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Severity of Work Disability and Work

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ABSTRACT

Severity of Work Disability and Work*

This paper analyzes the effect of severity of disability on labour force participation by using a self-reported work limitation scale. A dynamic labour force participation model is used to capture the feedback effect of past participation on current participation. The results suggest that net of persistence and unobserved heterogeneity, differences in severity levels explain a significant portion of the variance in the participation rates among disabled individuals. Moreover, the disability is shown to have longer lasting adverse effects on female participation and work limited women will be more likely to benefit from the work requirements imposed on Disability Support Pension recipients.

JEL Classification: J28, I12, C81

Keywords: severity, work disability, labour force participation

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1 Introduction

This paper analyzes the impact of severity of work limitations on labour force participation by using six waves of the Household, Income and Labour Dynamics in Australia (HILDA) Survey. In order to group work limited individuals into separate severity categories, I use a novel feature of HILDA: the self-reported work limitation scales. The impact of work limitation of varying degrees is then estimated using a dynamic panel data model of labour force participation that explicitly controls for lagged participation and unobserved heterogeneity. Since labour force behaviour is highly persistent, static models may over-estimate the role of current disability for individuals who are out of work force in the previous period(s). Naturally, non-participation in the past may be due to past health conditions, a fact that is controlled in the estimations. Similar models were recently used by Kapteyn et al. (2008) for the US, and by Oguzoglu (2009) for Australia to measure a global disability effect. However, ignoring the distinction between people with some limitation and people who are incapable of work disregards an important dimension of disability (Bound et al. (1995)). For severely limited individuals, not to participate in the labour force may not be a choice but an absolute requirement of their health condition. Therefore, variation in severity levels can explain changes in labour force participation decisions that can not be picked up by general disability status alone.

There is international evidence on the impact of severity of functional disability (i.e. limitation in daily activities) on labour force outcomes (Hum and Simpson (1996); Wilkins (2004); Gannon (2005)). However, studies that employ the severity of work limitation directly are rare. O'Donnell (1998) controls for incapacity to work explicitly by a latent index of capacity, specified to be a linear function of observed characteristics. Jones (2006) reports that for the work limited individuals, severity, as measured by the number of health problems, is strongly significant and negative in the probit model of employment status.

The approach taken in this paper is highly policy relevant due to its ability to present the intertemporal effect of disability on labour force participation. That is, not only can the decline in the participation at time t due to work limitation be captured, but also the impact on future participation levels -due to a feedback effect coming from lagged participation- and recovery paths can be reported. This is important for policy makers whose aim is to speed up the recovery process for individuals who are temporarily incapacitated by health shocks. The effectiveness of one such policy, work requirements for the Disability Support Pension (DSP) recipients, will be demonstrated in this paper. Another contribution of the paper is that it decomposes the participation gap between not-disabled and disabled persons into two components: a gap due to disability and a gap due to differences in human capital. The aim is to provide a measure for the efficient allocation of resources that are devoted to promote sustainable employment among the disabled.

The remainder of the paper is organised as follows: section 2 introduces the data source and describes the sample used. Section 3 describes the econometric model; section 4 reports estimation results and model simulations, section 5 concludes.

2 Data

The data used for this paper come from the first six waves of the Household, Income and Labour Dynamics in Australia (HILDA) Survey. Details of this survey are documented in Watson and Wooden (2004). In the first wave, 7,683 households representing 66 percent of all in-scope households were interviewed, generating a sample of 15,127 persons who were at least 15 years old and eligible for interviews, of whom 13,969 were successfully interviewed. Subsequent interviews for later waves were conducted one year apart. In addition to the data collected through personal interviews, each person completing a personal interview was also given a self-completion questionnaire to be returned upon completion by mail or handed

back to the interviewer at a subsequent visit to the household. The HILDA attrition rates for waves 2 to 6 were 13.2, 9.6, 8.4, 5.6 and 5.1 percent respectively.

The HILDA survey contains detailed information on each individual's labour market activities and history. Socio-demographic characteristics of the respondents and information indicating health status are also recorded. In each wave, respondents are asked the following question to assess if they have a long-term health condition:

> [$\cdots$] do you have any long-term health condition, impairment or disability that restricts you in your everyday activities, and has lasted or is likely to last, for 6 months or more?

While this question is asked, specific examples of *long-term health conditions* were shown on a card. These include, among many others, limited use of fingers or arms, or problems with eyesight that could not be corrected with glasses or contact lenses. Furthermore, individuals with long term health conditions are also asked if their condition is work limiting. (*Does your condition limit the type of work or the amount of work you can do?*). Finally, the degree (or severity) of work limitation is identified using the following HILDA question

> [$\cdots$] could you pick a number between 0 and 10 to indicate how much your condition(s) limit(s) the amount of work you can do?

where an answer of 0 means *not at all* and 10 means the respondent is *unable to do any work*.

In addition to the information collected from the face-to-face interviews, HILDA contains more detailed questions, such as Short Form 36 health status questions (SF-36), in the self-completed questionnaire (SCQ)[1]. The survey items in the SF-36 are scored such that 8 scale scores are given: physical functioning, role physical, bodily pain, general health perceptions,

[1]SCQ response rates for HILDA is around 90 percent, more specifically they are 93.5, 89.2, 92.3, 91.9, 89.9 and 90.8 for waves 1 to 6.

vitality, social functioning, role emotional, and mental health. Physical functioning index is shown to be the most valid SF-36 scales for measuring physical health (Ware (2000)).

2.1 Severity Categories

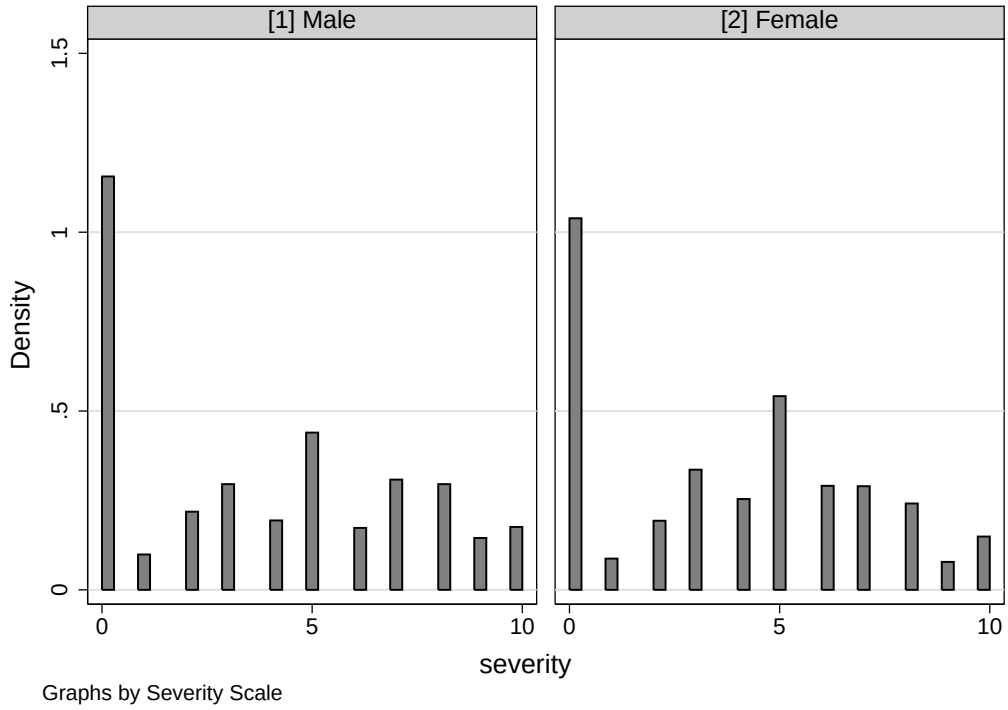
In order to help the tractability of the descriptive and multivariate analysis, the sample was divided into mutually exclusive severity categories. Unfortunately, there is no natural cut-off point in the scale provided by HILDA. This is a common problem for the studies that group individuals using a raw limitation scale and the decision is often made arbitrarily[2]. For example, Hum and Simpson (1996) develop a severity index for the Labour Market Activity Survey (LMAS) by assigning scores 0 (no disability), 1 (partial disability) or 2 (full disability) to different health conditions and summing these scores to construct four categories (no disability, mild , moderate and severe). Statistics Canada provides categories that represent deciles of a global severity index using the Participation and Activity Limitation Survey (PALS). Using Survey of Income and Program Participation (SIPP), DeLeire (2001) divides disabled individuals into *activity and work limited*, and *only activity limited* categories[3]. Although the HILDA survey offers much richer severity measure than the aforementioned datasets its potential has not being fully exploited. Only two examples are from happiness literature, namely Shields et al. (2009) and Headey and Wooden (2004). These studies construct three categories; those who could not work (severe), those with a not work-limiting disability (mild) and those with reported work limitation scale between 1 to 9 (moderate).

In order to decide the cut-off points for the severity categories, I followed a visual approach. Individuals with limitation scales similar in density are grouped together. Figure (1) represents the distribution of the scale. The severity groups are constructed as follows:

[2]ABS provides clear definition of severity categories based on daily activity limitations. However, details on activity limitation was collected only once in wave 4, therefore can not be used in our current analysis

[3]Activity limitations include: getting around the house, getting out of bed or chair, bathing, dressing, eating and using the toilet.

Figure 1: Distribution of Severity Scale



severe (cannot work), profound (scale between 6 to 9), moderate (scale is 5), mild (scale between 1 and 4) and low (scale is 0)[4].

2.2 Characteristics of the Sample

The sample used in this study contains men between 24 and 64 years of age and women between 24 and 60 years of age at the time of the interview. Young people in full time study, older people who are eligible for Old Age Pension (age 65 for men and age 60 for women[5]) and anyone with missing data points are excluded from the analysis. The final

[4]For the regression analysis, several alternative definitions have been tried. For example, a limitation score treating severity scale as a continuous variable, more aggregated groupings as in Shields et al. (2009) or groupings based on frequency of Disability Support Pension (DSP) receipt across severity scale. The regression results were not significantly different.

[5]In fact, the age which women can claim the pension is slowly being increased to reach 65 by year 2015. Current sample may therefore exclude some individuals that should be considered in the labour force.

sample consists of an unbalanced sample of 4387 male and 4545 female respondents that were observed at least two consecutive waves during the first six waves of HILDA[6]. Table 1 describes the demographic and disability characteristics of the sample. The demographic information provided in Table 1 is later used in the labour force participation model and is standard in the literature. Namely, they include age, marital and immigration status, racial background, educational attainment, state of residence, employment and unemployment history, the household's non-labour income and indicators for dependent children and partner's labour force status.

The relationship between severity of work limitations and labour force participation is represented in Table 2. It is apparent that ill health is associated with worse labour force performance. For example, compared to 94 percent of not-disabled men, only 74 percent of the mildly limited and 58 percent of the moderately limited persons are labour force participants. The participation rate for severely limited is 8 percent. Similarly, compared to 78 percent of not-disabled women only 65 percent of mildly limited, 50 percent of the moderately limited and 36 percent of profoundly limited women are in the labour force. Severely limited women's participation rate is again around 8 percent[7].

[6]The sample restriction is primarily dictated by the regression methodology used. The results using a balanced sample were similar and are available upon request.

[7]These participation rates are still unexpectedly high for the severe category. Various possibilities were investigated. It was initially suspected that the severely work limited labour force participant must have been unemployed, self-employed or with significantly short working hours or, simply, unable to fully comprehend the interview questions. However, after careful study of the data none of these speculations turned out to be correct. The models estimated in this paper may therefore underestimate the effect of severe limitations.

Table 1: Mean of the Demographic Variables

Variable	Definition	MEN	WOMEN
nodisab	1 if Not Disabled	0.76	0.80
low	1 if Disabled without work limitations	0.08	0.06
mild	1 work limited (scale is between 1 - 4)	0.05	0.05
moderate	1 work limited (scale is 5)	0.03	0.03
profound	1 if work limited (scale between 6 - 9)	0.07	0.05
severe	1 if work limited (scale is 10)	0.01	0.01
age	$(Age - 24)/10$	1.95	1.73
age2	$(Age - 24)^2/100$	4.89	3.84
aust	1 if Australian Born	0.76	0.76
atsi	1 if Aboriginal or Torres Strait Islander	0.01	0.02
nesb	1 if Immigrant from Non-English Background	0.11	0.12
esb	1 if Immigrant from English Background	0.12	0.10
mcity	1 if Reside in Major city	0.61	0.61
NSW	1 if from New South Wales	0.28	0.29
VIC	1 if from Victoria	0.25	0.24
QLD	1 if from Quensland	0.21	0.21
SA	1 if from South Australia	0.10	0.09
WA	1 if from Western Australia	0.11	0.10
TAS	1 if from Tasmania	0.03	0.03
NT	1 if from Northern Terretories	0.01	0.01
bachplus	1 if BA or higher	0.24	0.27
othps	1 if Other post secondary schooling	0.42	0.26
highed	1 if High shool diploma	0.10	0.14
nothi	1 if No High School diploma	0.24	0.33
mar	1 if Married or de facto	0.77	0.75
kid04	1 if Have dependent child 0-4 years old	0.16	0.19
kid514	1 if Have dependent child 5-14 years old	0.28	0.37
mark04	1 if Married and have Dep. Child 0-4 yrs old	0.16	0.16
mark514	1 if Married and have Dep. Child 5-14 yrs old	0.27	0.30
nrkids	Number of kids in household	0.97	1.25
unemphst	Percentage of time spent unemployed after education	0.05	0.04
workexp	Percentage of time spent employed after education	0.90	0.72
lothinc	Logarithm of non-labour income	8.27	8.84
prtinlf	1 if partner is in labour force	0.53	0.62

Note: Above figures are based on pooled sample of six waves.

3 Methodology

The dynamic panel data model capturing labour force behaviour of person i at time t can be represented as follows:

Table 2: Labour Force Participation by Severity

	Men	Women
Not Disabled	0.94	0.78
Low	0.88	0.75
Mild	0.74	0.65
Moderate	0.58	0.50
Profound	0.33	0.36
Severe	0.08	0.08
Observations	15502	16407

$$(1) \qquad y^*_{it} = \gamma_1 y_{i,t-1} + \beta_1 X_{it} + \sum_{j=1}^{3} \delta_{1j} S_{ijt} + \sum_{j=1}^{3} \delta_{2j} S_{ij,t-1} + \alpha_i + \epsilon_{it}$$

$$y_{it} = 1[y^*_{it} > 0]$$

$$i = 1, ..., N; t = 1, ..., T; j = severe, profound, moderate, mild, low$$

where the latent labour force participation variable y^*_{it} is unobserved except for its sign, y_{it} is a dummy variable that is equal to 1 if individual i participates in the labour force at time t, X_{it} are observed individual characteristics, α_i captures the time invariant unobserved heterogeneity, and ϵ_{it} is the random disturbance that is assumed to follow a normal distribution with mean 0 and variance σ^2_ϵ. The severity of current and past disability are represented by indicators $S_{ij,t}$ and $S_{ij,t-1}$. More specifically $S_{ij,t}$ is equal to 1 if individual i has a work limitation j (e.g. severe, profound, moderate, mild or low) at time t.

One caveat with the random effect specification is that the unobserved heterogeneity should be assumed to be uncorrelated with the observed characteristics of the sample. In order to relax this assumption time averages of all time varying variables are added in to the model as in Mundlak (1978)[8].

[8]To fully relax the random effect assumption requires fixed effect models. However, dynamic probit with fixed effect model is nautoriously unreliable (Heckman (1981)) and recent advances in nonlinear dynamic

Another complication with the estimation of (1) is due to the *initial conditions problem*. Due to the dynamic nature of (1), current labour force participation status depends on the initial labour force status which -for most of the individuals in the sample- predates the start of the data collection and, therefore, is unknown. Treating initial conditions as exogenous variables leads to inconsistent model estimates (Heckman (1981)). Wooldridge (2005) suggests that consistent parameters can be obtained if one forms the likelihood function conditional on the initial observation of the dependent variables, y_{it}. This method requires the inclusion of the dependent variable from the first wave as an explanatory variable. The main advantage of this approach is that estimation can be carried out using standard panel probit procedures in existing software such as STATA[9].

4 Results

In Table 3, results from the dynamic panel data estimation are reported. Models are estimated for men and women separately. According to the results, lagged participation is highly significant. This implies that, independent of health status, individuals who participate in the labour force now are expected to be participants in the future. Put another way, regardless of how individuals became non-participants, it is difficult for them to get back into the labour force. This finding is in support of policies designed to encourage participation among the disabled population, such as job network assistance, specialist disability assistance and vocational rehabilitation services, which are made available by the Australian government. Similarly, work requirements imposed on DSP recipients who can supply more

fixed effect models, such as Honore and Kyriazidou (2000), are not fit to handle rich datasets. A linear probability model based on the System GMM estimator (Arellano and Bover (1995)) was investigated. However, Sargan test rejected the validity of instruments used in the estimation.

[9]An other approach suggested by Heckman (1981) is to approximate the initial conditions with a static probit model using information from the first wave. The dynamic equation (1) and the initial condition equation can then be simultaneously estimated using *Full Information Maximum Likelihood*. The Heckman method is computationally more demanding than the Wooldridge approach and it ran into convergence problems when it was employed to estimate (1).

than 15 hours of work per week may have beneficial outcomes.

Table 3 shows the impact of severity on participation. Current work limitations, net of state dependence and unobserved heterogeneity, have a significant negative effect on individual work activity. For men, even those with low level limitations are adversely affected by their disability. This finding is consistent with Gannon (2005) where disabled men with no limitations in daily activities are reported to perform worse in the labour market than comparable not-disabled men. Even after controlling for current limitations past severe and profound limitation appear to lower participation propensities for men and women[10]. This is over and above the indirect effect of past limitations on current participation via lagged participation.

Demographic controls in the model suggest an inverse-U shaped age profile. Having a bachelor's degree or higher increases the likelihood of participation. For women, having a other post secondary diploma also significantly facilitates labour force attachment. Married women and women with small children are less likely to participate. Labour force participation is increasing in time spent in employment, and decreasing in time spent in unemployment. Both men and women are more likely to participate in the labour force if their partners are also participants.

4.1 The Role of Disability

The probit model results presented in Table 3 can be used to predict labour force participation rates for individuals with different severity levels. Such predictions can be used to analyze the percentage of labour force participation gap between healthy and disabled individuals that can be attributed to disability and the percentage that is due to differences in observed characteristics, such as education, age or potential work experience. Knowing

[10] $Severe_{t-1}$ is significant at the 10 percent level.

Table 3: Dynamic Labour Force Participation Model

	MEN		WOMEN	
LF Participation				
LFP_{t-1}	1.152***	(0.0898)	0.925***	(0.0561)
$Severe$	-2.467***	(0.236)	-2.123***	(0.259)
$Profound$	-1.106***	(0.0965)	-0.797***	(0.0855)
$Moderate$	-0.637***	(0.112)	-0.430***	(0.0963)
$Mild$	-0.472***	(0.0985)	-0.157	(0.0846)
Low	-0.227*	(0.0889)	-0.00846	(0.0759)
$Severe_{t-1}$	-0.360	(0.208)	-1.101***	(0.288)
$Profound_{t-1}$	-0.389***	(0.102)	-0.406***	(0.0887)
$Moderate_{t-1}$	-0.116	(0.116)	-0.157	(0.0996)
$Mild_{t-1}$	-0.0205	(0.102)	-0.152	(0.0869)
Low_{t-1}	0.0318	(0.0923)	-0.0760	(0.0768)
Age	0.0326	(0.0545)	0.109**	(0.0411)
Age Squared	-0.202***	(0.0291)	-0.261***	(0.0292)
ATSI	0.0993	(0.238)	-0.262	(0.149)
Non ENG Background	-0.0265	(0.0950)	-0.126	(0.0681)
ENG Background	0.00419	(0.0898)	-0.0698	(0.0734)
Major City	0.0859	(0.0636)	-0.0723	(0.0472)
NSW	0.119	(0.228)	-0.0561	(0.157)
VIC	0.0637	(0.229)	-0.0185	(0.158)
QLD	-0.0475	(0.230)	-0.170	(0.159)
SA	0.0900	(0.240)	-0.157	(0.168)
WA	0.135	(0.239)	-0.335*	(0.165)
TAS	-0.185	(0.266)	-0.133	(0.198)
NT	-0.323	(0.386)	0.243	(0.306)
Bachelor or Higher Educat.	0.267**	(0.0908)	0.373***	(0.0621)
Other Post Sec. Sch	0.0202	(0.0702)	0.234***	(0.0564)
Completed Year 12	0.106	(0.111)	0.0736	(0.0678)
Married	-0.122	(0.188)	-0.465**	(0.149)
Have 0-4 yrs old children	-0.340	(0.592)	-0.737***	(0.126)
Have 5-14 yrs old children	-0.214	(0.244)	-0.254*	(0.108)
Married X 0-4 yrs children	0.205	(0.592)	-0.221	(0.129)
Married X 5-14 yrs children	0.191	(0.228)	0.300**	(0.0988)
Number of Kids	0.0979*	(0.0445)	-0.0340	(0.0269)
Unemployment History	-0.428*	(0.174)	-0.620***	(0.136)
Experience	1.805***	(0.208)	1.274***	(0.101)
Log(Other HH Income)	-0.0189	(0.0138)	-0.00731	(0.0108)
Partner in LF	0.486***	(0.103)	0.457***	(0.0901)
Initial LF Status	1.108***	(0.133)	1.157***	(0.0808)
Constant	-1.290***	(0.337)	-0.913***	(0.227)
lnsig2u				
Constant	-0.521**	(0.192)	-0.483***	(0.123)
Observations	15502		16407	

Models include time dummies and time averages of time varying variables

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

the proportion of non-participation that can be attributed to disability has very important policy implications since it determines how the budget should be allocated between disability prevention, health recovery, and investment on human capital investment. The methodology used here is similar to an Oaxaca Decomposition that is commonly used to examine wage differentials (Oaxaca (1973)). Table 4 reports the total predicted gap, the gap due to disability and the gap due to observed characteristics separately for different severity and gender groups. The dynamic panel data model predicts the total participation gap between healthy and severely disabled persons as 96 percent and 80 percent for men and women, respectively. Nearly half of this gap can be explained by differences in observed characteristics between the two male samples. For women, however, almost 90 percent (0.71/0.80) of the gap is due to disability. Similarly, profoundly limited men were predicted to have on average 70 percent lower participation rates than the healthy male sample, of which around 58 percent is due to disability. For women with profound limitations, observed characteristics can explain only 16 percent of the total gap (24 percent). For men, the predicted total gap between the not-disabled sample and moderate, mild and low samples are 37, 17 and 4 percent respectively. Again, the majority of this gap seems to be related to differences in characteristics other than disability. Moderately and mildly limited women were predicted to have 11 and 2 percent lower participation rates than not-disabled women; this gap is almost entirely due to disability. For the low sample, the model does not predict any significant participation gap. In Table 4, it also appears that the proportion of non-participation attributable to disability is decreasing in severity for men.

4.2 Simulations

In this section, I simulate the intertemporal labour force response to a work limitation shock across various severity levels using the estimated parameters of (1). The aim here is to show that the indirect impact of past limitations on current labour force participation due

Table 4: Oaxaca Decomposition of Predicted Participation Gap

	Total Gap	Gap due to Charactheristics	Gap due to Disability
		MEN	
Severe	0.96	0.46	0.50
Profound	0.71	0.29	0.42
Moderate	0.37	0.16	0.21
Mild	0.17	0.06	0.11
Low	0.05	0.02	0.03
		WOMEN	
Severe	0.81	0.10	0.71
Profound	0.24	0.04	0.20
Moderate	0.11	0.03	0.08
Mild	0.02	0.00	0.02
Low	0.00	0.00	0.00

Note:Total Gap is the predicted participation gap by the model. Gap due to disability is the difference between predicted rates where 2 groups only differ in limitation status. Gap due to characteristic is the difference between two predicted rates where groups only differ in observed characteristics.
Random effects are set to zero.

to a decline in past participation, may be substantial. Due to this feedback effect, a one-off health shock may alter future levels of work activity even if and individual's health recovers after one period. In order to show this possibility, I simulate the intertemporal participation response over 10 years. Figure 2 represents the simulated response after a work limitation shock at time t, and I assume that at $t+1$ the individual no longer has a work limitation. The impact of different severity levels is simulated for an average men and for an average women separately[11].

Figure 2 shows that recovery from a severe work limitation shock takes on average 5 years for women and 3 years for men. Similarly, the full impact of profound limitations takes two to four years to be realised. This implies that the decline in current work activity, in response to a one-off shock, may have severe long-run consequences due to the persistent nature of labour force behaviour. Encouraging labour force attachment among work limited

[11]All the control variables are set to their respective gender's sample averages. Random effects are set to zero

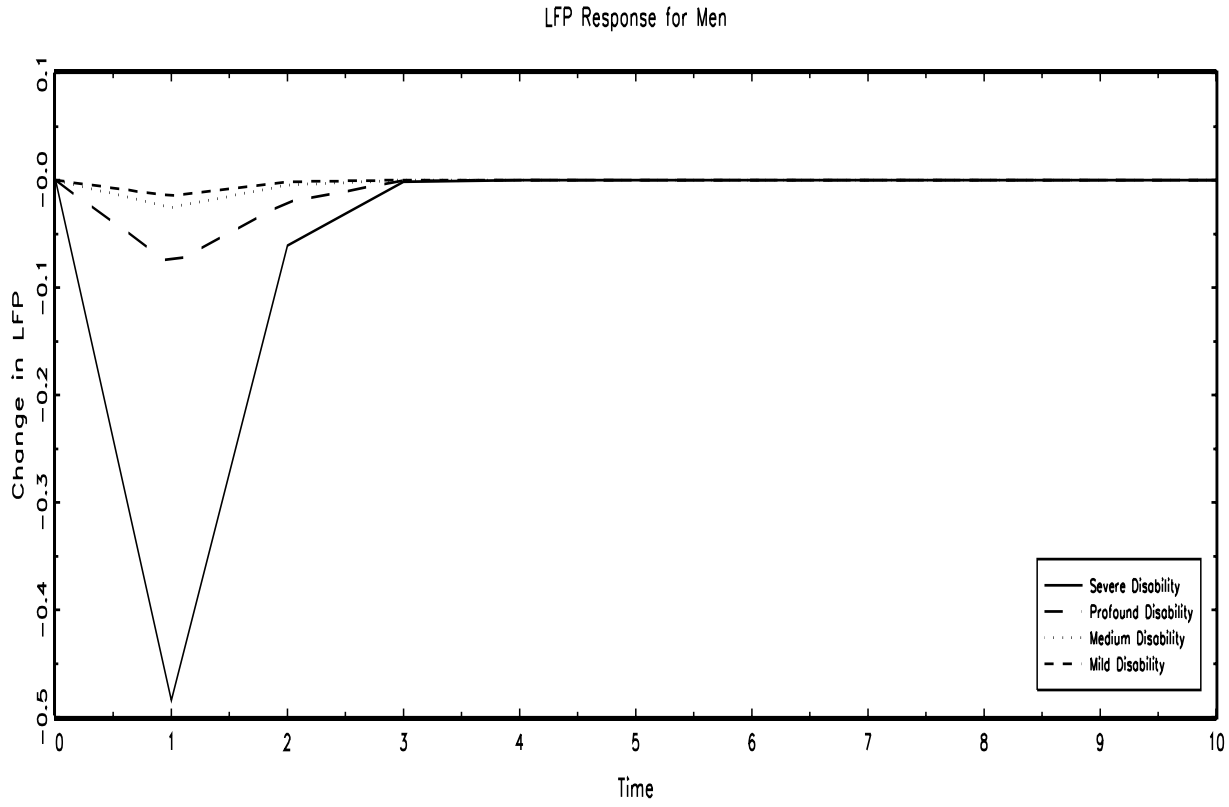
individuals while they are recovering is, therefore, crucial.

Note that Figure 2 represents a scenario where an individual's health recovers fully from the shock within only one year. In particular, for severely or profoundly limited individuals, it would be more likely that some or all of their health limitations would persist in the next period. Therefore, the long run impact of work limitation is probably more severe than is pictured in Figure 2. Such a scenario is presented in Figure 3 where an individual who is severely work limited at t becomes moderately work limited at $t+1$. Figure 3 presents two cases: in the first, I assume that the individual participates while moderately work limited. This situation mimics the recently introduced work requirements by the Australian government for disabled people who are able to work more than 15 hours per week. For the second case, the work requirement is omitted. Figure 3 shows that women with severe work limitations may significantly benefit from the work requirements once their health improves. The recovery for women who were exposed to the labour market while they were moderately limited is two years faster than those who were not required to participate in a work activity. For men, the labour force exposure does not seem to alter the recovery path much.

4.3 Endogeneity of Work Limitation

There is disagreement in the literature on the reliability of self-reported health data. Although some studies are confident with the self-reported work limitation (Stern (1989); Dwyer and Mitchell (1999); Benitez-Silva et al. (2004); Cai (2009)) other research presents concerns about misreporting due to psychological, social and economic incentives that leads to the *justification bias* (Kerkhofs and Lindeboom (1995); Kreider (1999)). Namely, since ill health is one of the most socially acceptable reasons to exit work, individuals may report health problems in order to justify their labour market performance. In order to control for this possibility, a physical functioning index based on SF-36 health status questions is used

Figure 2: Labour Force Response to a Work Limitation Shock



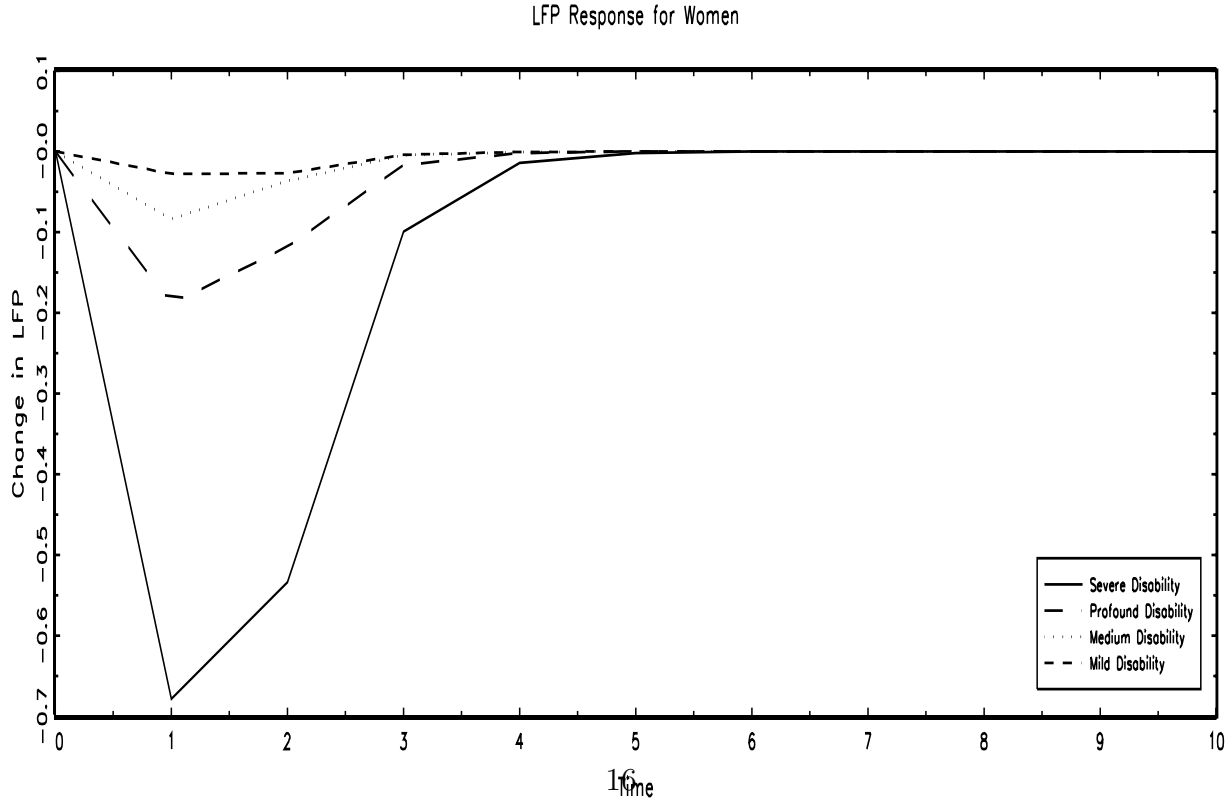
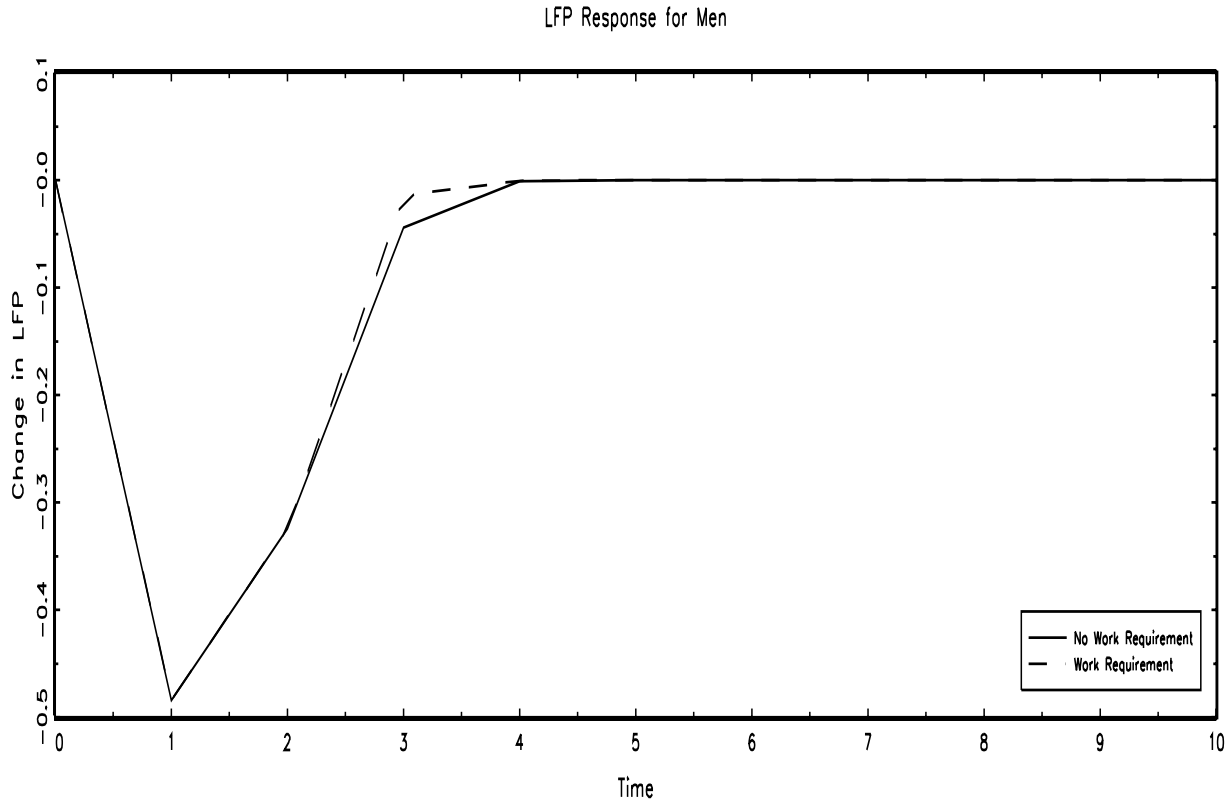
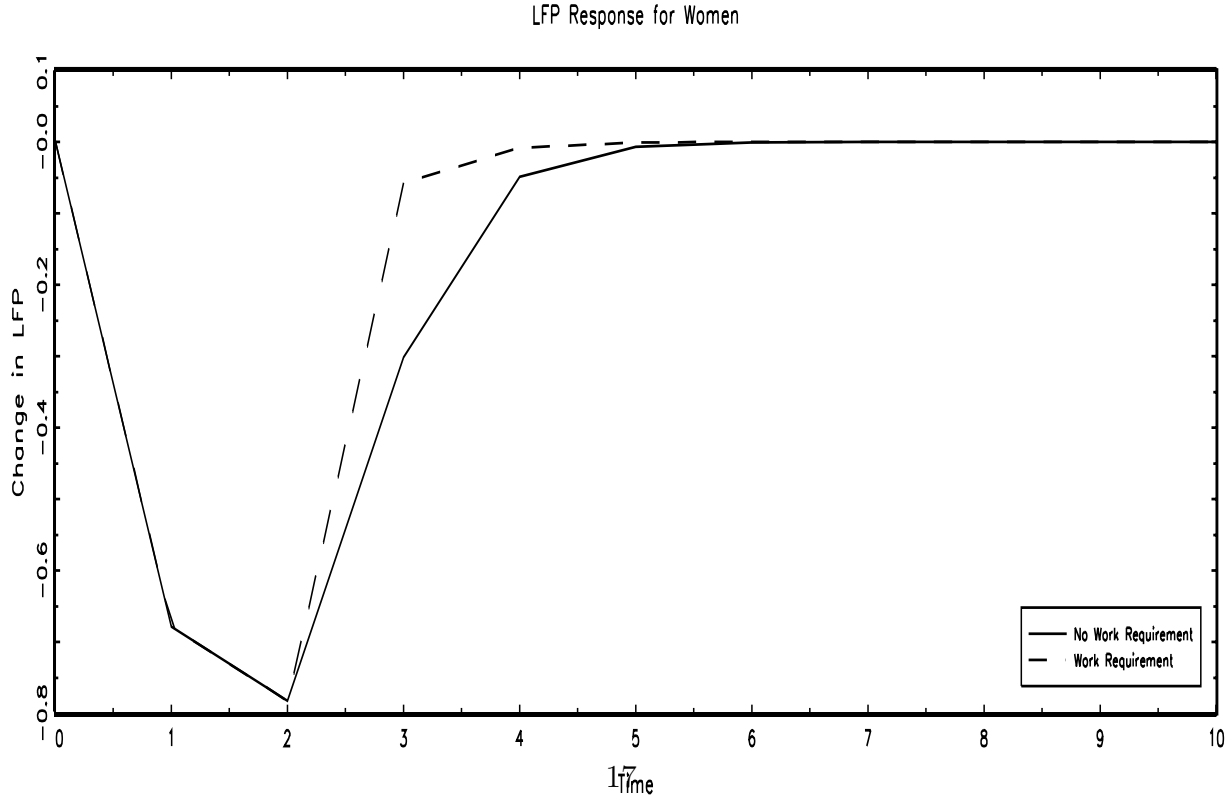


Figure 3: Labour Force Response With and Without Work Requirement





as an instrument for the severity measure used in the previous section[12]. This approach is similar to the one taken by Stern (1989); Cai and Kalb (2006) and Campolieti (2002). The main idea here is that while answering to specific health questions (such as difficulty in carrying groceries or walking 100 meters), individuals would be less inclined to misreport in order to rationalize their labour force status. Therefore, the physical functioning index (albeit self-reported) can be less likely to be subject to systematic reporting errors than self-reported work limitation data, particularly if individuals have frequent visits to health professionals (Campolieti (2002)). One problem with specific health measures is that they are not a perfect proxy for work capacity and often underestimate the role of health in employment behaviour. However, Bound (1991) suggests that the biases within global and specific health measures may work in opposite directions, and so to supply accurate measures of the disability effect.

In order to test the robustness of model estimates to the endogeneity assumption, I introduce a health reporting function that links observed severity levels to observed characteristics of the sample. The health reporting equation can be written as follows:

$$Sev_{it} = \beta_2 Z_{it} + \delta_3 H_{it} + \nu_{it} \tag{2}$$

where Sev_{it} is an ordinal variable that indicates the self-reported severity categories. It takes 6 values depending on the disability status of the individual (severe, profound, moderate, mild, low and not disabled). H_{it} is the detailed health information provided by the physical functioning index. Z_{it} are observed characteristics, and ν_{it} is the random disturbance that follows $\nu_{it} \sim (0, \sigma_\nu^2)$.

The estimation of the model is carried out in two steps. First, (2) is estimated using a

[12]Physical functioning index ranges from 0 to 100, where 100 indicates perfect health.

pooled ordered probit. The predicted values from this estimation are used in the estimation of dynamic labour force equation (1) in lieu of $S_{ij,t}$ and $S_{ij,t-1}$. A practical problem with this approach is that (2) provides a continuous index of severity rather than separate severity categories. Hence, the coefficient estimates of this section are not directly comparable to the results provided in Table 3. In order to demonstrate the impact of endogeneity correction on the estimates, I also estimate the model by including Sev_{it} without correction. The results for the health variables are provided in Table 5[13]. According to the results, the negative impact of the current disability, after controlling for the endogeneity of the measure, is still highly significant for both men and women. However, although the uncorrected measure for the lagged severity is still significant, the coefficient for the endogeneity corrected measure is no longer significant for men. This implies that significance assigned to direct effect of past severe and profound limitations in the previous section should be taken with caution. Nevertheless, even if past limitations do not have a significant direct effect, their impact via persistence channels can be substantial. The lagged severity is still significant for women after controlling for endogeneity.

5 Conclusion

In this study, the effect of self-reported work limitations on labour force participation was investigated by allowing heterogeneity in severity levels. Results from the dynamic labour force participation model shows a strong association between current and past labour force participation, implying that, regardless of how people become non-participants, it is very hard for them to get back into the work force. However, low participation levels of work limited individuals cannot be explained by their relatively weaker attachment to the labour

[13]Full results for the participation model and the severity model are available upon requests. Severity model contains the same observed characteristics excluding the information about dependent children

Table 5: Endogeneity Corrected Model Estimates Table

	MEN		WOMEN	
	Uncorrected	Corrected	Uncorrected	Corrected
LF Participation				
LFP_{t-1}	1.147***	1.192***	0.921***	0.945***
	(0.0896)	(0.0913)	(0.0561)	(0.0559)
Severity	-0.299***	-0.575***	-0.200***	-0.313***
	(0.0218)	(0.0551)	(0.0185)	(0.0378)
$Severity_{t-1}$	-0.0378**	-0.0127	-0.0879***	-0.123**
	(0.0119)	(0.0563)	(0.0193)	(0.0381)
Initial LF Status	1.109***	1.280***	1.169***	1.205***
	(0.133)	(0.145)	(0.0809)	(0.0822)
Constant	-0.923**	-3.157***	-0.596**	-2.336***
	(0.337)	(0.374)	(0.230)	(0.247)
lnsig2u	-0.505**	-0.363	-0.464***	-0.428***
	(0.190)	(0.186)	(0.122)	(0.120)
Observations	15502	15502	16407	16407

Models include all controls used in Model 1

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

force alone. After controlling for state dependence, observed and unobserved characteristics, the impact of current limitations are still highly significant. This impact is not uniform across severity levels which emphasises the heterogeneous nature of the disabled population.

The estimation results are shown to have important policy and budgetary implications. This is accomplished in two ways. First, the predicted participation gap between healthy and limited individuals is decomposed to measure the proportion that is due to disability. The results were strikingly dissimilar across men and women. For men, 40 to 50 percent of the predicted gap is shown to be related to observed characteristics such as age, education or employment history. For women, however, the gap is almost entirely due to work limitations. This may be due to double-discrimination disabled women may face in the labour market

(Deegan and Brooks (1985)), lack of social support available for disabled women (Katz et al. (2000)) or unobserved gender specific factors that affect health reporting (Oguzoglu (2009)). Another interesting finding is that the proportion of non-participation that is attributable to health appears to be decreasing in severity for men.

The negative impact of a one-time work limitation shock is demonstrated to be long lasting. According to model simulations, work limited individuals' labour force status appears to suffer long after their health recovers fully. Again, the recovery path is not uniform across severity levels or gender. Severely and profoundly limited men are expected to return to their pre-shock participation levels in 3 years. The recovery takes up to 5 years for women.

The findings in this paper are in support of policies that are designed to keep nearly disabled individuals attached to the work force. One such policy, work requirements for DSP recipients, is expected to produce positive outcomes. However, a one-fit-for-all policy will probably fail to reach to its full potential due to the heterogeneous nature of the disabled group. For men, building up incentives that encourages return-to-work should go hand in hand with education and training (or re-training). For work limited women, whose work activity suffers more and longer than men's, the solution might be harder and may require more aggressive policies. In this regard, both side of the labour market should be convinced that there are long-run benefits of not losing temporarily-disabled women to permanent inactivity.

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