2: Two-way table of frequencies of the variable "health satisfaction" and "disability" and mean of life satisfaction.

	Non-disabled	**Disabled**	**Total**
Health satisfaction			
0			
% row	0	100	**100**
% column	0	16.75	1.12
Mean life satisfaction	-	4.089	4.089
1			
% row	0	100	**100**
% column	0	13.24	0.89
Mean life satisfaction	-	4.336	4.336
2			
% row	0	100	**100**
% column	0	33.12	2.22
Mean life satisfaction	-	5.030	5.030
3			
% row	88.85	11.15	**100**
% column	4.00	6.99	4.20
Mean life satisfaction	5.398	5.509	5.408
4			
% row	92.49	7.51	**100**
% column	4.96	5.61	5.00
Mean life satisfaction	5.754	5.820	5.758
5			
% row	94.06	5.94	**100**
% column	11.70	10.3	11.60
Mean life satisfaction	6.129	6.240	6.134
6			
% row	96.90	3.10	**100**
% column	9.56	4.26	9.20
Mean life satisfaction	6.559	6.681	6.562
7			
% row	98.20	1.80	**100**
% column	18.06	4.63	17.16
Mean life satisfaction	6.987	7.000	6.988
8			
% row	99.12	0.88	**100**
% column	27.00	3.32	25.41
Mean life satisfaction	7.394	7.542	7.395
9			
% row	99.64	0.36	**100**
% column	14.07	0.70	13.18
Mean life satisfaction	7.808	7.902	7.808
10			
% row	99.28	0.72	**100**
% column	10.66	1.08	10.02
Mean life satisfaction	8.049	8.033	8.049
Total	93.30	6.70	100
	100	**100**	**100**
Mean life satisfaction	7.072	5.239	6.970

Source: Author's calculations using the German Socio-Economic Panel (GSOEP) for the period 1984-2008.