

This is an Open Access document downloaded from ORCA, Cardiff University's institutional repository:<https://orca.cardiff.ac.uk/id/eprint/107219/>

This is the author's version of a work that was submitted to / accepted for publication.

Citation for final published version:

Jones, Melanie , Mavromaras, Kostas, Sloane, Peter J. and Wei, Zhang 2018. The dynamic effect of disability on work and subjective well-being. *Oxford Economic Papers* 70 (3) , pp. 635-657.
10.1093/oep/gpy006

Publishers page: <https://doi.org/10.1093/oep/gpy006>

Please note:

Changes made as a result of publishing processes such as copy-editing, formatting and page numbers may not be reflected in this version. For the definitive version of this publication, please refer to the published source. You are advised to consult the publisher's version if you wish to cite this paper.

This version is being made available in accordance with publisher policies. See <http://orca.cf.ac.uk/policies.html> for usage policies. Copyright and moral rights for publications made available in ORCA are retained by the copyright holders.



The dynamic effect of disability on work and subjective well-being

By Melanie Jones^a, Kostas Mavromaras^b, Peter Sloane^c, and Zhang Wei^d

^a Cardiff Business School, Cardiff University; and IZA

^b Future of Employment and Skills Research Centre, University of Adelaide; IZA; and GLO

^c WELMERC, Swansea University; and IZA

^d Future of Employment and Skills Research Centre, University of Adelaide, Adelaide, South Australia 5005; e-mail: zhang.wei@adelaide.edu.au

Abstract:

Using longitudinal data from the Household, Income and Labour Dynamics in Australia (HILDA) Survey (2001-2013) we examine the relationship between the dynamics of work-limiting disability, employment and life satisfaction. By employing two alternative classifications of the dynamic trajectories of disability we are able to explicitly consider the influence of disability exit in addition to examining onset by chronicity and severity. After controlling for unobserved individual heterogeneity, we find pronounced declines in the probability of employment and life satisfaction at disability onset. Further, while individuals are found to recover rapidly and completely from a one period disability, there is little evidence of recovery even after ten years for those whose disability is chronic, defined as evident for three or more years post-onset, and severe.

JEL classification: I10, J21, I31.

1. Introduction

Most analyses of the labour market experience of people with disability are cross-sectional in nature and implicitly assume that disability is an unchanging or permanent condition. Yet, this is far from the case in practice. As Burchardt (2000) puts it, the ‘perception that disabled and non-disabled people make up two entirely distinct and fixed groups in the population is misleading’ (page 662). Using the British Household Panel Survey (BHPS) she shows that only a small proportion of working age individuals who become disabled remain so long-term. Recognising this, a limited number of studies have highlighted the insights afforded by using longitudinal data to explore how labour market outcomes, such as the probability of employment and earnings, change according to the dynamic patterns of disability (see, amongst others, Charles, 2003 and Meyer and Mok, 2013).

This paper extends the longitudinal literature by applying an event study approach to data from the Household, Income and Labour Dynamics in Australia (HILDA) survey. This evidence forms a useful comparator to, and integrates elements of, existing work, particularly in the US and UK. Moreover, HILDA has a number of advantages in this context, the main one being that, in addition to labour market indicators, it contains direct questions on life satisfaction and its facets which enable us to explore the broader impact of disability, an issue Meyer and Mok (2013) suggest should be ‘seriously addressed in future research’ (page 33). As such, the analysis incorporates largely distinct exploration of subjective well-being into the literature on the economic impact of disability onset and, in doing so, is able to provide a more complete picture of the experience of disability onset and the channels through which disability influences well-being. The thirteen waves (2001-2013) provide a panel element which is now sufficiently long to trace how employment and life satisfaction change pre-onset, at onset and post-onset and the focus on disability transitions within a contemporary panel enables us to classify the dynamic patterns of disability according to alternative

definitions in the literature so that we are able to consider disability exit explicitly (Jones *et al.*, 2016) and identify the effects of onset according to chronicity and severity (Meyer and Mok, 2013).

The focus of this paper on Australia also provides timely evidence in a key area of major policy change, the National Disability Insurance Scheme (NDIS). The concept of the NDIS was first introduced in 2011 through a Productivity Commission report (Productivity Commission 2011) and was followed by the National Disability Insurance Scheme Act 2013. The Scheme's implementation commenced with a trial of approximately 40,000 people with disability from July 2013 to June 2016 and has been in its national rollout phase since July 2016. This is expected to be completed by the end of 2019 with approximately 460,000 participants at an estimated cost of AU\$22 billion per annum, which represents almost a doubling of the national annual spending on disability. This paper's emphasis is relevant to many aspects of the NDIS, but principally through (i) its focus on employment and life satisfaction and (ii) the analysis of the changing impact of disability on these outcomes.

First, this paper focusses on one of the core objectives of the NDIS, which is to improve the well-being of people with a significant and permanent disability in Australia. Mavromaras *et al.* (2016) discuss the way the NDIS places emphasis on improving economic and social participation, firstly by allowing the person with disability to increase their choice and control over what economic and social participation they wish to engage in and secondly, by providing the necessary planning process and funding. Funds provided by the NDIS can be managed in a variety of ways including complete self-management. The range of supports funded by the NDIS is very diverse and the Scheme is designed to enable and empower the person with disability to choose those they believe optimal. The trial area evidence indicates that funding has been used to improve the quality of life of people with disability in a wide variety of ways, which include individual and social activities, home based and outdoors,

including taking holidays.¹ The emphasis on well-being in this paper is clearly shared with the NDIS.

Second, notwithstanding that NDIS participation is limited to people with a significant and permanent disability, once eligibility has been established, the NDIS rules allow for considerable flexibility in provisions and supports, in recognition that these need to account for both the changing nature of disability and its impact on well-being. To facilitate this, the NDIS rules provide for regular (re)assessments of individual support plans. In identifying the magnitude and nature of changes in employment and life satisfaction over the course of disability onset, this paper provides evidence from which these support plans can be tailored to assist those likely to experience the most pronounced change in life outcomes, and at the time and in the areas where support is needed most.

The contribution of this paper therefore, lies in its combination of elements – a dynamic approach, analysing the impact of alternative disability trajectories on employment, life satisfaction and facets of satisfaction, and a contemporary focus on Australia. In doing so, it builds on previous longitudinal evidence, to provide an integrated, unique and particularly policy relevant contribution to the literature.

The remainder of the paper is structured as follows. Section 2 provides a brief review of the existing evidence relating to the dynamics of disability. Section 3 introduces HILDA and the measures and methods employed in this analysis. The results are presented and discussed in Section 4 and Section 5 concludes.

¹ Mavromaras *et al.* (2016) present evidence that people with disability in the trial areas have been choosing to use their NDIS funding in different ways including to spend time with family at home and outside the home, going out to see a movie or for food or for drinks, spending time with friends outside the home, playing sports, going for a walk or swimming, using the internet for social networking and emailing, spending time with friends at home and going for a holiday (p. 89, Figure 11). Funding also can cover longer-term activities, such as further learning and training aimed at improving well-being through economic and social participation.

2. Previous Literature

While the focus of the international evidence has been the cross sectional association between disability and labour market outcomes recent analysis, particularly in the US, has used panel data and fixed effects methods to examine the effects of patterns of disability, particularly in terms of duration, on employment and earnings. For example, using an event-study approach, Charles (2003) focuses on physically impaired male heads of household who appear in at least three consecutive waves of the Panel Survey of Income Dynamics (PSID) over the period 1968 to 1993 and finds a sharp drop in annual earnings as a result of hours reductions around the date of onset. Further, drops in earnings seem to predate the recorded date of onset, consistent with declining health before the individual reports disability. Charles reports long-run losses in expected annual earnings amounting to about 12% per annum ten years post-onset, with older workers, non-whites, the less educated, and the more chronically disabled suffering the biggest losses. Industry affiliation after onset seems to be important, as whites and more educated disabled people are more likely to switch industries and occupations, making their recovery larger and more immediate.

Even more substantial effects were found by Mok *et al.* (2008) and Meyer and Mok (2013), using a similar methodology and the PSID up to 2009. Mok *et al.* (2008) attempted to replicate the published results of Charles (2003), but were unable to do so, finding much larger effects. Thus, it appears that the Charles (2003) earlier results should be treated with a degree of caution. Meyer and Mok (2013) examine a far broader range of outcomes including incidence of poverty, transfer income and food and housing consumption. They find evidence of a long-term decline in after tax income and consumption for those with chronic disability which is substantially greater for those who report their disability as severe. In a similar manner, Jolly (2013) uses the 1968-2007 waves of the PSID to compare the income mobility patterns associated with work-limiting disability. The onset of disability is associated with an

increased possibility of falling and a decreased possibility of rising in the earnings distribution; a change which occurs not just in the year of onset, but which also lasts for at least ten years afterwards.

For the UK, Jones *et al.* (2016) examine the dynamic relationship between work-limiting disability and labour market outcomes, using a dataset created by matching individuals in the Local Labour Force Survey, 2004-2010. Unlike the earlier literature they explicitly consider disability exit but are restricted by the short longitudinal element of these data and therefore examine only the period immediately before and after onset/exit. They find that disability onset has a significant negative effect on hours of work and this effect continues post-onset. However, after controlling for unobserved heterogeneity, there is no evidence that disability exit leads to an increase in hours so that the influence of onset and exit appear to be asymmetric.

In Australia, labour market analysis of disability using longitudinal data has tended to focus on identifying the causal impact of disability onset on labour force participation and hours. Using the first five waves of the HILDA survey Oguzoglu (2010) estimates a two equation dynamic panel model which explicitly considers past labour force participation and the endogeneity of disability. He finds that disability has a significant negative influence on participation even after taking into account the persistence of labour market participation and unobserved individual heterogeneity. In extensions to this work based on the same data Oguzoglu (2011) considers the severity of work-limiting disability and Oguzoglu (2016) further disaggregates labour market status into full-time employment, part-time employment, unemployment and inactivity. Interestingly, the effect of disability on participation is found to vary substantially by the severity of disability (severe, moderate and mild and low severity are constructed from self-reported information on a 0-10 point scale) suggesting a need for a differentiated policy response. Finally, Polidano and Vu (2015) adopt a difference-in-

difference propensity score matching approach on the first nine waves of the HILDA survey to examine the effects of disability onset and find negative employment effects four years post-onset which are more pronounced for those with lower educational attainment.

We apply the event study methodology to data from Australia, which is facilitated by the growing panel element of HILDA and is important if one wishes to trace the evolution of the labour market impact of disability onset. This includes identifying anticipation effects, when the impact of disability precedes its occurrence and adaptation effects, when outcomes improve as individuals adjust or are better able to accommodate their disability post-onset, as well as the neglected impact of recovery and disability exit. We further add to this evidence by considering how the influence of disability varies by chronicity and, the extent to which disability influences a range of outcomes through examining facets of life satisfaction.

Meyer and Mok (2013) highlight the absence of consideration of life satisfaction in their analysis of the PSID. It has nevertheless been explored in a similar manner by Oswald and Powdthavee (2008) and Powdthavee (2009) using data from the BHPS, albeit using a less well established definition of disability (which is conditional on non-employment) since their focus is on adaption to ‘life shocks’. Evidence from both papers finds that individuals exhibit considerable recovery in life satisfaction post disability onset. For example, Oswald and Powdthavee (2008) find that three years post-onset adaptation amounts to 30% for severely disabled and 50% for moderately disabled individuals.² Powdthavee (2009) further examines facets of life satisfaction using an event study approach, and finds a pronounced decline in health satisfaction that starts at least four years prior to disability onset but that disability also has a negative effect on satisfaction with income, social life and use of leisure time. While adaptation to mild disability (measured as no limitation on daily activity) seems to be

² Oswald and Powdthavee (2008) also find adaptation to disability onset in sensitivity analysis performed on the German Socio-Economic Panel.

complete within three years, for those with severe disabilities it is incomplete across a range of facets, including health and income, over the four year post-onset period considered.

A similar analysis has been performed using data from the German Socio-Economic Panel (1984-2006) by Pagán-Rodríguez (2010, 2012) who is able to consider an extended post-onset period of seven or more years but, due to discontinuities in the definition of disability, relies on a measure which incorporates satisfaction with health. Nevertheless, in line with the UK evidence, he finds complete adaptation in overall life satisfaction for males, but that partial adaptation is evident across some domains, particularly satisfaction with health.

Frijters *et al.* (2011) come closest to this study in using the HILDA data (2002–2007) and an event study approach but they focus on the short-term impact of a range of life events, with ‘serious personal injury or illness to self’ one of ten substantive events examined. In response to this they find evidence of a decline in life satisfaction and adaptation, although this is incomplete after two years. Albeit in a different context, given our focus on disability onset and exit, it is interesting to note that they find asymmetry in the response to some positive and negative life events such as changes in financial circumstances and birth/death.

The Australian context for this study therefore serves as a useful comparator to the existing evidence on disability and life satisfaction predominately based on UK and German data prior to 2008. We are also able to consider longer-term changes using an extended post-onset period and a broader range of onset trajectories than Powdthavee (2009) or Pagán-Rodríguez (2012), which facilitate examination of heterogeneity in the impact of disability onset. More generally, we argue that the consideration of life satisfaction represents an important contribution to existing analysis of disability, not simply in terms of measuring adaption to a life shock but in recognising the broader range of mechanisms through which disability may affect well-being, including channels defined by the individual themselves. Indeed, regardless

of how extensive a set of economic or social outcomes considered, objective measures are unlikely to provide an exhaustive picture of the impact of onset or exit. Life satisfaction not only provides a more encompassing measure but will reflect individual aspirations and recognise that priorities (including in relation to work) may change. Moreover, it will also capture the influence of external support, such as from the family or government, which may act to mitigate the impact of adverse changes to labour market outcomes. In this respect, the experience of disability is comprehensively captured in this analysis through the combined examination of facets of life satisfaction and the range of dynamic disability trajectories previously explored within a labour market context. This is important given the emphasis of the NDIS but has broader international relevance for governments attempting to improve the lives of people with disability, particularly where subjective well-being is a stated objective of policy.

3. Data and Methodology

This paper uses the confidentialised unit record file from the first thirteen waves of the HILDA survey. Modelled on household panel surveys undertaken in other countries, the HILDA survey began in 2001 (Wave 1) with a large national probability sample of 7,800 Australian households and their members.³ Our sample is restricted to an unbalanced panel of working age individuals (16-64 for males and 16-59 for females⁴) who provide information at four or more waves in the survey.⁵ This includes approximately 12,600 individuals who

³ See Watson and Wooden (2004) for a detailed description of the HILDA data.

⁴ The upper age limits are defined by eligibility for state retirement income. While, since 1995, there has been an attempt to equalise the retirement age to 65 across gender it has been gradual (depending on year of birth) and has only just started to apply to the whole Australian population. Indeed, retirement ages remain younger for females in the present sample. The results are, however, robust to defining the samples as 16-59 for both males and females. We have also experimented by estimating our models on a sample of individuals constrained to be at least 25 years old to remove the influence of individuals in, and transitions relating to, full-time education. The results are robust to this change.

⁵ This is applied to all respondents but the results for consistent onset/exit are not sensitive to this restriction. We have also experimented with using a balanced panel of about 4,000 individuals (53,000 person-year observations) and find that the results for disability onset do not differ substantially from those from the

provide information over the thirteen waves of data, creating a maximum sample of about 116,000 person-year observations.

3.1 Disability

Consistent with the previous literature (Charles, 2003, Meyer and Mok, 2013 and Jones *et al.*, 2016) we focus on disability defined by work-limitation. In the HILDA survey, employees were asked: *Do you have any long-term health condition, impairment or disability (from a list of 17 conditions) that restricts you in your everyday activities, and has lasted or is likely to last, for 6 months or more?* Those who answer ‘yes’ were further asked: *Does your condition limit the type of work or the amount of work you can do?* We define a person to have a work-limiting disability if he or she answers ‘yes’ to both questions and all remaining responses are referred to as non-disabled.⁶ We acknowledge that the initial question, which makes reference to 6 months rather than one year and requires an individual to have an activity-limitation, differs from the international literature which tends to define long-term as 12 months and focus on the existence of a long-term health problem regardless of whether it is activity restricting. It is nevertheless possible that something limits one's everyday activities but, at the same time, does not limit the type or amount of work that the person performs. For example, disability might only limit a particular daily activity (such as reading and writing, household tasks, social activities etc.) or, it may limit daily activities but not work due to the presence of disability-related workplace accommodations. In our sample,

unbalanced panel. The findings in relation to disability exit are larger in magnitude for employment among the balanced panel but there remains no significant effect on life satisfaction.

⁶ Those who are non-disabled according to the work-limiting definition may therefore either have no long-term activity-limiting health condition (answer ‘no’ to the first question) or have a long-term health condition which is not work-limiting (‘yes’ to the first question but ‘no’ to the second question). As such, they are non-disabled only according to the work-limiting definition applied here. Those who are defined as disabled according to an activity-limiting definition but who are not work-limited, sometimes referred to as the non-work-limited, have previously been shown to have more similar employment and earnings to non-disabled individuals than work-limited disabled individuals (see Jones *et al.*, 2014). However, in additional analysis we explored the impact of excluding non-work-limited disability person-year observations and the results are qualitatively similar (albeit the effect of onset of chronic non-severe disability is insignificant). Since individuals are not asked to record their main health condition and, just less than 50% report multiple health problems, we do not attempt to explore the nature/type of disability.

about two thirds of those who report activity-limitation at the first question also report work-limitation which is not dissimilar from that found in the UK (Jones *et al.*, 2016). It should, however, be acknowledged that by construction, individuals who have a work, but not activity-limiting, disability are excluded from this definition.⁷

Those reporting work-limiting disability are asked a further question regarding the extent to which the condition limits the amount of work they can do. Responses range from 0 (not at all) to 10 (unable to do any work).⁸ We define severely disabled to be those selecting 6 or higher, whereas individuals selecting 0 to 5 are classified as not severely disabled. Under these definitions, 13.3% of observations are classified as work-limiting disabled, among whom 6.2% are severely disabled and 7.1% are not severely disabled, as shown in Table 1. Unlike much of the existing US literature we are able to consider males and females separately but observe no discernible gender difference in the prevalence of disability.

Despite its widespread use there are well-established limitations of using self-reported information on disability, including justification bias and measurement error (Bound, 1991). Similar criticisms may apply to our self-reported measure of severity, although Oguzoglu (2011) finds no evidence of justification bias in relation to self-reported severity. Further, Charles (2003) argues that such issues are likely to be less problematic in a longitudinal setting where the focus is on patterns of disability and where it is possible to control for unobserved individual heterogeneity. Following Polidano and Vu (2015) we use information on the widely used SF-36 measure of physical and mental functioning (measured on a positive scale between 0-100), as a proxy for objective health. Consistent with Meyer and

⁷ We have also experimented by estimating the same models using the broader activity-limiting definition of disability, reflecting those who respond positively to the initial question only. The results tend to follow the same qualitative patterns, although the effects are typically smaller quantitatively consistent with this being a less restrictive definition.

⁸ This (severity) question was asked specifically in relation to the ‘amount’ of work, while the previous question identifying work-limiting disability refers to both the ‘type’ or ‘amount’ of work, meaning zero is a valid response. There are, however, only a very small number of 0 responses on the severity scale (220 or 1.4% of all work-limiting disabled person-year observations).

Mok (2013) who find that changes in health rather than unemployment precede disability onset, we find evidence of deterioration in health but not employment or life satisfaction prior to disability onset. Moreover, confirming our self-reported classification we find that the decline in health is greater for those with chronic severe relative to chronic non-severe disability and that the former report significantly worse health at onset. In contrast, improvements in health are found at, but not prior to, disability exit.

[Table 1 about here]

Unlike Charles (2003) and Meyer and Mok (2013), HILDA does not contain retrospective information on the date of disability onset. Instead, like Kapteyn *et al.* (2008) and Jones *et al.* (2016) we focus on disability onset (and exit) defined during the panel as the first occurrence of reporting no disability followed by reporting disability in the subsequent year (and vice versa), and classify the dynamic patterns of onset using two alternative definitions applied in the literature.⁹ The first follows Jones *et al.* (2016) who, due to their short panel element, define five mutually exclusive disability trajectories and explicitly distinguish between disability onset and exit. The second follows Meyer and Mok (2013) who utilise a longer panel to distinguish between patterns of chronicity post disability onset. Definition 1 is constructed on the basis of Jones *et al.* (2016) as follows:

- (i) Continuously disabled: those who always report disability in the sampling frame.
- (ii) Continuously non-disabled: those who never report disability in the sampling frame.
- (iii) Consistent onset: those who are non-disabled prior to reporting disability onset and are subsequently disabled within the sampling frame.
- (iv) Consistent exit: those who are disabled prior to reporting disability exit and are subsequently non-disabled within the sampling frame.

⁹ We drop a small number of individuals (78 (0.6%)) where, due to the unbalanced nature of the data, we are unable to precisely date the transition year. Following Charles (2003) the robustness of the findings to a two-period definition of disability onset and exit are tested, but they are qualitatively unchanged.

(v) Irregular: all other patterns of disability within the sampling frame.

The categorisation following Meyer and Mok (2013), which we refer to as Definition 2, separates those who experience disability onset as follows:

(i) One-time: those who report disability onset but never subsequently report disability in the sampling frame.

(ii) Temporary: those who report a disability once or twice after disability onset, that is, a total of two or three instances in the sampling frame.

(iii) Chronic: those who report a disability three or more times after disability onset, that is, a total of four or more instances in the sampling frame.¹⁰

By combining information on chronicity and severity a further sub-division of the chronic disabled category is created to distinguish between chronic non-severe and chronic severe disability. We define severe as an average severity over the post-onset ‘disability’ waves of 6 or more, whereas individuals with an average between 0 and 5 inclusive are classified as not severely disabled.¹¹ Hence, this categorisation leads to four groups of individuals who experience onset of a work-limiting disability, namely, (i) one-time; (ii) temporary; (iii) chronic non-severe; (iv) chronic severe.

Despite the advantages of exploring longitudinal patterns of reporting disability and particularly the ability to identify consistent patterns to reduce measurement error (see Charles, 2003), we acknowledge that, regardless of the choice of classification, given the unbalanced nature of the data, we risk misclassification of the dynamic trajectory, particularly

¹⁰ As such we impose a restriction that those who experience disability onset are in the survey for at least three years post-onset. The results for consistent onset are more pronounced but none of the results are qualitatively sensitive to this restriction. A number of individuals with irregular patterns of disability have multiple disability spells. In the analysis of definition 2 we focus on the first disability onset in the panel conditional on not previously being observed as reporting disability. This results in the sample for definition 2 being smaller than consistent onset plus all irregular patterns of disability.

¹¹ We experimented with alternative cut-off points for average severity including 5 and 7 but the qualitative patterns remain unchanged and the magnitude of the effects are in the expected direction.

for those present for a limited number of waves within the panel. It is for this reason that we impose the minimum restriction of 4 waves noted above. Further, the average number of waves per person is considerably above this at 9.5 and doesn't vary substantially with the dynamic classification. In a similar manner we recognise that these classifications are dependent on the length of the panel and, since the data are right and left censored, interpretations are defined *within* the longitudinal element of data available, rather than in relation to the life course.

Table 2 presents the prevalence of dynamic trajectories using Definition 1 which explicitly distinguishes between disability onset and exit. Relative to the analysis by Jones *et al.* (2016), which is based on 4 waves of data, the definitions of consistent onset/exit are more stringent given the extended panel considered here and, hence, focus to a greater extent on more permanent transitions. Over the 13 year panel, 70.6% of the sample never report work-limiting disability, 4.0% continuously report disability, 1.8% experience consistent onset, 2.1% consistent exit, and 21.4% report irregular patterns of disability. These figures indicate that just under 30% of individuals experience at least one episode of work-limiting disability over a period of thirteen years and, of these, about two thirds are 'irregular' in nature. While the latter are not the focus of the analysis in Jones *et al.* (2016) they are examined here using Definition 2 (following Meyer and Mok, 2013), where heterogeneity in the patterns of onset are emphasised.

[Table 2 about here]

We separate those individuals who experience disability onset by chronicity and severity using Definition 2 and the results are reported in Table 3. Among the 2,191 individuals who experience disability onset, 30.2% are one-time disabled, 28.3% are temporary disabled, 18.4% are chronic non-severe and 23.1% are chronic severe. Despite differences in the

identification and definition of the groups the distribution is comparable to Meyer and Mok (2013), albeit with a lower concentration of onset classified as chronic non-severe.

[Table 3 about here]

3.2 Dependent Variables

We explore the impact of the dynamic patterns of disability on labour market outcomes and life satisfaction. In terms of the former we focus on employment since existing evidence highlights this as the key determinant of changes in income (Charles, 2003).¹² A binary measure is used to capture employment status based on activity in the last week where employment is based on the ILO definition and includes employees, those in self-employed, and on government training schemes. Non-employment is defined to include those in unemployment or inactivity. Consistent with cross sectional evidence the work-limiting disability employment gap is pronounced at 36.6 percentage points (82.0% for non-disabled compared to 45.4% for work-limiting disabled person-year observations).¹³

In order to capture the impact of disability more broadly we analyse a measure of life satisfaction which is recorded on an 11 point scale between 0 (least satisfied) and 10 (most satisfied) where individuals are asked *All things considered, how satisfied are you with your life?* The disability gap in life satisfaction is 0.8 index points or about 10% (average life satisfaction of 7.9 for non-disabled compared to 7.1 for work-limiting disabled person-year observations). In addition to utilising overall life satisfaction, following Powdthavee (2009), we explore the following facets of life satisfaction (measured on the same scale): the home in

¹² We also conducted some analysis of the effect of disability on earnings, but found no evidence that hourly earnings change in response to consistent disability onset or exit, though a more consistent decline in earnings emerges for chronic non-severe onset. For reasons of space we do not report these results.

¹³ We also considered an alternative measure of work quantity, namely, usual weekly hours (in all jobs) and include zero hours for those not in employment to model adjustment at the intensive and extensive margin simultaneously. The results are qualitatively similar and are available on request. We further explored adjustment in hours for those in work and these results confirm that adjustment occurs at the intensive as well as the extensive margin.

which you live; employment opportunities; financial situation; how safe you feel; feeling part of the local community; your health; the neighbourhood in which you live; the amount of free time you have. While an individual's satisfaction with his/her employment opportunities and financial situation have direct links to their labour market outcomes, the other measures are designed to capture the broader range of channels through which disability may impact on well-being.¹⁴

3.3 Methodology

Following Charles (2003) and Meyer and Mok (2013), who adopt a method earlier applied by Stephens (2001), we estimate the following fixed effects model:¹⁵

$$Y_{it} = \alpha_i + \gamma_t + X_{it}\beta + \sum_g \sum_k \delta_k^g A_{kit}^g + \varepsilon_{it} \quad (1)$$

Y_{it} refers to the outcome of interest (employment or life satisfaction) for individual i at year t . Time period (year) and individual fixed effects which capture macroeconomic conditions and time-invariant individual unobserved heterogeneity respectively are captured by γ_t and α_i . X_{it} is a set of time-varying personal and household characteristics that are used as control variables in the estimation, including age, age-squared, education level, marital status, dependent children within the household and an indicator of urban/rural area of residence.

The dynamic effects of disability are captured by a set of dummy variables, A_{kit}^g , which each equal 1 if in year t individual i belongs to disability group g and he/she is k years from onset (or exit) (a minus indicates prior to onset/exit) and are zero otherwise. ε_{it} is an idiosyncratic

¹⁴ For those who retain work, we are able to consider the influence of disability on job satisfaction.

¹⁵ Following Singleton (2012) we use a linear probability model for the binary measure of employment for ease of interpretation. However, the results are qualitatively similar if, instead, a conditional logit model is used. Consistent with the previous literature (Clark *et al.*, 2008 and Powdthavee, 2009), our approach treats life satisfaction as cardinal rather than ordinal and Ferrer-i-Carbonell and Frijters (2004) amongst others have previously noted the robustness of their results to this. Nevertheless, we have experimented by estimating the models for life satisfaction using a random-effects ordered probit model with Mundlak corrections in order to explore their robustness in this context. The results are qualitatively similar.

error. For each dependent variable we estimate several specifications of the model. Initially we focus on Definition 1 and consistent onset in particular, where the ‘ g ’ groups capture patterns of consistent and irregular disability onset. Subsequently we focus on consistent exit following Jones *et al.* (2016), where the ‘ g ’ groups capture patterns of consistent and irregular exit.¹⁶ Using Definition 2, the ‘ g ’ groups refer to the four patterns of onset by chronicity/severity as defined above. Throughout standard errors are clustered by person.

The sample for each regression model also includes individuals who are at risk of making the relevant disability transition but who do not. So, for example, in the analysis of onset we retain continuously non-disabled individuals. As discussed by Meyer and Mok (2013) this improves ‘the precision of the estimated effects of age, education and the other control variables’ (page 13). In a similar manner, continuously disabled individuals are included in the analysis of consistent disability exit. We introduce variables to capture the effects from three years prior to ten or more years post the year of disability onset (exit) $k \in [-3,10]$.¹⁷ The omitted category thus includes individuals at risk of (but who do not experience) onset (exit) as well as those more than 3 years prior to onset (exit).¹⁸ Since a fixed effects model is estimated, we follow Meyer and Mok (2013) and interpret δ_k^g as the causal effect of group g disability k years away from onset (exit).¹⁹ This interpretation holds under the assumption that all unobservable influences are time invariant and are therefore captured by individual

¹⁶ The irregular onset (exit) group contains those in the irregular category who are non-disabled (disabled) prior to the first onset (exit) observed within the panel. For simplicity of interpretation our discussion focuses on consistent onset (exit). The results for irregular patterns are available on request but show a similar qualitative pattern to the consistent transitions, albeit (where significant) the influence is considerably smaller in magnitude. The results for consistent onset and exit are not, however, sensitive to the inclusion of irregular patterns in the model.

¹⁷ We experimented with the inclusion of additional lags up to 5 years pre-onset but these were typically insignificant and therefore our results are robust to their exclusion. Among the dynamic classifications the minimum number of positive values for onset/exit at a given lead/lag is about 50.

¹⁸ Jacobson *et al.* (1993) highlight the importance of the comparison group in identifying changes that would have occurred in the absence of the event taking place.

¹⁹ Meyer and Mok (2013) argue that, due to the inclusion of fixed-effects, the effects can be interpreted as relative to the same individual pre-onset.

fixed effects. Time varying individual unobservables correlated with disability onset/exit and the outcomes of interest remain a potential bias.

Using this method we are able to distinguish the influence of disability pre-onset (pre-exit), from that at onset (exit) and post-onset (post-exit). In doing so it is possible to identify the timing of any deterioration in outcomes relative to disability onset and, where this deterioration occurs post-onset, rule out reverse causality. Of course, disability onset is not always sudden and unforeseen and pre-onset effects may reflect a more gradual deterioration in health which may nevertheless be attributed to disability onset. Indeed, as Jones *et al.* (2016) note, the issue may be even more acute for disability exit, where pre-exit effects will occur if the process of recovery includes labour market adjustment.

Summary statistics for all variables are included in Table 4. These are presented for each classification of dynamic disability trajectory, that is, Definition 1 and Definition 2. As might be expected, the most dramatic differences are between continuously disabled and continuously non-disabled individuals. The former have an average employment rate of 23% compared to 84% among the latter. Those continuously disabled also have lower life satisfaction than any other group. In terms of Definition 2, those with chronic severe onset exhibit the least favourable outcomes and, unsurprisingly, these contrast most starkly to those one-time disabled, who do not differ substantially from the continuously non-disabled.

[Table 4 about here]

4. Results

4.1 Employment

Table 5 presents results for employment status where Definition 1 (columns 2 and 3) applies a similar categorisation to Jones *et al.* (2016), albeit their definitions are based on a shorter

panel element. As such, our consistent onset group have longer average post-onset disability duration. A likely reflection of this, our results show a much stronger effect of work-limiting disability onset on employment than in the UK. Disability onset reduces the probability of employment by 34 percentage points and the magnitude of the effect increases with the duration of disability, at least until six years post-onset.²⁰ Indeed, formal tests are unable to reject the null hypothesis of equality of post-onset coefficients. There is evidence of a significant, but far more modest decline pre-onset consistent with the gradual decline in health noted above and in the US (Meyer and Mok, 2013).²¹ We find a significant increase in the probability of employment at disability exit and this effect also persists. This contrasts with the more limited exit effects noted by Jones *et al.* (2016) and may suggest that their short panel element was insufficient to identify more permanent exit from disability which is associated with labour market improvement.²²

Definition 2 (columns 4-7) applies a similar categorisation to Meyer and Mok (2013). The finding that chronic disability has damaging employment consequences in Australia, stronger and far more long lasting for severe cases is very much in agreement with the results of Meyer and Mok for the US. Indeed, despite similar chronicity among the severe and non-severe groups, ten years post-onset there is a decline in the probability of employment of 36 percentage points where onset is severe compared to 11 percentage points where onset is non-severe. Consistent with evidence from Meyer and Mok (2013) this divergence is partly a consequence of the impact of chronic severe disability being exacerbated over time. The impact of one-time disability is preceded by a negative employment effect up to three years before onset and is not evident post-onset, suggesting that post-exit the return to employment

²⁰ By way of illustration the coefficients for consistent onset and exit are presented in Figure 1 (a) and (b).

²¹ Alternative explanations include time-varying unobserved heterogeneity or reverse causality whereby a change in employment status causes a change in health or the threshold for reporting disability.

²² Disability onset and exit similarly effect hours of work with consistent onset (exit) leading to a reduction (gain) of about 16 (11) hours per week. Among those in employment, consistent onset (exit) reduces (increases) hours by 6 (9) per week. The magnitude of both effects grow post-onset (exit) and, for exit there is also evidence of significant gains pre-exit consistent with hours adjustment being part of a process of recovery.

becomes probable, with recovery largely achieved after 1 year. For those with temporary but recurrent disability, employment losses are similarly observed at onset and do not persist suggesting that these individuals perhaps become able to manage their disability and/or what we observed is the level of employment engagement in the long-run. A similar result is reported by Meyer and Mok (2013).²³

[Table 5 about here]

4.2 Life Satisfaction

The corresponding results for life satisfaction are presented in Table 6 and capture a far broader range of channels through which disability operates including in terms of health (pain/discomfort) but also social relationships, access to services, crime and inclusion. Here we are interested to explore the extent to which disability trajectories have different effects on life satisfaction and, whether individuals tend to return to some baseline level of well-being following disability onset consistent with adaptation effects as suggested by Clark *et al.* (2008). Results from Definition 1 suggest that consistent disability onset leads to a significant drop in life satisfaction equivalent to about 0.9 points (measured on an 11 point scale) at onset.²⁴ Further, the absence of significant pre-onset or anticipation effects is consistent with a causal relationship, whereby disability onset leads to a reduction in life satisfaction rather than vice versa. From then on, the level of life satisfaction remains relatively steady throughout the next ten years and, unlike Oswald and Powdthavee (2008) and Powdthavee (2009) for the UK or Pagán-Rodríguez (2010, 2012) for Germany, we do not observe a

²³ Analysis of hours of work show that the impact is small (about 3 hours) and short-lived for one-time and temporary disability. There is, however, a more pronounced and persistent change in hours than the probability of employment among those with chronic non-severe onset (about 6 hours), suggesting adjustment at the intensive margin. The decline in hours for chronic severe (about 12 hours) is nevertheless more pronounced and continues post-onset. Conditional on employment there is also a limited temporary impact on hours for those with one-time or temporary disability onset. Chronic onset is associated with a reduction in hours and, for chronic severe onset, the impact is magnified post-onset.

²⁴ By way of illustration the coefficients for consistent onset and exit are presented in Figure 2 (a) and (b).

pattern of adaptation. That is, there is no evidence that life satisfaction improves significantly for those who remain disabled which would be consistent with adjustment to that state. In addition, and perhaps surprisingly, although consistent with evidence relating to improvements in general health and recovery from specific health conditions in the UK (Binder and Coad, 2013), we find no evidence of an impact of disability exit on life satisfaction. The absence of significant improvement in life satisfaction both post-onset and at exit suggests that adaptation does not occur through either of the channels identified by Clark *et al.* (2008) in the context of unemployment, that is, because individuals adjust to, or exit, a state.²⁵

Aligned to the differential decline in material well-being highlighted by Meyer and Mok (2013), we find that the impact on life satisfaction varies across disability onset groups measured by Definition 2. For one-time disability, we observe a negative effect on life satisfaction only in the year of onset. For temporary onset deteriorations in life satisfaction are evident two years prior to onset and persist virtually throughout the post-onset period, albeit being of significantly smaller magnitude than at onset. Consistent with the results relating to employment status, we find very limited impact chronic (non-severe) disability onset on life satisfaction with declines significant at the 5% level only in the onset year. For those with chronic severe disability declines are far more pronounced being evident at onset and, in contrast to arguments of adaptation, have a persistent impact post-onset. Indeed, the magnitude of the effect, at about -0.6 points, shows no sign of diminishing, aligned with this group being unable to accommodate their disability. Although different in nature, particularly since chronicity is not explored, the distinct patterns related to severity are consistent with

²⁵ In similar analysis of job satisfaction we find no evidence of an influence of consistent onset, although chronic severe onset (Definition 2) is associated with a decline in job satisfaction. Consistent disability exit is, however, associated with an increase in job satisfaction which persists.

Powdthavee (2009), who finds evidence of complete (incomplete) adaptation to mild (severe) onset.

[Table 6 about here]

4.3 Facets of Life Satisfaction

We attempt to identify the key drivers of the change in overall life satisfaction by examining the facets separately and, in doing so, identify the channels through which disability influences well-being. These tables of results are reported in the Appendix. We separate our discussion of the eight facets into four themes namely (1) health; (2) economic circumstances; (3) amount of free time and (4) home/local area. As may be expected, the influence of disability onset/exit (Definition 1) on satisfaction with health is pronounced (Table A.1). Declines in satisfaction with health are evident immediately prior to onset, increase at onset to -2.5 points and persist post-onset consistent with limited adaptation. In contrast to overall life satisfaction, an increase in satisfaction with health is evident at disability exit and is most pronounced one year post-exit at 2.3 points. That the effect persists post-exit suggests that disability exit is associated with permanent gains in some facets of life satisfaction. Interestingly, especially given the absence of improvement in SF-36, there is evidence of a gradual improvement in satisfaction with health prior to disability exit (evident even three years prior).

In terms of Definition 2, there is a transient decline in satisfaction with health for one-time disability. The impact of temporary disability is evident prior to onset and, although the effect declines post-onset, it remains significant for several years. As might be expected, the decline at onset among those with chronic severe disability is significantly greater in magnitude (-2.4) than those with chronic non-severe disability (-1.5). There is also evidence of partial adaptation for chronic non-severe, but not for chronic severe, disability.

In line with the earlier analysis of employment, both satisfaction with employment opportunities (Table A.2) and financial situation (Table A.3) are significantly affected by changes in disability status. In terms of satisfaction with employment opportunities, which is likely to reflect individual aspirations and dimensions of job quality in addition to the probability of employment, there is a sizeable negative impact of onset which becomes more pronounced immediately post-onset, reaches a maximum of -2.0 points after five years and then largely persists.²⁶ Consistent with the results for employment status, disability exit is associated with increased satisfaction with employment opportunities. Moreover, the effect is of comparable magnitude to the negative onset effect and persists post-exit. In terms of Definition 2, the results are again markedly different on the basis of severity, in line with this measuring restrictions on work. Indeed, the onset of chronic severe disability (but not non-severe) reduces satisfaction with employment opportunities.

In terms of satisfaction with financial situation it is particularly interesting to note that the negative effect (-0.9 at onset) of consistent onset diminishes and becomes insignificant nine years post-onset. This is consistent with evidence of adaptation to satisfaction with household income in Germany (Pagán Rodríguez, 2012) and perhaps reflects adjustment within the household and/or government support (Meyer and Mok, 2013) in facilitating adjustment to persistent changes in employment. The smaller magnitude of the effects of onset on satisfaction with financial circumstances relative to employment opportunities are perhaps another manifestation of this and consistent with the notion that the impact of disability on well-being is overestimated when focusing on individual employment status alone. Here we find a pronounced impact of disability exit on satisfaction with financial situation where, in a similar manner to employment, the magnitude is at least as great as onset and, if anything, the influence is more persistent, consistent with a permanent change in well-being. Aligned to

²⁶ It is worth noting that fewer individuals respond to this facet, perhaps reflecting that employment isn't relevant to/desired by all.

evidence of pre-exit increases in satisfaction with health, satisfaction with both employment opportunities and financial situation, increase prior to exit. Again Definition 2 shows pronounced differences by severity, with no impact of chronic non-severe onset on satisfaction with financial situation consistent with the limited impact on own employment opportunities.

The influence of disability onset on satisfaction with the amount of free time (Table A.4) is interesting since unlike the other factors the influence is ambiguous a priori. Where disability onset is associated with additional time requirements to perform daily activities it is likely to be negatively associated with the amount of free time. Changes in labour market attachment identified above may, however, have the opposite influence. In line with the latter, disability onset has a significant positive (1.2 point) impact, although this diminishes post-onset. This is consistent with Powdthavee (2009) who finds a positive influence of onset on satisfaction with the amount (but not use) of leisure time in the UK. Despite evidence of labour market re-attachment at exit, there is less clear evidence of a negative influence of disability exit on free time, being significant only several years after onset. There are also few consistent findings for Definition 2.

We find limited impact of changes in disability status on the facets relating to the home (consistent with Powdthavee, 2009). For example, there are no significant patterns for consistent onset and exit on satisfaction with the home in which you live (Table A.5) which is aligned to disability onset not being associated with increased residential mobility in these data. A negative but relatively small (-0.3 points) onset effect is evident in relation to satisfaction with the neighbourhood (Table A.6) and for this measure onset effects are also evident for Definition 2. In contrast to the facets relating to economic circumstances, there is a decline in satisfaction for chronic non-severe and severe onset, albeit this tends to widen post-onset for the latter.

The difference in the impact on satisfaction with the neighbourhood relative to the home is possibly a reflection of personal interaction in relation to the former. Indeed, negative consistent onset effects are more pronounced for satisfaction with being part of the local community (Table A.7) and how safe you feel (Table A.8), with satisfaction declining by about 0.6 points at onset. Again there is no evidence of adaptation, with the effects persisting post-onset but evidence of a decline pre-onset possibly aligned to deterioration in health. There is some evidence of a positive effect of consistent disability exit on satisfaction with the local community, albeit this fails to reach significance at conventional levels for much of the post-onset period. Consistent with the previous analysis of Definition 2, onset effects are only significant for chronic disability where onset is severe.

Overall, the analysis confirms that both the magnitude and direction of the influence of disability onset differs depending on the particular facet of life satisfaction, suggesting that individuals distinguish between facets and that it is possible to identify the channels through which disability affects subjective well-being. Indeed, the evidence demonstrates the range of aspects of life that are affected by disability onset beyond the labour market. Moreover, several common patterns emerge, particularly that the declines in life satisfaction are more pronounced when onset is chronic severe and, that there is limited evidence of adaptation to consistent disability onset. That disability exit is associated with improvements in life satisfaction across several facets but that this is not reflected in the overall measure is a puzzle and may suggest these facets provide an incomplete picture, or that individuals respond in a different way when reflecting on their life overall. The results nevertheless reinforce the importance of examining the facets in addition to an overall measure of life satisfaction.

5. Conclusion

This paper uses the first thirteen waves of the HILDA survey (2001-2013) to investigate the dynamic effect of work-limiting disability on employment and life satisfaction in Australia. We categorise the dynamic patterns of disability according to two definitions (Jones *et al.*, 2016; Meyer and Mok, 2013) and, in doing so, are able to explicitly consider the impact of disability exit and the influence of chronicity and severity of disability onset. Further, in addition to employment, we consider life satisfaction to capture a wider range of dimensions through which the impact of disability operates and accumulates, and thereby integrate largely separate strands of research within the literature.

Focusing on consistent patterns of disability onset (exit), we find a significant and long lasting decline (increase) in the probability of employment following disability onset (exit). Disability onset also leads to a significant drop in life satisfaction and, in contrast to arguments and evidence of adaptation in response to many life shocks (Clark *et al.*, 2008), the level of overall life satisfaction shows no signs of recovering post-onset. This is, however, consistent with evidence from Binder and Coad (2013) who find no evidence of adaptation to some health impairments in the UK. Indeed, the absence of evidence of adaptation may reflect worsening health and/or increasing restrictions associated with the duration of disability.

Consistent with Powdthavee (2009) and Pagán Rodríguez (2012), analysis of facets of life satisfaction suggests negative onset effects are most pronounced for health, followed by employment and financial situation, although there are also negative impacts on satisfaction with the community and personal safety and, albeit to a lesser extent, the neighbourhood. While positive effects of disability exit are evident for satisfaction with health, employment and financial situation we find no significant improvement in overall life satisfaction which

suggests an asymmetric influence of onset and exit on subjective well-being. Although this leaves unanswered questions as to whether there are important dimensions of life satisfaction which are not captured here, such as in terms of personal relationships or social life, it has implications for policy since it suggests that exiting disability may not lead to an improvement in subjective well-being, and that support may be needed post-exit. Of course, gradual recovery from disability may be associated with increased life satisfaction pre-exit but we find no clear evidence of this. The suggestion of a scarring effect, whereby *past* disability continues to adversely influence current life satisfaction would therefore seem to reinforce the need for additional government support at onset. However, future research should consider onset and exit for the same individual to better address selection into disability exit when exploring this apparent asymmetry.

Our second definition distinguishes temporary patterns of onset from chronic disability, and within the latter we are able to consider severity. One-time disability is found to have a negative but relatively short-lived impact on both employment and life satisfaction. Indeed, within most cases we find that there is no significant impact post-onset, suggesting full recovery. In contrast, the impact of chronic severe disability remains 10 years post disability onset. This differs from arguments and previous evidence of adaptation (Oswald and Powdthavee, 2008; Powdthavee, 2009) and raises important questions as to how policy can be better tailored to support this group. The pronounced and long-lasting impact of chronic severe disability onset also contrasts to the smaller, and sometimes absent, impact of chronic non-severe disability. While it is possible that chronicity and self-reported severity may partially reflect the impact of onset, our findings reinforce their importance as indicators of the extent and persistence of declines in employment and life satisfaction and dimensions over which policy support should be tailored.

Although our analysis is able to capture heterogeneity in the form of chronicity and severity of disability we are nevertheless unable to clearly identify the type of disability and future research which is able to separate onset arising from physical and mental health conditions is likely to capture additional important dimensions. The findings which emerge in terms of the differential impact of disability onset on facets of life satisfaction provide useful insights for identifying priority areas in terms of policy. However, this analysis also highlights questions for future research such as the role of the household and government policy in reducing the impact of disability onset. Indeed, measures of life satisfaction offer additional opportunities to explore the impact of disability onset on other family members and among those beyond working age. Further, as Oswald and Powdthavee (2008) highlight, this framework offers the potential to calculate a monetary compensation required to maintain life satisfaction post-onset for different patterns of disability.

Finally, the results of this paper lay the foundations for specific policy guidance for the newly established and rapidly developing NDIS in Australia. First, the paper offers up to date estimates of the impact of disability on various facets of life satisfaction and other relevant indicators of economic participation, using data that largely precedes the NDIS trial and can therefore be used as a pre-NDIS benchmark. Second, the paper develops and estimates the dynamics of disability in a manner that recognises that the nature of disability onset is not uniform and that its impact on economic and social participation may change over time. This aligns to the flexible design of the NDIS supports planning process, thus making the estimation results of this paper pertinent for this important policy innovation in Australia.

Supplementary material

The Appendix is available online at the OUP website. The data used is the confidential unit record file from the Household, Income and Labour Dynamics in Australia (HILDA) survey. The HILDA Survey Project was initiated, and is funded, by the Australian Government Department of Social Services, and is managed by the Melbourne Institute of Applied Economic and Social Research. However the STATA program (do file) is available online.

Acknowledgements

We are grateful to the editor and two anonymous referees for constructive comments on an earlier draft.

References

- Binder, M. and Coad, A. (2013) 'I'm afraid I have bad news for you...' Estimating the impact of different health impairments on subjective well-being, *Social Science and Medicine*, 87, 155–67.
- Bound, J. (1991) Self-reported versus objective measures of health in retirement models, *Journal of Human Resources*, 26, 106-38.
- Burchardt, T. (2000) The dynamics of being disabled, *Journal of Social Policy*, 29, 645-68.
- Clark, A. E., Diener, E., Georgellis, Y. and, Lucas, R. E. (2008) Lags and leads in life satisfaction: a test of the baseline hypothesis, *The Economic Journal*, 118, F222–43.
- Charles, K. K. (2003) The longitudinal structure of earnings losses among work-limited disabled workers, *Journal of Human Resources*, 38, 618-46.
- Ferrer-i-Carbonell, A. and, Frijters, P. (2004) How important is methodology for the estimates of the determinants of happiness? *The Economic Journal*, 114, 641-59.
- Frijters, P., Johnston, D. W. and, Shields, M. A. (2011) Life satisfaction dynamics with quarterly life event data, *The Scandinavian Journal of Economics*, 113, 190–211.
- Jacobson, L. S., LaLonde, R. J. and, Sullivan, D. G. (1993) Earnings losses of displaced workers, *American Economic Review*, 83(4), 685-709.
- Jolly, N. A., (2013) The impact of work-limiting disabilities on earnings and income mobility, *Applied Economics*, 45, 5104-18.
- Jones, M. K., Davies, R. and, Drinkwater, S., (2016) The dynamics of disability and work in Britain, forthcoming *The Manchester School*.
- Jones, M. K., Mavromaras, K., Sloane, P and, Wei, Z. (2014) Disability, job mismatch, earnings and job satisfaction in Australia, *Cambridge Journal of Economics*, 38, 1221-46.
- Kapteyn, A., Smith, J.P. and, van Soest, A. (2008) Dynamics of work disability and pain, *Journal of Health Economics*, 27, 469-509.
- Mavromaras, K., Moskos, M. and Mahuteau, S. (2016) Evaluation of the NDIS: Intermediate Report, National Institute of Labour Studies, Flinders University, Adelaide, Australia.
- Meyer, B. D. and Mok, W. K. C. (2013) Disability, earnings, income and consumption, *mimeo*, University of Chicago.
- Mok, W. K. C., Meyer, B. D., Charles, K.K. and, Achen, A. C. (2008) A note on 'the longitudinal structure of earnings losses among work-limited disabled workers, *Journal of Human Resources*, 43, 721-28.
- Oguzoglu, U. (2010) Dynamics of work limitation and work in Australia, *Health Economics*, 19, 656-69.
- Oguzoglu, U. (2011) Severity of work disability and work, *Economic Record*, 87, 370–83.

- Oguzoglu, U. (2016) Disability and multi-state labour force choices with state dependence, *Economic Record*, 92, 28-46.
- Oswald, A. J. and Powdthavee, N. (2008) Does happiness adapt? A longitudinal study of disability with implications for economists and judges, *Journal of Public Economics*, 92, 1061-77.
- Pagán-Rodríguez, R. (2010) Onset of disability and life satisfaction: Evidence from the German Socio-Economic Panel, *European Journal of Health Economics*, 11(5), 471-85.
- Pagán Rodríguez, R. (2012) Longitudinal analysis of the domains of satisfaction before and after disability: Evidence from the German Socio-Economic Panel, *Social Indicators Research*, 108(3), 365-85.
- Polidano, C. and Vu, H. (2015) Differential labour market impacts from disability onset, *Health Economics*, 24, 302-17.
- Powdthavee, N. (2009) What happens to people before and after disability? Focusing effects, lead effects, and adaptation in different areas of life, *Social Science and Medicine*, 69, 1834-44.
- Singleton, P. (2012) Insult to injury: disability, earnings, and divorce, *Journal of Human Resources*, 47, 972-90.
- Stephens, M. (2001) The long-run consumption effects of earnings shocks, *Review of Economics and Statistics*, 83, 28-36.
- Watson, N. and Wooden, M. (2004) The HILDA survey four years on, *Australian Economic Review*, 37, 343-49.

Figure 1(a): The dynamic effect of consistent work-limiting disability onset on being in employment

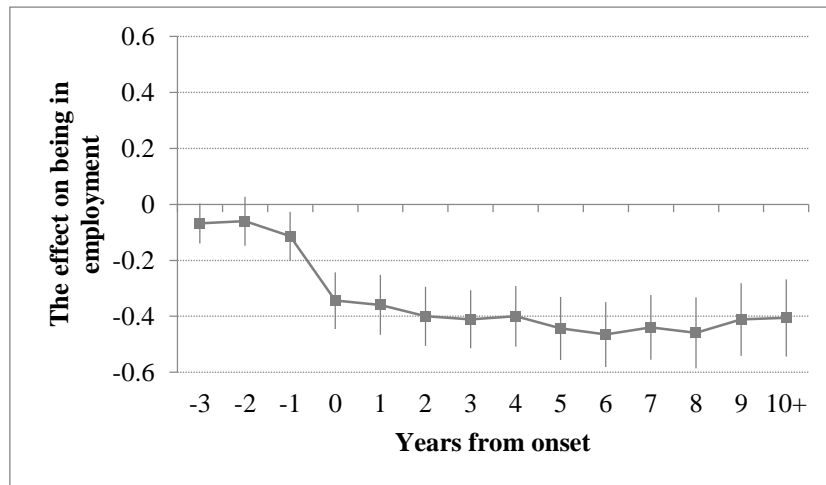
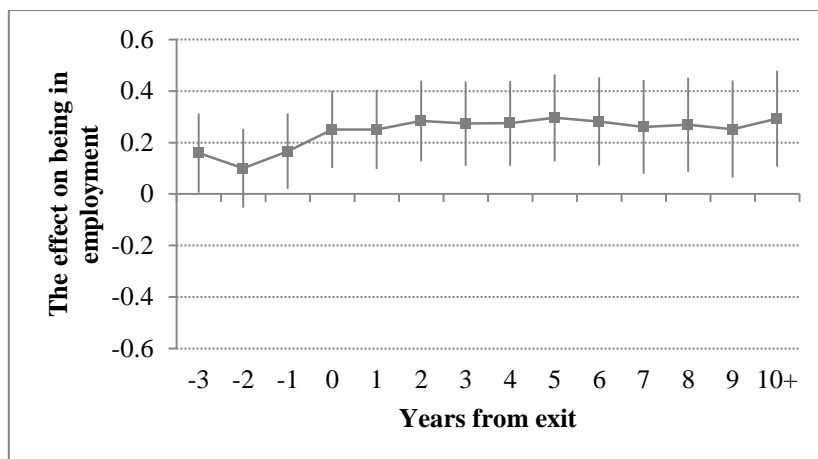


Figure 1(b): The dynamic effect of consistent work-limiting disability exit on being in employment



Note: Figures represent coefficient estimates presented in Table 5, along with the 95% confidence interval.

Figure 2(a): The dynamic effect of consistent work-limiting disability onset on overall life satisfaction

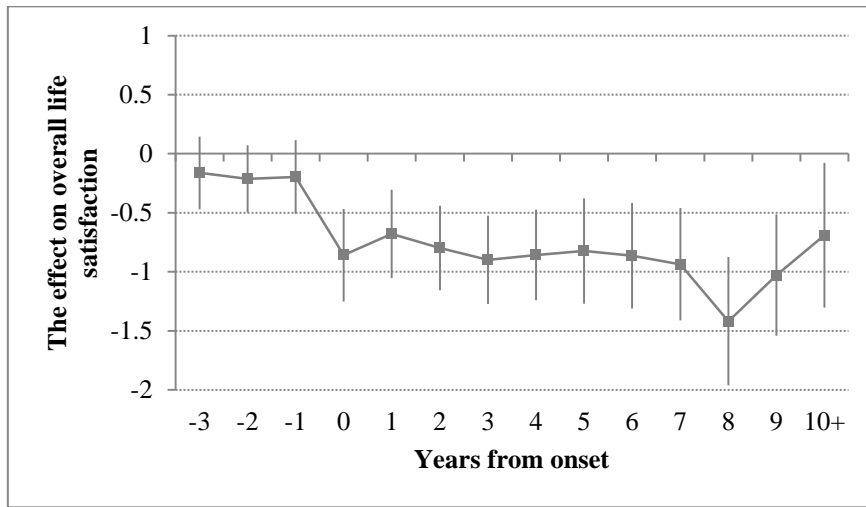
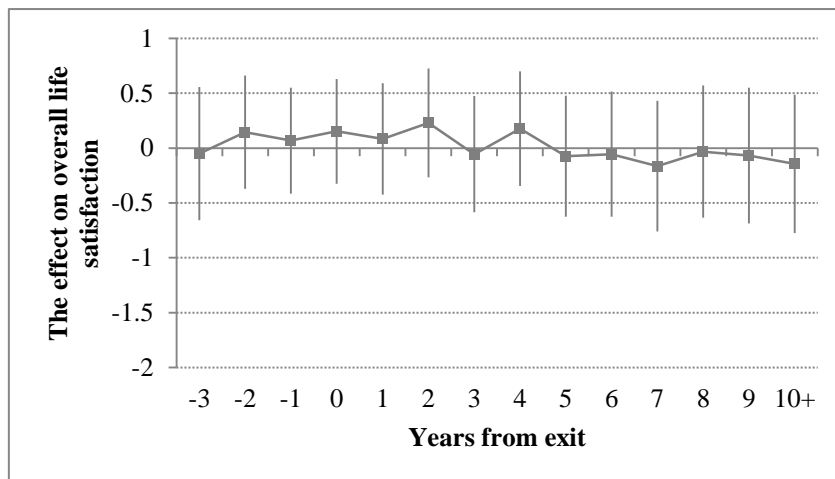


Figure 2(b): The dynamic effect of consistent work-limiting disability exit on overall life satisfaction



Note: Figures represent coefficient estimates presented in Table 6, along with the 95% confidence interval.

Table 1: Disability status of working age population in Australia

	Males		Females		Total	
	Cases	%	Cases	%	Cases	%
No work-limiting disability	50,004	86.8	50,734	86.6	100,738	86.7
Non-severe disability	3,982	6.9	4,265	7.3	8,247	7.1
Severe disability	3,621	6.3	3,577	6.1	7,198	6.2
Total	57,607	100.0	58,576	100.0	116,183	100.0

Note: Unit of observation is person-years.

Source: HILDA waves 2001-2013.

Table 2: Dynamic patterns of work-limiting disability (Definition 1)

	Males		Females		Total	
	Cases	%	Cases	%	Cases	%
Continuously disabled	284	4.6	222	3.5	506	4.0
Continuously non-disabled	4,418	71.1	4,405	70.0	8,823	70.6
Consistent onset	95	1.5	133	2.1	228	1.8
Consistent exit	149	2.4	119	1.9	268	2.1
Irregular	1,266	20.4	1,413	22.5	2,679	21.4
Total	6,212	100.0	6,292	100.0	12,504	100.0

Note: Unit of observation is persons.

Source: HILDA waves 2001-2013.

Table 3: Dynamic patterns of work-limiting disability (Definition 2)

	Males		Females		Total	
	Cases	%	Cases	%	Cases	%
One-time disabled	309	30.3	352	30.0	661	30.2
Temporary disabled	300	29.4	320	27.3	620	28.3
Chronic disabled (non-severe)	191	18.7	212	18.1	403	18.4
Chronica disabled (severe)	219	21.5	288	24.6	507	23.1
All onset	1,019	100.0	1,172	100.0	2,191	100.0

Note: Unit of observation is persons.

Source: HILDA waves 2001-2013.

Table 4: Details and summary statistics for variables used in estimation by disability trajectory

<i>Variable</i>	<u>Definition 1</u>					<u>Definition 2</u>			
	Continuously disabled	Continuously non-disabled	Consistent onset	Consistent exit	Irregular	One-time	Temporary	Chronic non-severe	Chronic severe
Average number of waves present	8.6	9.3	9.6	8.2	10.3	10.7	10.3	10.5	10.1
Being in employment	0.23	0.84	0.50	0.76	0.70	0.82	0.75	0.75	0.46
Overall life satisfaction	6.79	7.99	7.09	7.67	7.54	7.73	7.64	7.49	7.21
Age	(2.16)	(1.25)	(2.01)	(1.41)	(1.63)	(1.39)	(1.49)	(1.50)	(2.03)
	48.27	36.19	45.87	36.51	42.36	39.69	41.37	43.02	46.02
	(10.80)	(12.61)	(11.44)	(13.52)	(12.52)	(12.34)	(12.56)	(12.29)	(11.52)
Completed school	0.10	0.21	0.12	0.18	0.15	0.19	0.18	0.14	0.13
Certificate III/IV	0.22	0.20	0.24	0.23	0.23	0.21	0.22	0.22	0.24
Advanced diploma or diploma	0.10	0.09	0.08	0.05	0.08	0.09	0.08	0.08	0.07
University degree	0.10	0.26	0.19	0.20	0.20	0.24	0.23	0.23	0.13
Married	0.55	0.65	0.60	0.56	0.66	0.70	0.67	0.64	0.62
Have children aged between 5 and 14	0.05	0.15	0.05	0.12	0.12	0.15	0.14	0.08	0.08
Have children aged under 5	0.13	0.25	0.20	0.20	0.25	0.28	0.27	0.23	0.21
Urban	0.81	0.88	0.88	0.84	0.85	0.84	0.86	0.84	0.85

Note: With the exception of the average number of waves the figures refer to means (standard deviations) across person-years.

Source: HILDA waves 2001-2013.

Table 5: The dynamic effect of work-limiting disability on being in employment

Year from onset/exit	<u>Definition 1</u>				<u>Definition 2</u>							
	Consistent onset		Consistent exit		One-time		Temporary		Chronic non-severe		Chronic severe	
	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>
-3	-0.068*	(0.04)	0.159**	(0.08)	-0.039**	(0.02)	-0.015	(0.02)	-0.021	(0.03)	-0.056*	(0.03)
-2	-0.060	(0.05)	0.100	(0.08)	-0.045**	(0.02)	-0.020	(0.02)	-0.024	(0.03)	-0.042	(0.03)
-1	-0.114**	(0.05)	0.166**	(0.07)	-0.045**	(0.02)	-0.017	(0.02)	-0.020	(0.04)	-0.076**	(0.03)
0	-0.344***	(0.05)	0.251***	(0.08)	-0.067***	(0.02)	-0.063***	(0.02)	-0.072**	(0.04)	-0.270***	(0.04)
1	-0.359***	(0.06)	0.251***	(0.08)	-0.020	(0.02)	-0.053**	(0.02)	-0.086**	(0.04)	-0.266***	(0.04)
2	-0.399***	(0.05)	0.284***	(0.08)	-0.036*	(0.02)	-0.030	(0.02)	-0.077**	(0.04)	-0.297***	(0.04)
3	-0.411***	(0.05)	0.274***	(0.08)	-0.023	(0.02)	-0.012	(0.02)	-0.059	(0.04)	-0.310***	(0.04)
4	-0.400***	(0.05)	0.275***	(0.08)	-0.021	(0.02)	-0.036	(0.03)	-0.065*	(0.04)	-0.273***	(0.04)
5	-0.444***	(0.06)	0.296***	(0.09)	-0.003	(0.02)	-0.009	(0.03)	-0.056	(0.04)	-0.325***	(0.04)
6	-0.465***	(0.06)	0.282***	(0.09)	-0.011	(0.02)	-0.009	(0.03)	-0.070*	(0.04)	-0.343***	(0.04)
7	-0.440***	(0.06)	0.261***	(0.09)	-0.011	(0.02)	0.006	(0.03)	-0.081**	(0.04)	-0.318***	(0.04)
8	-0.460***	(0.06)	0.269***	(0.09)	-0.035	(0.03)	0.014	(0.03)	-0.080*	(0.04)	-0.339***	(0.04)
9	-0.412***	(0.06)	0.252***	(0.10)	-0.017	(0.03)	0.038	(0.04)	-0.098**	(0.05)	-0.344***	(0.05)
10+	-0.406***	(0.07)	0.292***	(0.10)	0.048	(0.03)	-0.027	(0.04)	-0.105**	(0.05)	-0.360***	(0.05)
No. of observations	102,382		12,073		102,382							

Note: Coefficient estimates are from the fixed effects models described in equation (1). Standard errors are clustered by person and are reported in parenthesis. *, **, *** denote significance at the 10, 5 and 1% level respectively. Controls for age, age squared, education, marital status, the presence of dependent children, an indicator of urban/rural area of residence and a set of time period fixed effects are included in all specifications but are not reported. For Definition 1, controls for the timing of irregular onset (or exit) are also included but are not reported.

Source: HILDA waves 2001-2013.

Table 6: The dynamic effect of work-limiting disability on overall life satisfaction

Year from onset/exit	<u>Definition 1</u>				<u>Definition 2</u>							
	Consistent onset		Consistent exit		One-time		Temporary		Chronic non-severe		Chronic severe	
	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>	<i>Coef.</i>	<i>S.E.</i>
-3	-0.163	(0.16)	-0.050	(0.31)	0.007	(0.06)	-0.082	(0.07)	0.004	(0.12)	-0.071	(0.12)
-2	-0.213	(0.15)	0.145	(0.26)	-0.079	(0.06)	-0.158**	(0.07)	0.016	(0.11)	-0.108	(0.12)
-1	-0.197	(0.16)	0.068	(0.25)	-0.074	(0.06)	-0.198***	(0.07)	-0.040	(0.11)	-0.136	(0.12)
0	-0.858***	(0.20)	0.153	(0.24)	-0.292***	(0.07)	-0.379***	(0.08)	-0.241**	(0.12)	-0.635***	(0.14)
1	-0.679***	(0.19)	0.084	(0.26)	-0.091	(0.07)	-0.320***	(0.07)	-0.039	(0.12)	-0.618***	(0.13)
2	-0.798***	(0.18)	0.229	(0.25)	-0.023	(0.06)	-0.253***	(0.08)	-0.019	(0.11)	-0.586***	(0.13)
3	-0.899***	(0.19)	-0.055	(0.27)	-0.035	(0.06)	-0.214***	(0.08)	-0.172	(0.12)	-0.677***	(0.14)
4	-0.857***	(0.20)	0.177	(0.27)	0.008	(0.06)	-0.241***	(0.08)	-0.102	(0.12)	-0.612***	(0.14)
5	-0.824***	(0.23)	-0.073	(0.28)	0.100	(0.07)	-0.192**	(0.08)	-0.057	(0.13)	-0.673***	(0.15)
6	-0.864***	(0.21)	-0.055	(0.29)	-0.015	(0.08)	-0.258***	(0.10)	-0.168	(0.13)	-0.689***	(0.15)
7	-0.936***	(0.24)	-0.165	(0.30)	0.045	(0.08)	-0.276***	(0.10)	-0.226*	(0.14)	-0.705***	(0.17)
8	-1.418***	(0.28)	-0.032	(0.31)	-0.029	(0.09)	-0.187*	(0.11)	-0.194	(0.13)	-0.891***	(0.16)
9	-1.028***	(0.26)	-0.068	(0.32)	0.092	(0.10)	-0.299**	(0.12)	-0.253*	(0.15)	-0.715***	(0.19)
10+	-0.691**	(0.31)	-0.144	(0.32)	-0.060	(0.13)	0.041	(0.11)	-0.188	(0.14)	-0.650***	(0.16)
No. of observations	102,400		12,072		102,400							

Note: See notes to Table 5.

Source: HILDA waves 2001-2013.