Improving the employment rates of people with disabilities through vocational education

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Abstract: During the 2001-8 period, the employment rate of people with a disability remained remarkably low in most western economies, hardly responding to better macroeconomic conditions and favourable anti-discrimination legislation and interventions. Continuing health and productivity improvements in the general population are leaving people with disabilities behind, unable to play their role and have their share in the increasing productive capacity of the economy. This paper combines dynamic panel econometric estimation with longitudinal data from Australia to show that vocational education has a considerable and long lasting positive effect on the employment participation and productivity of people with disabilities.

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1. Introduction

There is evidence from most western economies, that people with disabilities are less likely to be in paid employment and more likely to be paid less than people without disabilities (Stern 1989, Baldwin and Johnson 1994, Wilkins 2004, Gannon 2005). Despite the introduction of both demand-side and supply-side measures to reduce the pay and participation gap, such as anti-discrimination legislation and education and training policies, improvement in the last decades has been well below targets and expectations. The employment outcomes of people with disabilities have improved only marginally and continue to be a serious concern for economic and social policy alike.

Governments have tried to address labour market disadvantage associated with disability by introducing anti-discrimination legislation. Decades after the introduction of legislative change, empirical studies cannot show without doubt that the desired policy objectives have been met (Schumacher and Baldwin 2000, Hotchkiss 2004, DeLeire 2000, Acemoglu and Angrist 2001 and Bell and Heitmueller 2005). Indeed, authors such as DeLeire (2000) and Acemoglu and Angrist (2001) have argued that anti-discrimination laws, in the form of workplace accommodations, reduce the demand for workers with a disability by increasing the cost of employing them.

Besides anti-discrimination laws, the labour market disadvantage of people with disability can be addressed through education and training, aiming principally at improving the productivity of people with disabilities. There are many ways in which increased education and training may reduce the labour market disadvantage of people with disabilities.

People with disabilities are considerably more likely to be older and less skilled.[1] It would follow that, other things equal, people with disabilities as a group would stand more to gain from education and training than people without disabilities. Further, for those people who

[1] See Australian Bureau of Statistics 2004

experienced the onset of their disability after they had entered the labour market (which is the vast majority of working-age adults with work limiting disabilities), undertaking education and training can help them aim at jobs in which their capacity to work may be affected less by their disability.[2] Education and training, enables people with a disability to readjust their productivity to suit the new realities that their disability presents them with. Finally, for people with disabilities, retraining can improve their market signal to potential employers. People with disabilities who complete an education qualification are sending a market signal which may help offset statistical discrimination that occurs when employers overlook a candidate because of uncertainty surrounding how disability affects their productivity. Especially for those who are unemployed and are seeking work, completing a qualification may send more than one valuable productivity signal to employers. Completion of a qualification will suggest that their disability does not affect their ability and motivation to perform, first, the job-specific tasks build into the qualification, and second, those essential but general tasks (e.g. in terms of mobility, time keeping) that are associated with successful course attendance and completion of the qualification.

While previous studies have shown that the presence of education qualifications is more strongly associated with employment for people with disabilities than for people without (Kidd et al. 2000, Jones et al. 2006), no study that we are aware of has examined whether *completing* a qualification can reduce the labour market disadvantage of people with disability. The aim of this paper is to examine the extent to which completing a vocational education and training (VET) qualification improves the employment rates of people with disabilities. The focus on VET is based on the evidence that VET is by far the most popular educational pathway for working-age

[2] In the United Kingdom for example, 75 percent of people who experience disability onset are of working-age, 11 percent are born with the condition and 12 percent experience onset prior to reaching working-age (Burchardt 2003).

people with disabilities.[3] There are many practical reasons for the popularity of VET. Compared to university courses, on average VET courses are shorter, more accessible, more flexible in their delivery, with stronger vocational orientation, and closely linked to employer needs.

We choose to analyse the benefits of VET in Australia because the Australian VET system is, by international standards, highly flexible in its delivery, content and recognition of past experience and learning (Hoeckel 2008, OECD 2008), which makes it well-suited for training working-age people with disabilities. An Australian VET qualification is attained by demonstrating competency against nationally recognised standards, which means that after an assessment of a candidate's existing skill set, the course can be individually tailored to achieve the necessary minimum competency standards (commonly called recognised prior learning).[4] Recognised prior learning reduces the duration of vocational courses (which typically take 6 to 12 months to complete) and makes participation more attractive for working-age adults.

. To conduct the analysis, we use the Household Income and Labour Dynamics in Australia (HILDA) survey data and a dynamic random effects panel probit model using the Heckman (1981) method augmented by the Mundlak (1978) corrections methodology. The main finding of the paper is that vocational education increases the employment probability of people with disability and that the effect is long lasting, indicating that education has resulted in a permanent productivity improvement for those who undertook it. The paper finds that the employment benefits of equivalent qualifications are weaker for people without disability, which confirms the hypothesis that vocational education addresses some of the specific labour market disadvantages encountered by people with disabilities. The paper also finds that the benefits from vocational education differ between those who enrolled whilst out of work and those who were employed

[3] The Australian Survey of Education and Training 2005 conducted by the Australian Bureau of Statistics suggests that 2 out of every 3 courses undertaken by working-age people with a disability is a vocational course, compared to around half for people without disability.

[4] National standards are set by a statutory authority in consultation with employers, professional groups and training providers.

when they enrolled. The findings of the paper are robust to the addition of non-random self-selection into vocational education using a propensity score matching approach.

The paper is structured as follows. Section 2 describes the data design and the data set. Section 3 presents the econometric model. Section 4 presents and discusses the results and Section 5 concludes. An appendix contains descriptive statistics and estimation results.

2. The Data

The paper uses the Household Income and Labour Dynamics in Australia (HILDA) survey data between 2001 and 2008. The HILDA is a large-scale nationally representative annual panel survey of Australian households which combines detailed information on reported health and disabilities and employment outcomes with a rich host of socio-demographic variables. The HILDA survey is very similar in its design to the British Household Panel survey and the German Socioeconomic Panel survey.[5] Given that the HILDA survey spans a period of strong economic growth in Australia, we are able to analyse the benefits of further education in an environment that is unencumbered by low labour demand. This section first explains how the data has been constructed for the specific estimation purposes of the paper. In order to compare the employment effect of completing a vocational qualification by disability status, the paper estimates separate models for those classified as being with a disability and those classified as being without a disability.

In the HILDA survey, an individual's disability status is determined in each wave of the survey by asking whether they have a '*a long-term health condition, impairment or disability that restricts everyday activities that has lasted or is likely to last, for 6 months or more'*. A challenge when using this definition

[5] The Appendix contains relevant descriptive statistics (Table A.1). A detailed description of the survey and its instruments can be found at Melbourneinstitute.com/HILDA.

is how to allocate individuals between the categories of people with and without a disability, given that disability status can change over time (Burchardt 2000). The method used in this paper, is based on the approach used by Burkhauser and Daly (1996) and Jenkins and Rigg (2004), which runs as follows. An individual is allocated to the with or without a disability group according to whether they have spent at least two consecutive time periods with the same disability status. A one-period spell with or without a disability is omitted from the sample. If individuals have consecutive time periods with a disability and later experience consecutive time periods without disability, they will appear in both groups. Omitting one-period spells rules out transient changes in disability status, caused by illnesses or injury that have had no longer-term employment impacts, whereby such transient spells would be less likely to have motivated any new education and training (Burkhauser and Daly 1996 and Jenkins and Rigg 2004).[6] An additional advantage of restricting inclusion in the sample to at least two consecutive periods with the same disability status, is that it reduces the risk of measurement error and 'rationalisation bias' that may be present if people report a disability to justify being out of employment (Bound 1991).[7]

Based on this inclusion rule for the construction of the two samples the paper uses for estimation, the sample of people with a disability contains 4467 individuals and the sample of people without a disability contains 14702 individuals, with 1240 individuals appearing in both samples because they changed disability status during the 2001-2008 observation frame of the HILDA survey. To control for differences between those whose disability status does and does

[6] Transient health shocks are a different issue and they lead to distinct responses in terms of labour market behaviour (see Cai et al. 2008), which are not the subject of this paper.

[7] We also estimated comparable models where individuals are allocated between the two groups based only on their current disability status. The estimated effects are close to those presented in this paper, which suggests that omitting one-period spells with and without disability makes little difference to the results. Results are available upon request from the authors.

not change, estimations include a dummy variable which takes the value 1 for individuals whose disability status changed between 2001 and 2008 and 0 otherwise.[8]

To control for differences in the severity of disability that may influence employment outcomes, the paper uses information on the extent to which individuals report that their disability limits the amount of work they can do on a scale from 0 to 10, where 0 is unaffected and 10 is cannot work. The average disability severity response is around four and there are few individuals in the disability sample who report that they cannot work at all because of their disability.

The HILDA survey provides detailed information on the highest education qualification obtained at the time of interview, or the stock of education. The paper distinguishes between those who have (i) completed school, (ii) completed a vocational education post-school qualification and (iii) completed a university post-school qualification. In the initial period of the sample, people with a disability have a lower level of education, with the exception of vocational education (Table 1).

The question that concerns this paper is how helpful education becomes in assisting people with a disability who want to find and retain a job. To address this question, the paper utilises a general definition of employment (including paid- and self-employment) and does not make the distinction between full-time and part-time employment. The HILDA question used is sufficiently broad to capture different aspects of employment and asks '*any time at all in the last 7 days did you do any work in a job, a business or farm?*'

[8] It is possible that those who changed status (and therefore appear in more than one of the sub-samples) may have experienced different employment outcomes for a variety of reasons. Part of this difference could be captured by the relevant dummy variable.

Table 1: Highest qualification held in the initial period of the sample

	Without disability	With a disability
	%	%
Higher education		
Postgraduate – masters or doctorate	3	2
Graduate diploma or graduate certificate	4	3
Bachelor	15	8
Vocational qualification		
Advanced diploma or diploma	8	7
Certificate III or IV	18	21
Certificate I or II	1	2
Certificate undefined	0	1
Secondary school qualifications		
Secondary school completion	20	13
Did not finish secondary school	30	43
Number of individuals	14702	4467

The completion of a qualification is identified in the HILDA survey through asking individuals if they completed any new qualifications since their last HILDA interview. Those who report completing either a Certificate, a Diploma or an Advanced Diploma, are identified as having completing a vocational qualification. Because the sample size would be too small, the paper does not distinguish between the levels of vocational qualifications. However, it should be noted that treating all vocational courses equally is not likely to affect the comparison of the overall employment benefits between those with and without disability because there is little difference in the level of courses undertaken between the two groups. A similar variable was generated for those who completed a higher education course.[9] The reference group in the analysis is those who did not complete a course, including those who were enrolled and did not complete a qualification. To the extent that there may be employment benefits from the partial completion

[9] Although the completion of a higher education (university) course is included in the estimated models, it is not a point of focus because it is relatively uncommon and there are only a small number of observations in the data.

of a course, grouping non-completers with those who never enrolled would under-estimate any improvement in employment rates.

3. The econometric model

3.1 The general model

This paper models the effect of obtaining a vocational education qualification on the probability of employment of people with and people without a disability. Since the probability of employment is not observed, the paper uses a binary indicator of employment as the dependent variable in the following equation

$$y_{it} = x_{it}^{'}\beta + \gamma y_{it-1} + \alpha_i + \varepsilon_{it} \quad (1)$$

with $y_{it} = 1$ if $y_{it}^{*} > 0$ and $y_{it} = 0$ if $y_{it}^{*} \leq 0$, where y_{it}^{*} is the underlying unobserved probability of employment generating binary outcomes y_{it}, x_{it} represents a range of economic and socio-demographic variables, including education and training, and the error term is the sum of two components, an individual heterogeneity term α_i and a stochastic error term ε_{it}. The model contains a lagged dependent variable y_{it-1} in the right hand side in order to introduce the dynamic element in the estimation. Including a lagged dependent variable allows the model to estimate the effect of past employment status on present employment status, but crucially, also the possible effect of employment status in the year prior to completing a vocational qualification on the employment status after completion of the qualification.

The paper estimates Equation 1 using a Random Effects Dynamic (RED) Probit model where the dependent variable takes the value 1 if the individual is employed and 0 if not. In order to overcome the problem of initial conditions that is generated by the inclusion of the lagged dependent variable in the right hand side of the model, the paper uses the method proposed by Heckman

(1981).[10] This method uses the information contained in the first wave of the panel data set as the best available approximation of the true initial conditions in the data and estimates it using Equation 2 as a simple cross section.

$$y_{i0}^{*} = x_{i0}'\beta + \alpha_i + \varepsilon_{i0}, \qquad (2)$$

This paper adopts the shortcut to estimating the Heckman model that was suggested by Arulampalam and Stewart (2009), which involves a series of data transformations so that the parameters in Equations 1 and 2 can be estimated jointly within one equation. These transformations involve setting the values of independent variables in Equation 1 (x_{it}) equal to zero in the initial period, and setting the values of independent variables in Equation 2 (x_{i0}) equal to zero after the initial period. Under this approach, the two equations share the same individual effect (α_i), but the variance of the individual effect is allowed to vary between the two equations (through the parameters τ and σ)[11]. Following Greene (2007), the equation that is estimated can be written as:

$$y_{it}^{*} = x_{i0}'\beta + x_{it}'\beta + y_{i,t-1}\gamma + \phi d_{it} + \varsigma f_{it} + d_{it}\tau\alpha_i + f_{it}\sigma\alpha_i + \varepsilon_{it} \qquad (3)$$

where d_{it} and f_{it} are equation specific constants (in the initial period d_{it} is one and f_{it} is zero and the reverse in the following periods).

The identification of the initial conditions equation relies on historical information that was clearly determined at the time a subject joined the survey. The paper uses the variables *country of birth* and *labour market experience* in wave 1. Both variables contain past information, are not included in the main Equation 1, and are statistically significant in Equation 2.

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[10] Estimation of the model is performed in LIMDEP using the random parameters command, which is equivalent to the random effects estimator (Greene 2007). Under this approach, the correlation in the error terms between the two periods (commonly referred to as θ) is equal to 1 because the two equations are assumed to share the same individual heterogeneity term,

[11] Because Equations 1 and 2 share the same individual heterogeneity term, correlation between the unobserved heterogeneity terms between the two equations is 1.

The paper introduces Mundlak (1978) correction terms in the form of the means of all time-varying explanatory variables as additional explanatory variables in Equation 1. The intuition is that the Mundlak variables will estimate the average impact of the individual fixed effect by variable, so that the time-varying element of the estimated variables will reflect the conventional (unbiased) Fixed Effects panel estimates. In the context of this paper, the Mundlak variables are also important in controlling for the impacts of unobserved time invariant factors, such as ability, that may affect selection into a vocational course. The paper reports marginal effects as they allow clear interpretation.

3.2 Interactions between vocational education and employment status

The main novel results of the paper are generated by estimating a number of two-way interaction terms in order to capture the effects of vocational education on post-qualification employment outcomes differentiating by pre-qualification employment status. These interaction terms allow the paper to test various hypotheses. One such hypothesis of interest is whether the employment benefits from completing a vocational qualification are higher for those who are out of work prior to studying, than for those who are employed prior to studying. One could expect that those who are out of work prior to undertaking and completing a vocational qualification are more likely to chose that qualification in order to find work, whereas those who already have a job are more motivated by other factors, such as, for example, the prospect of higher wages. Equation 3 can be extended to write: [12]

$$y_{it}^{*} = x_{i0}'\beta + x_{it}'\beta + y_{i,t-1}\gamma + \delta EDSTOCK_i + \varphi VET_{it} + \varphi_1 VET_{i,t-1} + \varphi_2 VET_{i,t-2} + \theta(y_{i,t-1} * VET_{it}) + \theta_1(y_{i,t-1} * VET_{i,t-1}) + \theta_2(y_{i,t-1} * VET_{i,t-2}) + \phi d_{it} + \varsigma f_{it} + d_{it}\tau\alpha_i + f_{it}\sigma\alpha_i + \varepsilon_{it} \quad (4)$$

[12] Equation 4 will be used as the main building block for predicting probabilities that can test a large number of hypotheses, some of which are presented in the remainder of the paper. This is done using post-estimation calculations involving the marginal effects obtained here.

where $EDSTOCK_i$ is the highest qualification held in the individual's initial period (or education stock), VET_{it}, VET_{it-1} and VET_{it-2} represent new vocational qualifications since the initial period. For each individual *i* and time period *t* in the data, VET_{it}, VET_{it-1} and VET_{it-2} indicate whether a new qualification was obtained in the last three years; VET_{it} since the last interview (which would be within the last year), VET_{it-1} since the second last interview (which would be between one and two years ago), and VET_{it-2} since the third last interview (which would be between two and three years ago) respectively.[13] Including interactions between obtaining new vocational qualifications and employment status prior to those qualifications, introduces a set of flexible terms, where the effects of completing a vocational qualification are allowed to vary from year-to-year, depending on the previous year's employment status. All regressions are carried out separately for observations with and without a disability. Estimated interaction terms are combined with the main terms to produce predicted probabilities which are then used for the calculation of counterfactuals. These are presented in the next section in the form of specific comparisons relating to the effect of VET on employment probabilities for different sub-groups in the labour force. Descriptive statistics for all variables included in Equation 4 are provided in Table A.1 in Appendix.

[13] To decide on the optimal number of lags, the paper estimated models with 1 to 4 lags and chose the one with the lowest Akaike Information Criterion (AIC), which is a method commonly used for selecting the number of lag variables in time-series models. The justification of using the AIC criterion over stepwise regression is that a stepwise procedure can often be path dependent (Anderson 2004).

4. Estimation results and discussion

4.1 General results

Estimation results are based on Equation 4 and are presented in Table 2.[14] The first two columns report results for people without disability and the next two columns for people with a disability. Marginal effects are reported for ease of interpretation and comparability.

Before focussing on the results related to disability and vocational qualifications, it is necessary that an overall assessment of the model be made. The marginal effects of education at the start of the survey (initial period) indicate that employment probabilities improve with education levels, the main dividing threshold being between those with and those without post-school qualifications. There is relatively little difference in the marginal effects of holding vocational and university qualifications. Given that the wages of vocational education graduates are markedly less than the wages of university graduates, the paper provides evidence that the advantage of university over vocational education manifests itself more through higher wages than through better employment probabilities. Results also support the finding from previous studies that the effect of qualifications on employment probabilities is higher for people with disabilities than for people without (Kidd et al. 2000, Jones et al. 2006). The presence of children in the household has a significant effect on employment outcomes, but only for female members of the household. The effect of marital status differs by gender and disability status. Age matters for both people with and without disabilities.

[14] The marginal effects for the initial conditions values and the Mundlak correction terms are presented in the Appendix. All marginal effects have been estimated at the variable means and the standard errors have been estimated using the delta method. The marginal effects for the interaction terms have been calculated using cross-differences in the values that make up the interaction terms as outlined by Ai and Norton (2003), and not from discrete changes in the interaction terms. Although the choice of method does not matter in the case of linear models, it does for non-linear models, because the predicted probabilities on which the marginal effects are based, are conditional on the values of all variables in the model, including the values of the terms that make up the interaction terms.

Table 2: Marginal effects of employment for people with and without a disability

	Without disability		With disability	
	ME	t-stat	ME	t-stat
Highest education in the initial period (Ref. Cat.: did not)				
Higher education	0.060	7.99	0.130	4.54
VET	0.035	6.65	0.086	4.27
Secondary school completion	0.036	6.34	0.060	2.25
Completed a course since in the last year (Ref. Cat.: did not)				
VET	0.038	3.41	0.218	3.66
Higher education	0.025	2.04	0.545	2.41
Completed a course 2 years prior (Ref. Cat.: did not)				
VET	0.075	4.71	0.047	0.56
Higher education	0.028	1.90	0.106	0.37
Completed a course 3 years prior (Ref. Cat.: did not)				
VET	0.033	1.74	0.271	2.90
Higher education	0.024	1.39	0.025	0.12
Missing lag indicator(reference category: no missing lags)				
Missing lag 2 years prior	-0.012	-3.05	-0.023	-1.07
Missing lag 3 years prior	-0.020	-5.02	0.003	0.11
Enrolled in full-time education	-0.086	-8.30	-0.167	-4.18
Female	0.002	0.45	0.036	1.32
Married or *de facto*	0.020	1.58	0.137	1.84
Married or *de facto* x female	-0.034	-2.13	-0.117	-1.15
Dependent children less than 15	-0.024	-1.47	-0.029	-0.32
Dependent children x female	-0.099	-4.88	-0.206	-1.61
Age (reference category: 15-24)				
25-34	0.004	0.72	0.060	1.61
35-44	0.031	4.74	0.010	0.27
45-54	-0.013	-2.30	-0.089	-2.48
55-64	-0.146	-9.74	-0.347	-8.72
Live in rural area	0.001	0.16	0.063	3.00
Housing tenure (reference category: live rent free)				
Own home	0.018	1.63	0.150	2.23
Rent home	0.022	1.97	0.140	2.21
Index of socio-economic advantage of local area (1 least advantaged - 10 most advantaged)	0.004	5.74	0.023	7.05
Extent of work limitation (0 no limitation - 10 can't work)	-	-	-0.022	-4.92
Changed disability status since initial period	-0.007	-0.98	0.144	8.32
Employed last interview	0.200	9.51	0.618	32.14
Completed VET since last interview x Employed last period	-0.091	-4.64	-0.196	-2.95
Completed VET 2 years prior x Employed last period	-0.157	-7.33	0.015	0.18
Completed VET 3 years prior x Employed last period	-0.071	-1.91	-0.199	-2.06
σ_v	0.633	52.75	0.739	26.40
τ	0.814	42.84	0.644	23.00
ϱ	0.286	40.86	0.353	20.80
Log-Likelihood	-18296		-4770	
Number of observations	62918		13016	
Number of individuals	14702		4467	

Note: RED Probit estimation with Marginal Effects and their t-ratio. State variables are included in the estimation

The usual quadratic shape of the effect of age on employment outcomes, whereby outcomes improve at the start of the working age and peak at some mid-career point, is present among those without disabilities, but not present among those with disabilities. The deterioration of employment prospects as age progresses presents itself much more strongly for those with disabilities. The employment probability among those with a disability in the 55+ age cohort is remarkably lower than that of their younger counterparts. Better housing status and a stronger local economic advantage show a significant association with higher employment probabilities. None of the state and territories variables are statistically significant, presumably because regional differences are controlled for more accurately by the other individual level variables. Full estimation results are in the Appendix, Table A2 for the main and the initial conditions estimations and Table A3 for the Mundlak corrections that accompany the dynamic panel estimation.

4.2 Vet completion and employment

The main focus of the paper is to estimate how employment outcomes may change after the completion of a vocational qualification, and investigate if any estimated change differs significantly by disability status. The marginal effects of the vocational education terms and their interactions estimated using Equation 4 (and presented in Table 2) are difficult to interpret individually: they need to be combined with the corresponding main terms in order to provide the necessary overall picture. To generate marginal effects with a meaningful economic interpretation the paper estimates the marginal effects of completing a vocational qualification as the difference in the predicted probabilities of employment for an individual with average characteristics, conditional on their employment status in the period prior to completing a vocational course.[15] To estimate the marginal effects over time, the predicted probability of employment in any given year is calculated as the sum of predicted employment probabilities for

[15] The average characteristics used are those that relate to individuals in the corresponding with disabilities and without disabilities groups.

various paths to employment in that given year from the year prior to completing a vocational qualification. For example, for an average individual, the probability of employment in their second year after course completion (period t+1), given that they were out of work in the year prior to completion in period t is equal to:

$$\begin{aligned} & P\left[y_{it+1} = 1 \middle| VET_{it} = 1, y_{t-1} = 0 \right] \\ & = P\left[y_{it} = 1 \middle| VET_{it} = 1, y_{it-1} = 0 \right] * P\left[y_{it+1} = 1 \middle| VET_{it} = 1, y_{it} = 1 \right] \\ & + P\left[y_{it} = 0 \middle| VET_{it} = 1, y_{it-1} = 0 \right] * P\left[y_{it+1} = 1 \middle| VET_{it} = 1, y_{it} = 0 \right]. \end{aligned} \quad (5)$$

The second line in Equation 5 is the estimated predicted probability of employment in the second year after completion, conditional on finding employment in the first year, and the third line is the probability of employment in the second year after completion, conditional on finding employment in the first year. Similar employment predictions are made for an average individual given that they did not complete a qualification and their comparisons are presented in Tables 3 and 4. Results are split in a number of dimensions.

First, Table 3 reports predictions for people with disabilities and Table 4 reports predictions for people without disabilities. Second, within each one of these two tables, the first set of three rows (marked *Out of work prior to completion*) report predicted probabilities for an average individual given that they were out of work prior to a given period t and the second set of three rows (marked *Employed prior to completion*) report predicted probabilities for those who were in employment prior to a given period t. In each set of three rows, the first (second, third) row presents the predicted probability of employment in the 1st (2nd, 3rd) year after completion for an average individual. Finally, in both tables, Column 1 reports the predicted employment probabilities for those who in period *t Did not complete a VET qualification* Column 2 reports the predicted employment probabilities for those who in period *t Completed a VET qualification* ; Column 3 reports the estimate of the *Difference* between Column 2 minus Column 1; and Column

4 provides the estimated t-statistic of the difference in predicted probabilities between those who did and those who did not complete a qualification.

Beginning with Table 3, Column 1 suggests that, for those who did not complete a vocational qualification and who are out of work, the probabilities of having obtained employment one, two and three years later are 26 percent, 41 percent and 50 percent respectively.

Table 3: Predicted employment probabilities for an average person *with* disability

	1.Did not complete a VET qualification	2. Completed a VET qualification	3. Marginal effect of difference (Col2-Col1)	4. t-statistic of difference (Column 3)
Out of work prior to completion				
1st year after completion	0.26	0.47	0.21**	3.42
2nd year after completion	0.41	0.61	0.20**	3.43
3rd year after completion	0.50	0.73	0.24**	3.77
Employed prior to completion				
1st year after completion	0.83	0.84	0.01	0.21
2nd year after completion	0.73	0.79	0.06	1.22
3rd year after completion	0.67	0.81	0.13**	2.53

***Significant at 1%, significant at 5%, *significant at 10%. Standard errors are calculated using the delta method.

These estimates indicate the difficulties faced by people with disability in obtaining employment. It is worth noting that these low rates of obtaining employment apply to a period of high and continuous economic growth, tight labour market conditions and general economic optimism in the Australian economy. Column 2 suggests that, for those who completed a vocational qualification, the employment probabilities one, two and three years later are much higher, at 47 percent, 61 percent and 73 percent respectively. The employment benefits of completing a vocational qualification for people out of employment are estimated in Column 3 to be a 21, 20 and 24 percent point improvement in the chances of employment one, two and three years later. Column 4 shows these differences to be statistically highly significant. The conclusion is that, for people with disabilities who wish to find a job, the completion of a vocational education course

increases the probability of obtaining employment for at least three years after course completion.

The second half of Table 3 focuses more on the issue of remaining in employment rather than obtaining employment, and shows how different employment prospects look for people with disabilities depending on their present employment status. The main result is that the completion or not of a VET qualification plays no role in the short run (up to the 2nd year after completion). Interestingly, there is a strong long term positive effect of qualifications in that those with completed qualifications appear to have steady employment probabilities (84, 79, 81 percent in the three years after completion), while those without qualifications experience a reduction in employment probabilities (83, 73 67 percent in the three years after completion). Hence, by the third year after completion, it is estimated that those who were employed before completing a course are 13 percentage points more likely to be employed than those who did not. VET qualifications appear to increase the retention probabilities of people with disabilities, but the effect takes time to work through.

Comparative results for people without disabilities are presented in Table 4. Columns 1 and 2 in Table 4, suggest that the probability of (obtaining or retaining) employment for people without disability is much higher than that for people with disability (presented in Table 3). Looking at both rows predicting employment rates in the 3rd year after completion, it is obvious that the long run employment outcome does not depend on VET qualifications. It is worth noting again the tight labour market and overall favourable economic conditions.

Table 4: Predicted employment probabilities for an average person *without* disability

	1.Did not complete a VET qualification	2. Completed a VET qualification	3. Marginal effect of difference (Col2-Col1)	4. t-statistic of difference (Column 3)
Out of work prior to completion				
1st year after completion	0.71	0.79	0.08***	4.03
2nd year after completion	0.89	0.88	-0.01	-0.84
3rd year after completion	0.94	0.96	0.02***	2.81
Employed prior to completion				
1st year after completion	0.97	0.96	-0.01*	-1.68
2nd year after completion	0.96	0.96	-0.01	-1.03
3rd year after completion	0.96	0.96	0.00	0.35

***Significant at 1%, significant at 5%, *significant at 10%.

Looked at three years after their interview, all groups of people without a disability had converged towards a high employment probability (between 94 and 96 percent) , which is indeed what one would expect to see within the Australian market between 2001 and 2008 when unemployment was at an all-time low. The findings of Table 4 highlight the differences in the outcomes between people with and people without disabilities. They indicate that, whatever it is that supports people without disabilities in obtaining employment, does not always work for people with disabilities.

4.3 How much does selection matter?

An important consideration when evaluating the outcomes of education is to ensure that estimated effects are not biased by unaccounted for non-random selection into different educational pathways (Kenny et al. 1979). In the context of the present paper, if the more able and better motivated workers are the ones that are more likely to complete a vocational qualification, and if the data do not contain sufficient information on the ability and motivation of workers, then any estimated positive returns to completed vocational qualifications could be over-stated. What complicates matters in the context of this paper is that, not only there may be

such bias present, but also that this bias may be different between people with and without disabilities. It follows that the accuracy and usefulness of the results that have been presented in this paper will depend on how well the variables used in the estimation, including the lagged employment outcomes and the Mundlak correction terms, have managed to control for observed and unobserved differences between those who do and those who do not complete a vocational qualification. In the remainder of this section the paper presents a kernel propensity score matching (PSM) estimation, as an alternative estimation method which utilises additional information in the matching process, which could control for some of any remaining sample selection bias.[16] The choice of PSM over alternative parametric methods is often suggested because it deals with the potential problem of common support (Blundell and Costa Dias 2008) and because it has the advantage over instrumental variables (IV) of not relying on having to find (and justify) valid exclusion restrictions (Dustmann and Engracia Rochina-Barrachina 2000, Dehejia and Wahba 2002).[17]

The propensity score is calculated using predictions derived from a probit model of vocational course completion utilising all the explanatory variables used in the estimation of Equation 4. Additional variables are used on employment and income history and on whether or not those out of work prior to completion are actively looking for work or not and, if not, whether they would like to work.[18] These additional variables have been introduced to provide further controls for possible selection bias into obtaining a VET qualification. Intentions to return to work for those out of employment will reflect the part of the motivation to gain further qualifications that is related to employment outcomes. Similarly, work and income history will

[16] Kernel matching is used over other matching techniques, such as nearest neighbour, because for each individual comparisons are made with multiple 'like' individuals and not just one (that are weighted), which produces more consistent results (Blundell and Costa Dias 2008). Nearest neighbour matching was also used and yielded very similar results.

[17] Experimentation with an extended version of the Orme (1997) dynamic model to include a selection equation produced no evidence of selection bias. We chose the PSM method because it does not rely on assumptions about exclusion restrictions.

[18] Results for the probit model of course completion are available from the authors on request.

reflect labour market achievement and form a measure of labour market related ability.[19] PSM results are presented in Table 5 for people with and without disabilities respectively.

Table 5: Effect of completing a VET course on employment (PSM estimation)[20]

	Employment status prior to completion			
	Out of work		Employed	
	1. Effect of VET	2. t-stat	3. Effect of VET	4. t-stat
1st year after completion				
With Disabilities	0.16***	3.09	0.025	0.80
Without Disabilities	0.13***	4.46	0.001	0.15
2nd year after completion				
With Disabilities	0.16***	2.68	0.052	1.54
Without Disabilities	0.15***	4.94	0.011	1.16
3rd year after completion				
With Disabilities	0.20***	3.35	0.042	1.20
Without Disabilities	0.14***	4.26	0.019	1.60

***Significant at 1%, **Significant at 5%, *Significant at 10%.

Note that Columns 1 and 3 marked Effect of VET (and 2 and 4 marked t-stat) correspond to the Difference Columns 3 (and their significance in Columns 4) in Tables 3 and 4. A comparison of the results between Tables 3, 4 and 5 is presented in Table 6 below.

In line with the general tenor of the results of the paper, having completed a VET qualification does not appear to have an effect on retaining employment for those who were already in employment prior to completion of the qualification Table 5 Column 3). This result holds for both people with and without disabilities. It makes intuitive sense to find that there is no self

[19] In this analysis, because course completions are identified in each wave of the survey, to avoid the influence of time trends on our post-treatment outcomes, we use predictions from the probit model to generate control groups for each year as well. Once matched, outcomes from the group who completed a qualification in a given year are compared to their control group for the following three years Post-matching balancing tests to ensure equality of means of each variable in the treated and control group after matching provide satisfactory results. The resulting t-tests are based on a weighted regression of each variable on the treatment/control group indicator in each wave and overall. Results are weighted by the matching weight. Results from the balancing tests are available from the authors on request.

[20] This is the average treatment effect on the treated.

selection on observables into VET in the context of a qualification that is shown to have no discernible employment retention effect for those who are employed.

Table 6: Comparing estimates: people out of work at *t*-1

	Employment status prior to completion			
	With disabilities		**Without disabilities**	
	Effect of VET[a]	t-stat	Effect of VET[a]	t-stat
1st year after completion				
RED probit	0.21***	3.42	0.08***	4.03
PSM estimation	0.16***	3.10	0.13***	4.46
2nd year after completion				
RED probit	0.20***	3.43	-0.01	-0.84
PSM estimation	0.16***	2.68	0.15***	4.94
3rd year after completion				
RED probit	0.24***	3.77	0.02***	2.81
PSM estimation	0.20***	3.35	0.14***	4.26

***Significant at 1%, **Significant at 5%, *Significant at 10%. [a]The effect of VET under PSM estimation is the average treatment effect on the treated.

By contrast, estimates on the effect of VET for those who were out of work before completing the qualification are different between the PSM and RED Probit estimations. After selection on observables using PSM has been controlled for, the returns to VET for those with a disability appear to be reduced by about 0.04 for all three years after VET completion. The difference suggests that, to the degree that using the PSM estimation method controlled for some selection bias that the RED Probit estimation method did not, about $1/5^{th}$ of the total effect of VET (roughly 0.04 out of 0.20) on people with disabilities gaining employment, can be attributed to people with better chances of gaining employment self-selecting into VET. The main result of the paper, namely that people with disabilities who are out of work have a lot to gain from doing VET, remains strong.

The opposite selection effect appears in the case of people without disabilities and VET, suggesting that it would be those with worse chances of gaining employment that would be self

selecting into VET and, that this self selection may be one of the reasons why the RED Probit model shows very small benefits from VET for people without disabilities. Results suggest that the effect of selection into pursuing a vocational qualification may be different for those with and without disability. Among those with disabilities, those who complete a vocational qualification appear to have a slightly higher underlying probability to return to employment anyway, whereas among those without disabilities, those who complete a vocational qualification are those with lower underlying probability to return to employment, which implies that course completion may be undertaken to try and offset pre-existing labour market disadvantage.

4.4 Discussion

The difference in the estimates in Tables 3 and 4 is stark and it becomes even starker when one considers the economic context surrounding the time that the data represents, from 2001 to 2008. This was a very prosperous time for the Australian economy, with continuous growth, economic and financial stability and a strongly supportive international macro-economy. During that time an economically conservative government managed to run a substantial budget surplus, reduce taxes, boost superannuation and even introduce and support legislation that set the national minimum wage at a level that was the second highest among OECD countries. It is a stark finding therefore, that in macro-economic circumstances as benign and externally supportive as those encountered in Australia between 2001 and 2008, the probability that a person with a disability gains or retains employment was as low as that found in this research. It is also an important finding that VET can have a substantial effect on improving the employment chances of people with a disability and without a job.

The findings of this paper have important policy ramifications. First, the paper reveals how seriously embedded the labour market disadvantage generated by disability can be in a western economy, even in such prosperous times. Second, it points towards vocational education as a policy instrument that can address this disadvantage by increasing the productivity of this

disadvantaged part of the labour force. The result that the effect of vocational education starts straight after graduation and lasts for at least three years suggests clearly that what we observe with the completion of a vocational qualification is a productivity improvement of a lasting nature.

It is worth noting some possible reasons why vocational training may have this beneficial effect on people with a disability and what change vocational education brings regarding employment probabilities. First, it is worth remembering that people with a disability, especially those who find themselves without work but willing to work, will be generally older and with lower levels of education and skills. They are also less likely to have had university education experience, so longer study experiences that lead to higher qualifications, such as those provided by the university sector, will not be all that familiar to them. These personal characteristics make the type of education provided by the vocational sector more appropriate for people with a disability. What is needed is a means to improve productivity that can be fast, flexible, transferable and relevant, that can be easily recognised and readily used by employers. By contrast, the prospect of a qualification that will improve the long run potential of a graduate, along the lines that university degrees have been known to do, cannot be expected to be the top priority of a job seeker with a disability. The learning achieved through vocational education is more practical and directly linked to what the employers presently require.

It is not only the content, but also the way vocational education is provided that is well suited to people with disabilities. The vast majority of vocational education courses will last between 6 and 12 months, which will be more acceptable to older people with shorter employment planning horizons. Further, vocational education courses are provided in a flexible and highly modularised form. This means that, should the student find a suitable employment opportunity half way through their course, they can interrupt, take the job and decide whether they complete the course or not at a later stage. A sizeable proportion of vocational education students do so

for job reasons.[21] The same applies if ill health or other circumstances make an interruption necessary as a later return is feasible at low cost.

5. Conclusion

This paper estimated the difference that the completion of a vocational education qualification makes to the subsequent probabilities of employment of people with and without a disability. The findings of the paper are particularly pertinent for people with disabilities and are twofold.

First, the paper finds that despite the generally prosperous and supportive macro-economic conditions in Australia between 2001 and 2008, people with disabilities continued to be seriously disadvantaged when seeking employment. This is a strong indictment on the current legislative and regulatory environment which appears to be offering limited support to people with disabilities in gaining and retaining productive employment.

Second, the paper finds that vocational training has a strong and long-lasting effect on improving the employment probabilities of people with a disability. This core result of the paper finds a causal link between the completion of a vocational education qualification and gaining or retaining employment. More specifically, people with disabilities who undertake vocational education are shown to be more likely to experience a long-term improvement in their employment position. There are alternative underlying explanations for this finding. It could be that vocational education is removing some of the uncertainty that employers may have to consider when people with disabilities apply for a job. The completion of a qualification by a person with a disability could signal not only an applicant with specific vocational skills, but also an applicant with increased levels of motivation and commitment. It could also be that

[21] Most vocational education students do not complete the full course they enrolled in. Many interrupt after completing a module only. Out of all those with (without) a disability who interrupted their study, 17 (33) percent did so for job-related reasons, 18 (2) for ill health reasons and 16 (8) percent for Other reasons. Source: Student Outcome Survey 2008, NCVER, Aus.

vocational education is allowing people with disabilities to re-jig the composition of their skills set to suit the needs of prospective employers better and more transparently. A most pertinent aspect of this result is that the beneficial effect of vocational education on gaining and retaining employment is shown to be long-lasting for people with disabilities, with the data allowing the estimation of effects for three years after the completion of their vocational education qualification.

The paper discussed the reasons why the provision of vocational education to people with disabilities is an appropriate avenue for improving the human capital, productivity and market signals of this seriously disadvantaged part of the labour force. The results of this paper argue for the wider use of vocational education as a means of supporting people with disabilities in their efforts to gain and retain productive employment.

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APPENDIX

Table A.1: Sample average characteristics

	Without disability		With disability	
	Initial period	Subsequent periods	Initial period	Subsequent periods
Dependent variable: Employed in the last 7 days	0.8	0.86	0.57	0.44
Highest qualification in the initial period (reference category: did not complete school)				
Higher education	0.25	0.25	0.13	0.13
Vocational education	0.3	0.3	0.3	0.3
Secondary school completion	0.17	0.17	0.11	0.11
Completed a course since in the last year (reference category: did not complete a course in the last year)				
Vocational education	-	0.04	-	0.03
Higher education	-	0.01	-	0.01
Completed a course 2 years ago (reference category: did not complete a course 2 years ago)				
Vocational education	-	0.03	-	0.02
Higher education	-	0.01	-	0
Completed a course 3 years ago (reference category: did not complete a course 3 years ago)				
Vocational education	-	0.02	-	0.01
Higher education	-	0.01	-	0
Missing lag 2 years prior	-	0.25	-	0.31
Missing lag 3 years prior	-	0.45	-	0.53
Female	0.51	0.52	0.5	0.49
Married or *de facto*	0.63	0.72	0.63	0.61
Married or *de facto* x female	0.33	0.38	0.31	0.28
Dependent children less than 15	0.31	0.39	0.25	0.21
Dependent children x female	0.18	0.22	0.12	0.1
Age (reference category: 15-24)				
25-34	0.23	0.24	0.17	0.11
35-44	0.23	0.29	0.21	0.21
45-54	0.16	0.22	0.24	0.29
55-64	0.09	0.12	0.22	0.33
State of residence (reference category: NSW)				
Victoria	0.25	0.25	0.23	0.22
Queensland	0.21	0.21	0.21	0.2
Western Australia	0.1	0.1	0.09	0.09
Tasmania	0.03	0.03	0.04	0.05
South Australia	0.09	0.09	0.11	0.13
ACT/Northern Territory	0.03	0.03	0.03	0.02
Live in rural area	0.15	0.16	0.17	0.19
Housing tenure (reference category: live rent free)				
Home owner	-	0.72	-	0.64
Rent home	-	0.25	-	0.33
Index of socio-economic advantage of local area (1most disadvantaged-10 most advantaged)	5.62	5.79	4.91	4.67
Extent of work limitation (0 none -10 can't work)	-	-	3.31	4.54

Employed last interview	-	0.86	-	0.45
Employed last interview x completed VET since last year	-	0.04	-	0.02
Employed last interview x completed VET 2 years prior	-	0.03	-	0.01
Employed last interview x completed VET 3 years prior	-	0.02	-	0.01
Log of years in employment	2.39	-	2.67	-
Born in an English speaking country	0.87	-	0.88	-
Number of observations	55524		12369	
Number of individuals	13559		1255	

Table A.2: Results for subsequent periods of the dynamic random effects panel probit model

	Without disability			With disability		
	m.e.	s.e.	t-stat	m.e.	s.e.	t-stat
Highest education in the initial period (reference category: did not complete secondary school)						
Higher education	0.043***	0.007	6.287	0.120***	0.029	4.162
VET	0.028***	0.005	5.564	0.077***	0.020	3.765
Secondary school completion	0.027***	0.005	5.022	0.062**	0.028	2.231
Completed a course since in the last year (reference category: did not complete a course since last year)						
VET	0.042***	0.012	3.592	0.277***	0.070	3.975
Higher education	0.028*	0.015	1.932	0.432**	0.205	2.106
Completed a course 2 years prior (reference category: did not complete a course 2 years prior)						
VET	0.063***	0.016	3.867	0.135	0.096	1.415
Higher education	0.048***	0.018	2.714	0.138	0.261	0.530
Completed a course 3 years prior (reference category: did not complete a course 3 years prior)						
VET	0.028	0.019	1.492	0.215*	0.114	1.885
Higher education	0.031	0.020	1.551	-0.104	0.175	-0.592
Missing lag 2 years prior	-0.003	0.004	-0.744	-0.050**	0.024	-2.069
Missing lag 3 years prior	-0.010***	0.004	-2.880	0.032	0.026	1.261
Female	-0.003	0.005	-0.545	0.058**	0.029	2.039
Married or defacto	0.015	0.011	1.402	0.144*	0.078	1.850
Married or defacto x female	-0.027*	0.014	-1.957	-0.035	0.112	-0.309
Dependent children less than 15	-0.023*	0.014	-1.716	-0.037	0.096	-0.386
Dependent children x female	-0.071***	0.017	-4.109	-0.154	0.136	-1.129
Age (reference category: 15-24)						
25-34	0.003	0.005	0.669	0.079**	0.039	2.008
35-44	0.020***	0.006	3.474	0.062	0.038	1.638
45-54	-0.014***	0.005	-2.905	-0.031	0.038	-0.810
55-64	-0.114***	0.015	-7.756	-0.275***	0.040	-6.849
State of residence (reference category: NSW)						
Victoria	0.001	0.003	0.276	-0.013	0.024	-0.550
Queensland	0.004	0.004	1.257	0.001	0.025	0.032
Western Australia	-0.006	0.004	-1.470	0.006	0.033	0.193
Tasmania	0.009	0.007	1.164	-0.027	0.042	-0.634
South Australia	0.003	0.005	0.553	0.016	0.029	0.537
ACT/Northern Territory	0.009	0.008	1.156	-0.015	0.059	-0.255
Live in rural area	-0.002	0.003	-0.745	0.066***	0.021	3.083

Housing tenure (reference category: live rent free)						
Own home	0.021**	0.010	2.095	0.121*	0.068	1.772
Rent home	0.028***	0.010	2.673	0.174***	0.066	2.657
Index of socio-economic advantage of local area (1 least advantaged - 10 most advantaged)	0.004***	0.001	4.989	0.023***	0.003	6.772
Extent of work limitation (0 no limitation - 10 can't work)	-	-	-	-0.020***	0.005	-4.257
Employed last interview	0.152***	0.021	7.352	0.659***	0.018	36.910
Completed VET since last interview x Employed last period	-0.062***	0.014	-4.432	-0.229***	0.086	-2.655
Completed VET 2 years prior x Employed last period	-0.073***	0.018	-4.046	0.022	0.128	0.168
Completed VET 3 years prior x Employed last period	-0.031	0.020	-1.503	-0.069	0.138	-0.501
σ_v	0.693	0.014		0.662	0.027	
ρ	0.325	0.009		0.304	0.018	
Log Likelihood	-15044			-4572		
Number of observations	55524			12369		
Number of individuals	13559			1255		

*Significant at 10%, **significant at 5%, ***significant at 1%.

Table A.3: Results for the Mundlak correction terms, subsequent periods of the dynamic random effects panel probit model

	Without disability			With disability		
	m.e.	s.e.	t-stat	m.e.	s.e.	t-stat
Married or defacto	0.021*	0.012	1.718	0.008	0.083	0.099
Married or defacto x female	-0.042***	0.016	-2.578	-0.156	0.119	-1.315
Dependent children less than 15	0.025*	0.015	1.671	0.151	0.103	1.461
Dependent children x female	0.005	0.016	0.327	-0.071	0.143	-0.495
Housing tenure (reference category: live rent free)						
Own home	0.002	0.015	0.140	-0.087	0.093	-0.940
Rent home	-0.037***	0.012	-2.984	-0.248***	0.094	-2.635
Completed a course since in the last year (reference category: did not complete a course)						
VET	0.001	0.016	0.039	-0.356***	0.114	-3.125
Higher education	0.019	0.026	0.733	1.737	1.279	1.358
Completed a course 2 years prior (reference category: did not complete a course)						
VET	0.092***	0.032	2.846	0.652***	0.221	2.951
Higher education	-0.059	0.051	-1.155	-2.064	1.367	-1.510
Completed a course 3 years prior (reference category: did not complete a course)						
VET	-0.064*	0.033	-1.930	-0.321	0.234	-1.370
Higher education	-0.017	0.054	-0.316	0.024	0.676	0.036
Missing lag 2 years prior	0.014	0.013	1.119	0.006	0.071	0.086
Missing lag 3 years prior	-0.056***	0.012	-4.601	0.021***	0.069	0.312
Extent of work limitation (0-10)	-	-	-	-0.062	0.006	-9.544

*Significant at 10%, **significant at 5%, ***significant at 1%.